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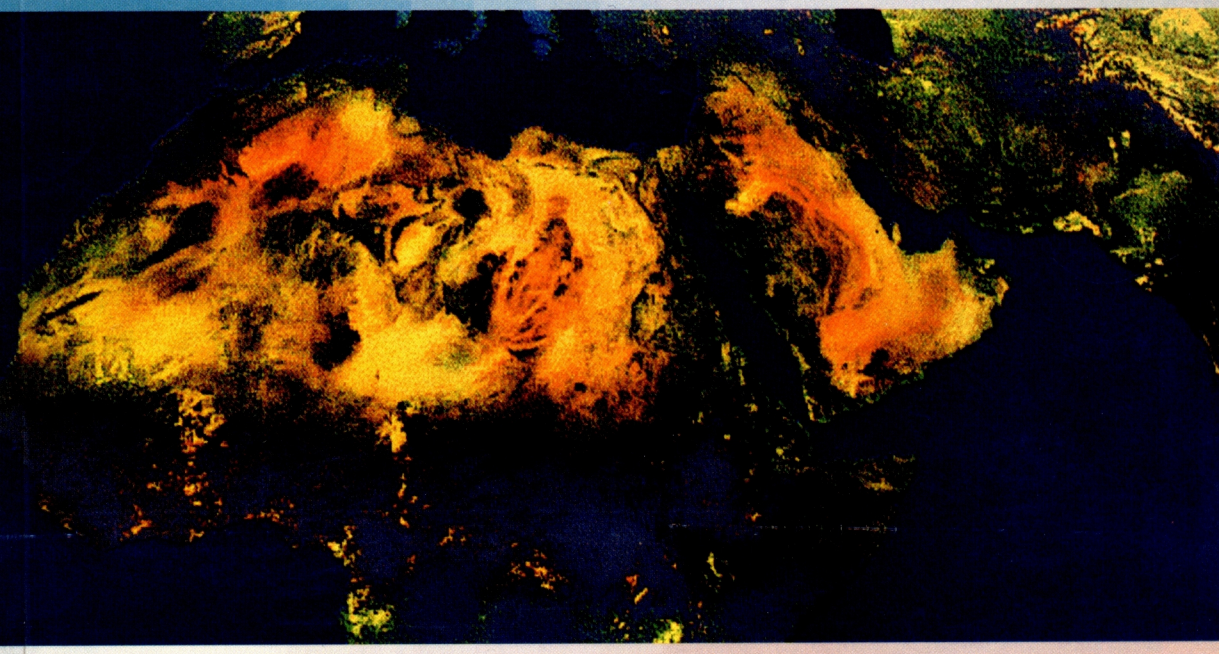
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Special Issue on Nutrition عدد خاص عن التغذية

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World Health Organization
Organisation mondiale de la Santé

المجلة الصحية لشرق المتوسط

هي المجلة الصحية الرسمية التي تصدر عن المكتب الإقليمي لشرق المتوسط بمنظمة الصحة العالمية. وهي منبر لتقديم السياسات والمبادرات الجديدة في الخدمات الصحية والترويج لها، ولتبادل الآراء والمفاهيم والمعطيات الوبائية ونتائج الأبحاث وغير ذلك من المعلومات، وخاصة ما يتعلق منها بإقليم شرق المتوسط. وهي موجهة إلى كل أعضاء المهن الصحية، والكليات الطبية وسائر المعاهد التعليمية، وكذا المنظمات غير الحكومية المعنية، والمراكز المتعاونة مع منظمة الصحة العالمية والأفراد المهتمين بالصحة في الإقليم وخارجه.

EASTERN MEDITERRANEAN HEALTH JOURNAL

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LA REVUE DE SANTE DE LA MEDITERRANEE ORIENTALE

EST une revue de santé officielle publiée par le Bureau régional de l'Organisation mondiale de la Santé pour la Méditerranée orientale. Elle offre une tribune pour la présentation et la promotion de nouvelles politiques et initiatives dans le domaine des services de santé ainsi qu'à l'échange d'idées, de concepts, de données épidémiologiques, de résultats de recherches et d'autres informations, se rapportant plus particulièrement à la Région de la Méditerranée orientale. Elle s'adresse à tous les professionnels de la santé, aux membres des instituts médicaux et autres instituts de formation médico-sanitaire, aux ONG, Centres collaborateurs de l'OMS et personnes concernés au sein et hors de la Région.

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Special Issue on Nutrition عدد خاص عن التغذية

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Editorial: Fiona Curlet, Marie-France Roux, Alison Bichard

Letter from the Editor

The importance of food and nutrition has been recognized since ancient times. The Ancient Egyptians used food as a source of medicine. The Ancient Greeks were also much concerned about nutrition and Hippocrates said, "Let food be your medicine and medicine be your food". Furthermore, the Holy Quran and the Prophetic traditions include numerous teachings with respect to food and nutrition, such as the Quranic verses: "*Do not forbid the good things which God has made lawful for you and do not exceed the limits*" (5:87); and "*Eat and drink but not to excess*" (7: 31).

In more recent times, the Universal Declaration of Human Rights in 1948 asserted that "everyone has the right to a standard of living adequate for health and well-being of himself and his family, including food ..." (article 25(1)). Two years earlier, the Constitution of the World Health Organization affirmed that promoting the improvement of nutrition (article 2) was among the functions through which WHO could achieve its objective of the attainment by all peoples of the highest possible level of health (article 1).

At the end of the 20th century, the United Nations set out the Millennium Development Goals, the very first of which is to eradicate extreme poverty and hunger; specifically, to reduce by half the proportion of people who suffer from hunger by the year 2015. This underscores the fact that nutrition is a cornerstone that affects and defines the health of all people. Good nutrition allows us to grow, develop and function well and aspire to reach our full potential at the individual and societal level. Conversely, by making us vulnerable to disease, increased morbidity and premature death, malnutrition seriously undermines our ability to achieve this potential. Thus the paramount aim of WHO's work in nutrition is to prevent, reduce and ultimately eliminate malnutrition worldwide and promote sustainable health and nutritional well-being of all people.

This special issue on nutrition represents a significant publication covering the key areas of nutrition. It comprises a selection of invited papers giving the regional perspective of nutrition together with some research papers which indicate the breadth of work being undertaken in our Region. Also included are a list of recent WHO publications on nutrition and a bibliography of papers related to nutrition that have been published in the EMHJ over the past 11 years.

We would like to take this opportunity to thank our distinguished guest authors for enriching this important Special Issue with their valuable contributions. We hope the issue will be a useful reference on nutrition and will stimulate further work in this area of vital public health concern.

رسالة من المحرِّر

للغذاء والتغذية أهميتهما ومكانتهما منذ فجر التاريخ. وقد استخدم قدماء المصريين الطعام كمصدر للدواء. واهتمّ الإغريق بذلك حتى قال بُقراط: «ليكن طعامُكم دواءَكم، ودواؤكم طعامَكم». وجاء في القرآن الكريم والسنة النبوية المطهرة ما لا يكاد يحصى من التعاليم الصحية في صدد الغذاء والتغذية، ومنها قولُ الله عزّ وجل: ﴿لا تحرِّموا طيِّبات ما أحل الله لكم ولا تعتدوا﴾ [المائدة: 87] وقوله سبحانه: ﴿كلوا واشربوا ولا تسرفوا﴾ [الأعراف: 31].

وفي العصور الحالية، أكّد الإعلان العالمي لحقوق الإنسان، الصادر في عام 1948، على أن «لكل شخص الحق في مستوى من المعيشة كافٍ للمحافظة على الصحة والمعافاة له ولأسرته، بما في ذلك التغذية....» (المادة 25–1). وقبل ذلك بعامَيْن أكّد دستور منظمة الصحة العالمية أن التشجيع على تحسين التغذية (المادة 2–ط) هو أحد الوظائف التي يمكن لمنظمة الصحة العالمية أن تحقّق من خلالها هدف بلوغ جميع الشعوب أرفع مستوى صحي ممكن (المادة 1).

وفي نهاية القرن العشرين أعلنت منظومة الأمم المتحدة المرامي الإنمائية للألفية، والتي يأتي في صدارتها استئصال شأفة الفقر والجوع، وعلى وجه التفصيل تخفيض نسبة السكان الذين يعانون من الجوع بحلول عام 2015 إلى نصف ما كانوا عليه عام 1990. كل ذلك يؤكّد على أن التغذية ركن ركين يؤثّر في صحة جميع البشر ويحدِّدها. فالتغذية الجيدة تتيح لنا النمو والنماء وأداء الوظائف على الوجه الأكمل، كما تتيح لنا التطلُّع إلى بلوغ طاقتنا الكاملة على مستوى الأفراد والمجتمعات. وعلى الجانب المقابل، فإن سوء التغذية يعرِّضنا للأمراض، ويزيد المراضة والوفيات في سن مبكّرة، فيقوِّض بذلك قدرتنا على بلوغ هذه الطاقة الكاملةَ التي نطمح إليها.

ومن ثَـمَّ، فإن الهدف الأسمى لعمل منظمة الصحة العالمية في مجال التغذية هو الوقاية من سوء التغذية في العالم، وتقليصه، والتخلُّص منه في نهاية المطاف، وتعزيز الصحة والمعافاة التغذوية المضمونة الاستمرار لكل البشر.

ويمثِّل هذا العدد الخاص من المجلة الصحية، المعني بالتغذية، منشورة بارزة تغطِّي المجالات الرئيسية للتغذية، ويشتمل على نخبة منتقاة من الورقات البحثية التي تعبِّر عن المنظور الإقليمي للتغذية، إضافةً إلى بعض الورقات البحثية الأخرى التي تشير إلى مدى اتساع العمل الجاري حالياً في إقليمنا. كما يشتمل هذا العدد على قائمة بمنشورات المنظمة الصادرة حديثاً حول التغذية، وقائمة ببليوغرافية بالورقات المعنيَّة بالتغذية، التي نشرت في المجلة الصحية لشرق المتوسط خلال الأحد عشر عاماً الماضية.

ونغتنم هذه الفرصة لتقديم الشكر لكُتّابنا البارزين الذين أغْنَوا بإسهاماتهم القيِّمة هذا العدد الخاص والهام. ويحدونا الأمل أن يكون هذا العدد مرجعاً نافعاً حول التغذية، وأن يكون حافزاً على مزيد من العمل في هذا المجال الحيوي الهام من مجالات الصحة العمومية.

Foreword

Mamdouh Gabr, MD, FRCP[1]

Early history of nutrition and health

The relationship between food and health dates as far back as far as 6000 years even before Imhotep, the ancient Egyptian father of medicine, described the use of certain foodstuffs as prescriptions. Night blindness and xerophthalmia (called "show" by ancient Egyptians) were treated by roasted beef liver or liver juice. A balanced diet for the wealthy was described in the message of King Unas, who reigned from around 2375 to 2345 BC, "eat good bread, ox flesh, wine, sweet and olive oil, fat, honey, figs, fish and vegetables everyday". Later, Greek, Roman and Arab scholars started to write on the relationship between food and health. Celsus (around 25 BC–45 AD) classified foodstuffs and emphasized their role in maintaining health in his treatise on medicine. Many dietary recipes to treat various illnesses were introduced by Ibn Sina (Avicenna) and others.

Achievements of nutritional sciences during the twentieth century

The twentieth century will be remembered as the golden age for nutrition. In this period most macro- and micronutrients were discovered, and nutritional needs and requirements were identified. The relationship between nutrition and health was documented and the sequelae of over-nutrition and under-nutrition were recognized. Through research, the availability of plant and animal food increased. Large-scale famines characteristic of the nineteenth century became controllable. There was a steady improvement in combating undernutrition and severe degrees of protein–energy malnutrition decreased. Great success was achieved in reducing iodine deficiency disorders. There was similar but less impressive success in controlling vitamin A deficiency. These improvements were accompanied by a marked increase in the rate of decline of under-five mortality between 1960 and 1980. In the year 2000, 32.5% of children under five years in developing countries (182 million) were stunted [*1*]. This was a great improvement over the 1980 figure of 47.1%; representing a decrease of 40 million in the number of stunted children over this period, in spite of the increase in population. In the year 2000, 26.7% of preschool children in developing countries were underweight as compared with the 1980 figure of 37.4% [*1*]. The improvement however was not homogenous. Improvement in the African region was much slower.

There is evidence that over-nutrition with its health consequences is increasing, especially in developing countries, which will therefore start to suffer the double burden of under- and over-nutrition.

[1]Professor of Paediatrics, University of Cairo, Cairo, Egypt and Past President the International Union of Nutritional Sciences and International Pediatrics Association.

Future trends and challenges

In spite of the great achievements in the field of nutrition during the past century, many factors prevented the attainment of the expressed goals and objectives of the various international conferences on nutrition. The statement of Henry Kissinger, United States Secretary of State at the 1972 World Food Conference in Rome that "within a decade no child will go to bed hungry, no family will fear for its next bread…" was never fulfilled. These factors remain today as challenges to be tackled in the quest to improve the nutrition of the world's people.

Economic and geopolitical factors

Poverty is a cause, associated factor, catalyst and result of malnutrition and ill health. The majority of the poor, who represent a quarter of the world's population, live in developing countries. Differences in gross national product between industrialized and least developed countries range from US$ 26.157 to US$ 261 [*2*]. While the digital divide between the rich and poor countries is narrowing, it remains tremendous. Although poverty and malnutrition are linked, they are not identical and malnutrition rates vary widely even among poor countries.

An important prerequisite for the alleviation of malnutrition is social and political stability. Peaceful resolution of geopolitical, socioeconomic and ethnic conflicts, as well as awareness of and respect for human rights, are important tasks for the world community to solve in the coming decades. Two million children died in armed conflicts in the last decade of the 20th century [*3*]. At the end of 1998 there were 12 million refugees worldwide.

Environmental factors

Environmental degradation, desertification, deforestation, global warming and seasonal variations have begun to have an impact on agriculture production and they will continue to do so in the future. Every year 5.7 million hectares of agricultural land are lost [*4*].

Emerging and re-emerging diseases

In spite of the successful control of many diseases through health education and vaccination, new diseases have emerged which have a negative impact on the nutrition of millions of people. For example, 90% of severely malnourished children in Lusaka, Zambia are HIV positive [*5*].

Demographic factors

Although there was a decline in population growth throughout the 20th century, the decline was not uniform. In view of the critical situation in sub-Saharan Africa, the high fertility rate in this region will impede efforts to combat malnutrition. Urbanization and megacities were characteristic features of the last decades of the twentieth century. The trend is continuing. Slum areas will doubtless increase, with all the accompanying negative effects on nutrition and health. The urban poor will replace the rural poor. This will alter the structure of the diet and introduce new patterns of "fast food", thus increasing vulnerability to nutrition-related illness.

Constraints of United Nations system

There is a need for better coordination and communication between the different UN agencies as well as between UN agencies and other international or bilateral players in the field of nutrition. A technical approach and scientific cooperation is not sufficient to combat malnutrition. UN systems must be more involved in political, economic and social areas and should play a more proac-

tive role in helping developing countries fund-raise. They cannot remain isolated in their work, bound only by their traditional mandate. They need to reconcile themselves to interdisciplinary multisectoral planning, action and coordination.

Globalization and privatization

Globalization will expand opportunities for some but not for others. Economic integration should be used as a force for improving the economies of poor countries. Cooperation should support political stability, conserve environment, empower the community, particularly women, seek justice rather than charity and pay special concern to equity and ethical issues.

Although international agreements include clauses to safeguard the needs of developing countries, it remains to be seen how these measures will be interpreted and implemented. The agreement on trade-related aspects of international property rights (TRIPS) may sometimes prevent the distribution of potential international public goods that may be helpful to poor countries because such countries can seldom afford the prices charged by patent owners. For example, some genetic technology is patented by the private sector and these patents may prevent farmers from reusing their seeds.

The influence of the private sector will grow including that of food manufacturing companies. This will make the cost of food up to three times higher than the farm value which will have a negative nutritional impact on the poor [*6*]. The fast food culture will undoubtedly spread, especially in newly urbanized areas. Globalization will raise concern on many ethical issues related to nutrition and health: genetic manipulation of food is an example.

Scientific advances

Technologies cannot simply be transferred but must be adapted or redesigned to suit different conditions. There is concern about the transfer of harmful by-products as a result of the transfer of a hazardous industry or technology. Advances in communication technology will highlight the role of the media in influencing style and food consumption patterns. Novel marketing techniques may adversely affect the consumption of a traditional cheap nutritious diet, and may aggravate inequities and contribute to the emerging menace of overnutrition and diet-related diseases in developing countries.

Conclusion

A new agenda of international scientific cooperation in nutrition research must be developed to deal with the changing trends of the 21st century. It is not enough for nutritional scientists to solve worldwide nutritional problems through laboratory studies or in pilot projects. They must play a pivotal role at both the community and the decision-making levels. They must act together to maximize nutritional benefits and minimize the possible harm of the trends described so that everyone, everywhere can attain optimal nutrition.

The contributors to this special issue on nutrition of the *Eastern Mediterranean Health Journal* have examined and reviewed the many and varied determinants affecting nutrition. These papers indicate the way forward and may act as a guide for the development of a much-needed future strategy to combat both under- and overnutrition in the Region.

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Nutrition is a fundamental pillar of life, health and development across the entire lifespan. From the earliest stages of fetal development, at birth, through infancy, childhood, adolescence and on into adulthood and old age, proper food and good nutrition are essential for survival, physical growth, mental development, performance and productivity, health and well-being. It is an essential foundation of human and national development. Information about the nutrition situation in the Eastern Mediterranean Region and the work of the WHO Regional Office for the Eastern Mediterranean in this vital area can be found at the nutrition website of EMRO at: http://www.emro.who.int/nutrition/index.htm

Invited paper

Two decades of nutrition assessment in the Eastern Mediterranean Region: scope, methodologies and dissemination

***W.A. Moussa*[1]**

SUMMARY Different nutritional disorders prevail at different stages in the life cycle, e.g. growth retardation in the fetus, protein energy deficiency in children, noncommunicable conditions in adults. The scope of nutrition assessment has changed over the past 2 decades. The focus shifted from pregnant and lactating mothers and children, through functional consequences of malnutrition to deficiency disorders. Now the focus is on obesity. Clinical methods of assessment (usually indicators of late-stage malnutrition) have become less important recently although clinical indicators of iodine deficiency and vitamin A deficiency are still useful. The key method now is anthropomorphic measurement, such as weight-for-age or body mass index. All the countries of the Region have nutrition education programmes for dissemination of information and most have drawn up national dietary guidelines applying the strategies that were developed after the 1992 International Conference on Nutrition.

Introduction

According to the global burden of disease concept, the disability adjusted life year (DALY) expresses years of life lost due to premature death and years lived with a disability of a specified severity and duration. One DALY is thus 1 year of healthy life lost [*1*]. In the list of main risk factors contributing to the global burden of disease, malnutrition was top, contributing 15.9% of total DALYs [*1*]. The burden of disease (expressed as DALYs) by cause, sex and mortality stratum has been estimated by the World Health Organization for each region for the year 2002 [*2*]. The total for DALYs due to nutritional deficiencies in the Eastern Mediterranean Region was 631 in the low child low adult mortality stratum countries and 3798 in the high child high adult mortality stratum countries [*2*].

Malnutrition was the direct or the underlying cause of death of 49% of children under 5 years in developing counties during 1995 [*3*]. The burden of mortality, morbidity and disability attributable to noncommunicable diseases now weighs heaviest in developing countries, where those affected are on average younger than in the industrialized countries. Unhealthy diets and physical inactivity were found to be the leading causes of the major noncommunicable diseases [*4*].

The negative impact of malnutrition on body functions has been extensively studied all over the world. In the Eastern Mediterranean Region, a prominent longitudinal study implemented in Egypt during 1982–

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1987 documented the effect of food intake on cognitive function, social behaviour, work performance, immunocompetence and reproductive health [*5,6*].

It is therefore important to assess nutritional status and establish the main determinants for both individuals and the community. This will provide tools for the prevention, early detection, management and control of nutrition disorders.

Key objectives of nutrition assessment in the Region can be summarized under 6 main topics:

- to identify high-risk groups and geographical areas with nutrition-related problems to facilitate implementation of public health intervention programmes;
- to recommend guidelines for the prevention, early detection and management of nutrition disorders;
- to study diet–health relationships and the impact of knowledge and attitudes toward dietary and health behaviour;
- to develop nutrition education and dietary guidance e.g. national food-based dietary guidelines [*7*];
- to assess progress toward achieving the nutrition and health objectives, e.g. the plan of action for nutrition promoted by the International Conference on Nutrition, Rome, 5–11 December 1992 [*8*];
- to monitor and evaluate nutrition intervention programmes.

Scope

Nutrition assessment done in the Region includes methodologies that deal with the nutritional disorders prevailing at different stages in the life cycle. These conditions can be summarized according to the life stage.

Fetal development within the maternal environment and neonatal period

- Intrauterine growth retardation leading to low birth weight of the neonate and growth retardation during infancy [*9,10*];
- iodine deficiency disorders, which may lead to developmental retardation and brain damage or stillbirths;
- folate deficiency among pregnant mothers may lead to neural tube defects on the neonate (in most counties of the Region, 400 μg/day folic acid is given as a supplement to pregnant mothers together with iron pills).

Recently, there has been considerable evidence, mostly from industrialized countries, that intrauterine growth retardation followed by very rapid postnatal catch-up growth is associated with an increased risk of coronary heart disease, stroke, diabetes and raised blood pressure [*11–13*]. On the other hand, large size at birth (macrosomia) is also associated with increased risk of diabetes and cardiovascular disease [*14,15*].

It is worth stating that as a result of industrialization, urbanization, economic development and market globalization in most countries of the Region, there have been changes in dietary and lifestyle patterns leading to the emergence of obesity and diet-related, chronic, noncommunicable diseases, which are taking over from the more traditional undernutrition and infectious diseases as causes of morbidity and mortality [*16–21*].

Infants and young children [*22–28*]

- Protein–energy malnutrition;
- iodine deficiency disorders;

- vitamin A deficiency and vitamin A deficiency disorders;
- iron deficiency anaemia.

These disorders may lead to stunting, developmental retardation, e.g. low cognitive performance, increased risk of infection and high risk of death.

Adolescents and preadolescents [*16,18,19,29–34*]

- Protein–energy malnutrition, iodine deficiency disorders and iron deficiency anaemia, with similar consequences to the previous stage;
- calcium deficiency, leading to inadequate bone mineralization with possible osteoporosis during adulthood;
- obesity, which may continue during adulthood with higher risk for all associated co-morbidities, particularly cardiovascular disease and type II diabetes.

Pregnant and lactating women [*25, 35–38*]

- Protein–energy malnutrition, iodine deficiency disorders, vitamin A deficiency and iron deficiency anaemia;
- folate deficiency;
- calcium deficiency.

Apart from the above-listed sequelae, these disorders may lead to insufficient weight gain during pregnancy, low-birthweight babies and increased risk of maternal mortality.

Adults [*18,19,39–43*]

- Protein–energy malnutrition and iron deficiency anaemia;
- obesity;
- diet-related, chronic, noncommunicable diseases, e.g. coronary heart disease, hypertension/stroke, diabetes and osteoporosis.

Thinness and chronic energy deficiency among adults as a result of protein–energy malnutrition are very rare in the Region apart from a few countries in the high child high adult mortality stratum.

The elderly [*44*]

- Protein–energy malnutrition, iron deficiency anaemia, obesity, osteoporosis and diet-related chronic diseases.

Scope of assessment in the Region

The scope of nutrition assessment in the Region has changed within the last 2 decades. At the beginning of the 1980s, the focus was on pregnant and lactating mothers and children under 2 or under 5 years. Main problems assessed were protein–energy malnutrition, iron deficiency anaemia, breastfeeding and weaning practices. Functional consequences of malnutrition were investigated in Egypt during the 1980s.

Iodine deficiency disorders and vitamin A deficiency emerged as the focus of nutrition assessment in the Region in the 1990s [*45,46*]. The goals of the World Summit for Children, New York, 29–30 September 1990, and the plan of action from the International Conference on Nutrition, Rome, 5–11 December 1992 were the initiators to focusing on micronutrient malnutrition in the Region [*47,48*].

With the nutrition transition in most countries of the Region, the problem of obesity and comorbidities among adults and adolescents attracted the attention of the nutrition investigators in the 1990s and this has continued to the present. With the beginning of the third millennium, diet and lifestyle-related problems like osteoporosis among adults and the elderly were also investigated within the scope of nutrition assessment [*19*].

Nutrition assessment methodologies commonly used in the Eastern Mediterranean Region

Nutrition and health assessment of the individual and the community

These include:

- anthropometric measurements, mainly weight, stature, arm circumference, waist circumference, waist-to-hip ratio, skin fold thickness (commonly at triceps) [*49,50*];
- clinical assessment, mainly by signs of deficiency and medical history [*51–55*];
- laboratory investigations; measurements of nutrients or their metabolites in biological fluids and comparison with reference standards and cut-off points [*52,54,56–59*];
- biophysical investigations e.g. X-ray for rickets, and dual-energy X-ray absorptiometry for assessment of bone mass density used to determine prevalence of osteoporosis [*60,19*].

The dark adaptation test for vitamin A deficiency is not used in the Region.

Assessment of the main determinants of nutritional status of the individual and the community

These include:

- food availability at the national level measured by the food balance sheet (available through the Food and Agriculture Organization and national ministries of agriculture);
- household food security and food intake of the individual, measured by dietary assessment methods;
- breastfeeding, weaning practices and weaning foods, which are extensively studied in the Region [*61–68*];
- morbidity status e.g. infection, infestations or chronic noncommunicable diseases [*69*];
- social, economic and cultural factors such as education, occupation, income, habits, beliefs and lifestyle, e.g. physical activity;
- availability and utilization of health, nutrition and social services and caring capacity at the community and household level [*70,71*];
- biodemographic factors, mainly age, sex, family size, interpregnancy interval, physiological status, e.g. pregnant or lactating.

All these determinants are assessed through prestructured questionnaires or rapid assessment procedures and focus group discussions. Observation methods at the household level are not culturally accepted in the Region; for instance, observation and weighing methods for dietary assessment could not be applied in Egypt [*72*]. The most commonly used dietary assessment methods are food frequency, to describe dietary pattern, and 24-hour recall or 24-hour recall and sample weighing, to determine dietary adequacy. Food intake in household measures is converted to grams and then to energy, macronutrients and micronutrients, which are compared with recommended dietary allowances [*72–75*]. Caring capacity and physical activity are assessed by questionnaire for time allocation rather than observation [*17,70*].

In the Eastern Mediterranean Region, the key method for assessment of nutritional status is anthropometric measurement, mainly weight and stature of the individual in the community. At the beginning of the last 2 decades, the focus was on anthropometric measurement of children under 5 years as an indicator of the nutritional status of the whole community. In-

terpretation of weight and stature measurements was mainly based on the Gomez classification, then the Waterlow classification using reference standards for weight-for-age, weight-for-height and height-for-age [*76,77*].

In 1983, the World Health Organization recommended using standard deviation (SD) scores for classifying children under 18 years into underweight, normal or overweight, and stunted, normal or tall children according to certain cut-off points: < –2 SDs, –2 to +2 SDs and > +2 SDs respectively from the reference median [*49*].

In 1995, body mass index (BMI, weight (kg)/height^2 (m^2) was recommended for use in adults to differentiate between normal weight, 3 grades of chronic energy deficiency (or underweight) and 3 grades of obesity [*50*]. In 2000, the obesity classification was modified into pre-obese (BMI 25.0–29.9 kg/m^2), obese class I (BMI 30.0–34.9 kg/m^2), obese class II (BMI 35.0–39.9 kg/m^2) and obese class III (BMI ≥ 40.0 kg/m^2) [*78*]. The Garrow classification [*79*] was used to describe weight status of adults before 1995.

In 1995, the World Health Organization recommended the use of percentile BMI for age for adolescents 10–19 years to differentiate underweight (< 5th percentile), normal (5th–< 85th percentile), overweight (85th–< 95th percentile) and obese (≥ 95th percentile) [*50*].

Clinical assessment for nutrition disorders has almost lost its value in the last 2 decades. Clinical signs of malnutrition are usually late signs, thus identifying severe cases of malnutrition. In most countries of the Region, malnutrition is usually mild to moderate, thus mainly detected by anthropometric, biochemical or haematological methods. The clinical signs still of value are those for iodine deficiency disorders and vitamin A deficiency [*52,54*]. In most countries of the Region, however, vitamin A deficiency is detected by serum retinol < 20 µg/dL and rarely by night blindness or Bitot's spots [*59*]. For iodine deficiency disorders, grades of goitre and urinary iodine are the most commonly used signs [*52*]. For iron deficiency anaemia, haemoglobin determination, and to a lesser extent serum ferretin, are the indicators most commonly used [*56*].

Recently, with the problem of obesity and co-morbidities emerging in the Region, blood glucose, total serum cholesterol and low-density lipoprotein cholesterol are measured [*80*].

Some sophisticated biochemical measurements are carried out for study of certain specialized problems, such as osteoporosis in Egypt [*19*].

In the Eastern Mediterranean Region, the approach for assessment is nutrition surveys rather than nutrition surveillance. All 22 countries have had national surveys within the past 2 decades, covering all the nutrition problems detected in the Region along with their main determinants (as discussed under "Scope") [*81–106*].

There have been efforts to establish nutrition monitoring or nutrition surveillance systems in many countries of the Region [*80,106*]. Strengthening of these efforts is, however, still required. Surveillance efforts are based mainly on the primary health care system, using growth monitoring and promotion of children under-5 as the core of the system. Most of the growth charts used in the Region are based on the World Health Organization model using percentiles of the American National Center for Health Statistics reference standards. In Egypt, the national growth chart simply consists of 2 curves, +2 SDs and –2 SDs of the NCHS reference standard of weight-for-age for boys and girls under 6.

Dissemination

During the past 2 decades, extensive nutrition assessment studies have been conducted in all countries of the Region. The main nutrition problems and risk factors have been identified. Population groups and geographic areas most at risk for each nutrition disorder in each country were determined. The wealth of information generated from these studies was disseminated to policy-makers to formulate strategies for prevention and control. Information was also disseminated to the scientific community through workshops, seminars, conferences and published papers.

Dissemination of simplified information to the public is the cornerstone of the promotion of health and nutritional status and the prevention of malnutrition. All the countries of the Region had enthusiastic nutrition education programmes applying all possible methods and vehicles appropriate to local conditions.

Activities using the information generated from nutrition assessment reached their peak at the beginning of the 1990s during the preparations for the international conference in Rome. Almost all countries of the Region submitted papers describing in detail nutrition problems and the immediate, underlying and basic factors leading to these problems, along with intervention programmes that were operating [*8,22*].

National and Regional workshops were conducted during the preconference consultation process. After the conference in December 1992 [*8*], almost every country of the Region prepared a plan of action on nutrition based on 9 action-oriented strategies [*107*]. These strategies constitute the framework of nutrition information disseminated to the different sectors of the population in the Region. They are:

- incorporating nutritional objectives, considerations and components into development policies and programmes;
- improving household food security;
- protecting consumers through improved food quality and safety;
- preventing and managing infectious diseases;
- promoting breastfeeding;
- caring for the socioeconomically deprived and the nutritionally vulnerable;
- preventing and controlling specific micronutrient deficiencies;
- promoting appropriate diets and healthy lifestyles;
- assessing, analysing and monitoring nutrition situations.

Most countries of the Region have prepared, or are in the process of preparing, national food-based dietary guidelines applying these strategies through a simplified and practical approach for the public.

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Invited paper

Dietetic practice: the past, present and future

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SUMMARY The history of dietetics can be traced as far back as the writings of Homer, Plato and Hippocrates in ancient Greece. Although diet and nutrition continued to be judged important for health, dietetics did not progress much till the 19th century with the advances in chemistry. Early research focused focuses on vitamin deficiency diseases while later workers proposed daily requirements for protein, fat and carbohydrates. Dietetics as a profession was given a boost during the Second World War when its importance was recognized by the military. Today, professional dietetic associations can be found on every continent, and registered dietitians are involved in health promotion and treatment, and work alongside physicians. The growing need for dietetics professionals is driven by a growing public interest in nutrition and the potential of functional foods to prevent a variety of diet-related conditions.

Introduction

Definition of dietetics

The word diet is derived from the Latin *diaeta*, meaning mode of life, a word that up until the last century was often used in a much broader sense than its current meaning. The word dietetics was noted in the early writings of Hippocrates (460 BC), Plato (460–348 BC), and Galen (130–200 AD) [*1*]. Recently, dietetics as a profession has been defined by the American Dietetic Association as the integration and application of principles derived from the disciplines of food, nutrition, management, communication, biological, physiological, behavioural and social sciences to achieve and maintain human health.

Origin of dietetics and diet therapy

Although not officially recognized as a profession, dietetics (and nutrition) has constituted a branch of the medical art since the time of the ancient Greeks. Intervention in the nutritional habits of the patient was a method of treatment [*2*]. Physicians and philosophers believed that proper diet was a precondition for corporal and intellectual well-being [*3*].

Dietetics was known in the 8th century BC. In Homer's epic *The Iliad*, Podalirius, one of the two physicians mentioned, was recognized for his special interest in dietetics [*3*]. Later, Hippocrates (5th century BC), the father of medicine wrote, "Let thy food be thy medicine, thy medicine be thy food," emphasizing that diet was the best way to treat disease [*1*]. He presented his nutritional concepts in his work *On diet*. Among his aphorisms are found statements which are in agreement with current research, such as "persons who are naturally very fat are apt to die earlier than those who are slender" [*3*].

Another example of the influence of food on many aspects of life in ancient Greek society comes from the famous philosophical works of Plato (5th–4th century BC), who makes frequent references to human diet. According to the philosopher, a moderate and thus healthy diet con-

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sists of cereals, legumes, fruits, milk, honey and fish. In addition, the dietary patterns presented in the Platonic dialogues were very similar to the current Mediterranean diet [*3*]. Plato suggested that the therapeutic approach to human diseases should be made through the regulation of diet rather than with medication, "Wherefore one ought to control all such diseases, so far as one has time to spare, by means of dieting rather than irritate a fractious evil by drugging" (Timaeus verse 89C-D). He recognized the importance of the proper nutrition for corporal development in many passages in his texts "for there ought to be no other secondary task to hinder the work of supplying the body with its proper exercise and nourishment" (Laws verse 807D) [*3*].

In the following centuries, many physicians highlighted the importance of diet in maintaining health and in the treatment of diseases. Members of the famous medical school of Alexandria like Erasistratus and Herophilus (3rd century BC), Celsus (1st century AD) and Galen (2nd century AD), produced many writings on diet [*4*]. Galen was the Roman emperor's physician, an anatomist, physiologist and a fruitful writer and his word in medicine and science became law for the following 12 centuries. He was one of the believers in diet, and said "health depends chiefly on the choice of food." He stressed the therapeutic value of climate and a full diet for tuberculosis, and emphasized the value of milk in the treatment of disease [*3*]. In later years, Boorde, a physician and experienced traveller of the 16th century, wrote 2 short books related to health, *Breuyary of helth* and *A compendious regiment or a dietary of helth*. He included brief chapters on bread, potage (soup), meat, eggs and cheese, fish and fowl, roots, herbs, fruits and spices, and diets for the following: sanguine, phlegmatic, choleric and melancholic temperaments and pestilence, fever, gout, leprosy, consumption, palsy, madness and dropsy.

Hospital dietetics appeared in the 12th century as shown in the records of the history of St. Bartholomew's Hospital in London, the oldest British hospital, established in 1123 [*5*]. In the Middle Ages, and even through the 18th century, hospital diet was based on bread. Other components were beef, beef broth, ale cawdel, beer, mutton, mutton broth, cheese, butter, milk pottage, rice milk, sugar soppes and water gruel [*1*].

Only little change in the type or amount of the daily food allowance for patients at St. Bartholomew's was noticed a century later [*6*]. Four different kinds of diet existed at that time; the common diet, the broth diet, the thin or fever diet, and the milk diet. The common diet was simply the normal diet. The broth diet was the same as the common diet but without any meat. The thin or fever diet did not include meat, beer or butter and consisted of 1 pint of milk with tapioca, arrowroot, sago or rice as prescribed, and barley water. The milk diet consisted of milk porridge, 12 ounces of bread, 2 pints of milk with tapioca, arrowroot, sago or rice as prescribed, barley water, 1 ounce of butter and bread pudding 3 times a week when ordered. At that time, most of the other hospitals in London used the same terms to describe their diets, with some including such terms as full, middle, and low diet, and spoon or fever diet [*1*].

By the early part of the 20th century, therapeutic diets had become more common and were usually named after the physician who prescribed them, such as Meulengraght's diet and the Sippy diet and the various adjustments of each. Nowadays, emphasis in diet therapy is placed on a diet adequate in all nutrients, with minimal modifications in quantity, consistency and texture of food according to patient needs [*1*].

Development of dietary studies and dietary standards

Diseases of dietary origin

Major progress in dietetics was made through the contribution of science, the emergence of diseases of dietary origin and the discovery of vitamins and minerals. The writings of keen observers and experienced physicians opened up new chapters in the history of nutrition and dietetics.

Iron deficiency anaemia, the most commonly occurring type of anaemia in many parts of the world today, was described in 17th century writings as the "green sickness" and was treated either with herbs or iron preparations [*1*]. The early history of goitre, a disease characterized by a swelling at the front of the neck, goes back to 1820 when Coindet used a tincture of iodine to paint goitre, and to Boussin-Gault's recommendation in 1833 that salt containing iodine should be used in the treatment of this disease. The latter observed the communities in the Andes, and noted that the difference between goitrous and non-goitrous communities was related to the iodine content of the salt they used [*1*].

The early years of the 20th century witnessed an enormous expansion in nutrition knowledge. Carpenter, in his work on the history of nutritional science, described what is called the vitamin era. Most vitamins were discovered in the 19th and 20th centuries [*7*].

A scheme for identifying vitamins by letter began before their chemistry had been worked out. Labelling of the vitamins was done according to their sequence of discovery. Factor A, found in leaves, and deficiency of which resulted in severe ophthalmia, was the first to be discovered. Next, McCollum and his colleagues agreed upon a water-soluble factor, factor B, as the antiberiberi factor, a cure for a deficiency observed in rice-eating countries (parts of Japan and China, the Philippines, India, etc. and coastal areas of South America and Africa) and which could develop in chickens and pigeons fed white rice. It was then realized that factor B was a complex of factors; these were called B1 and B2. Riboflavin (vitamin B_2), isolated, synthesized and named in 1935, was then discovered to save some dogs on a "blacktongue" diet (deficient in the B complex vitamins) that had collapsed with a prior condition of "yellow liver", a condition with marked fatty infiltration. Pantothenic acid, B_6 and biotin were added to the list of water-soluble vitamins in 1937 [*8*].

After the discovery in Wisconsin in 1924 of the curative effects of ultraviolet light on rachitic rats, many groups tried to determine the factor implicated in this operation. It was quickly traced to vitamin D (the letter C had already been given to the antiscorbutic vitamin, isolated by Albert Szent-Gyorgi from lemons in 1928) [*7*].

A factor found to prevent a number of clinical conditions, including abortion, impotence, and various forms of muscular dystrophy, was isolated in 1935 and named vitamin E. Haemorrhaging in chicks, which was at first thought to be caused by a deficiency of vitamin E, was later cured by a new fat-soluble vitamin, which was named vitamin K, recognized as having an essential role in blood coagulation [*7*].

The first dietary studies

Quantitative nutritional studies expanded with the progress in chemistry in the 19th century. Lavoisier (1743–1794) was the first to report that a labouring man needed more food than one at rest [*9*]. Furthermore, many researchers of the 19th century such as Mulder, Edward Smith and Lyon Playfair tried to quantify the amount of protein needed by humans. Values based on di-

etary studies and ranging from 60 g/day to 120 g/day were proposed; in contrast to Mulder's figures, which were based merely on the Netherlands army rations, Smith's and Playfair's figures were based on dietary studies of workers, soldiers, sailors, unemployed men, doctors and housewives [*1*].

Voit (1831–1908), a dominant figure in physiological chemistry in the latter half of the 19th century, developed the techniques for metabolic studies which instituted nutrition as a science. In 1881, he recommended a daily dietary allowance for an average labourer of 118 g protein, 500 g carbohydrate, and 56 g fat. Rubner (1854–1932), one of the most distinguished of the many pupils of Voit, worked with caloric needs and established the law of surface area in basal metabolism. He determined the caloric values of protein (4.1 kcal/g), fat (9.3 kcal/g), and carbohydrate (4.1 kcal/g) which for many years were the standard for dietary energy calculations. He also investigated protein foods and their digestibility. He was an advocate of a high-protein content of the diet: 127 g/day for the average worker and 165 g/day for those doing hard labour or soldiers in the field [*1*].

In the United States of America (USA), Atwater, on the basis of numerous dietary studies, recommended 125 g/day of protein in the diets of labouring men, along with 400 g/day carbohydrate, 125 g/day fat and 3230 kcal [*10*]. Chittenden (1856–1943), based on nitrogen balance studies, recommended 50 g/day protein for soldiers, a diet considered too low in protein compared to other recommendations [*11*]. In England, Hutchison, an advocate of the high-protein allowance, recommended that a diet of 3000 calories should supply 75 g protein [*12*].

Sherman, an authority on dietary standards, proposed 75 g protein/man per day as a low-protein diet, and for an average diet 100 g protein/day [*13*]. At this same time, he introduced recommendations for dietary requirements of iron (15 mg/day) and a minimum requirement of 0.7 g/day calcium oxide, preferably 1.0 g/day. By 1941, in the 6th edition of his text, Sherman preferred to use the term dietary allowance instead of requirement and recommended 75 g protein, or 10–15% of total calories, 0.8–1.0 g calcium and 12 mg iron daily. Balance studies formed the basis of his recommendations. He took the average from these studies as the minimal requirement and then added a safety margin of 50% for each nutrient. Sherman also made recommendations for desirable dietary intakes of vitamins A, C, D, thiamin and riboflavin [*1*].

Development of food composition tables

Food composition tables are the basis of the science of nutrition. They are essential to the dietitian to evaluate the adequacy of diets of individuals and groups and to plan therapeutic diets and set dietary recommendations. Until suitable methods of chemical analysis were developed, however, no accurate data on food composition could be obtained. In 1864, the Weende method for measuring crude fibre was developed by William Henneberg and Fredrick Stohmann and was used in Europe [*1*].

In 1877, Atwater ran extensive analyses of foods in America that led to the publication of food composition tables [*10*]. Later, similar tables were developed for use in other parts of the world, such as those of McCance and Widdowson [*14*], for tropical countries [*15*], the Middle East [*16*] and for international use [*17*]. Later on, food tables for use in Latin America [*18*], Africa [*19*] and the Near East were developed by

the Food and Agriculture Association of the United Nations [*20*].

Food enrichment and fortification

The enrichment of certain foods with specific nutrients was another step toward dietary improvement for the general population. In the USA in 1924, the State Medical Society of Michigan agreed on using iodized table salt as a remedy for iodine deficiency [*1*].

After the production of several nutrients in inexpensive form became possible, the enrichment of bread, flour, cornmeal and grits became mandatory in some 30 states of the USA. After the approval of salt iodization and the addition of vitamin D to milk, the Council on Foods of the American Medical Association discussed the possibility of improving the health of the public by the addition of other nutrients to food. Later on, fortification of margarine with vitamin A and the addition of calcium and iron to cereals were approved [*21*].

Dietary standards and recommendations

Finding adequate dietary standards continued to be the goal for those working in nutrition and dietetics. In September 1932, the health committee of the League of Nations met in Rome to "consider the question of dietary standards and draw up a scale of family coefficients for international use in order that the enquiries on the state of nutrition in various countries might be comparable." International dietary standards agreed upon were: calorie allowance for an adult not doing manual work should be 2400 calories net/day, with increases for light work of 75 calories per hour of work, moderate work 75–150 calories per hour of work, hard work 150–300 calories per hour of work, and very hard work up to 300 calories per hour of work. Concerning mothers and children under 18 years, energy requirements were obtained from a table of coefficients; for example, a child aged 3–5 years had a coefficient of 0.5 (1200 calories/day) and a nursing mother 1.25 (3000 kilocalories/day). Recommended protein requirement was 1 g/kg body weight per day [*1*].

During the Second World War it became essential for every country to make use of all the nutritional knowledge it had in order to maintain the health, morale, and working efficiency of its populace. In 1940, the US National Research Council appointed a Committee on Food and Nutrition (later called the Food and Nutrition Board). The committee's main concern was to define in accordance with newer information the recommended daily allowances for various dietary essentials for people of different ages. This was not an easy task because of the lack of data, especially regarding vitamins. After rigorous research, however, the committee finally formulated tentative allowances that were adopted in May 1941. The Food and Nutrition Board has continued to evaluate current research and whenever sufficient new information or more reliable data became available, changes were made in the recommended allowances [*1*].

Following the example of the USA, several other countries prepared their own dietary allowance tables. Each was formulated on a group or population basis, serving to evaluate the national food supplies and helping meet certain dietary goals [*1*].

Evidence-based medical nutrition therapy

Rapidly advancing nutritional knowledge and science led to the development of evidence-based nutrition. Nowadays, official nutrition bodies such as the American Die-

tetic Association are promoting evidence-based medical nutrition therapy, a practice that evolved from judicious use of published scientific evidence and best practices.

Moreover, evidence-based medical nutrition therapy means that nutrition advice and recommendations are based on evidence which has been assessed in an unbiased or impartial manner. Recommendations related to relationships between a specific nutrient or food component and a disease should only be made if there is sufficient evidence to support them.

Experimental studies conducted in laboratories have been used to show how a certain nutrient or food works to provide benefit or damage. Being able to prove how a food contributes to the health outcome adds credibility to the hypothesis. Intervention studies supplied the best evidence for determining how a nutrient affects health.

Studying the relationship between diet and health was not an easy task. To begin with, dietary recall methods have their limitations and nutrient composition data of foods consumed must be available and accurate, which is not always the case. In addition, it takes many years for the effect of diet to manifest itself and so studies need to be conducted over long periods. Finally, large numbers of people are required as participants in a study to detect an effect from diet. For this reason, evidence to support nutrition recommendations is sometimes incomplete or inconsistent.

The evolution of dietetics as a profession

Rise of the dietetic profession

War, which has always influenced man's lifestyle, food and health, ought to take some credit for the rise of the dietetic profession. Florence Nightingale (1820–1910), founder of the nursing profession, was also designated the first hospital dietitian. She said, "You cannot diet a patient from a book; you cannot make up the human body as you would a prescription." On November 5, 1854, she arrived at the barracks hospital in Scutari with a small band of nurses during the Crimean War. They found a hopeless confusion, lack of supplies and patients who were almost starved. The next day she began to cook extra from food supplies she had brought and within a week she had an extra diet kitchen established. In addition, due to her organizing ability (characteristic of a dietitian today), the purveyor's department was reorganized, a corps of medical orderlies was established and the cooking service of the soldier-patients' food was rearranged and improved [*1*].

Alexis Soyer (1809–1858), a famous chef born in France, also went to the Crimea, where he was recognized as the first army dietitian and was given credit for the rise of the dietetic profession. He taught the soldiers how to cook and to make their rations delicious and nutritious [*22*]. After his return to London, at the request of Miss Nightingale, he organized schools of hospital cookery, planned kitchens and general diets and wrote a booklet on the preparation of diets for sick soldiers which was adopted by the military hospitals. During Soyer's, time and despite his leadership, dietetics was considered a woman's profession. However, the year 1936 saw the first male member of the American Dietetic Association, and an increasing number of young men followed. In the Second World War they served not only as dietitians in military services but with the Veterans Administration and in civilian positions [*1*].

In the United Kingdom, dietitians who first followed Miss Nightingale's example came from the nursing profession, but the

progress in the science of nutrition and the specialized knowledge required for modern therapeutic diets led to dietetics becoming a specialized field of training with specific academic qualifications as well as hospital training [*23*].

International dietetics

Dietetic associations now exist in many countries on every continent. They all have their own qualifications for academic and professional education and may differ in the scope of their dietetic and nutritional activities, as these are adapted to the needs of the individual countries and the opportunities available. Few studies in the scientific literature have described the field of international dietetics.

Dietetics in the USA

Sarah Tyson Rorer (1849–1937) was the first American dietitian. She founded the Philadelphia Cooking School in 1881 so she could teach dietetics as well as cooking. In addition, she started a diet kitchen "where physicians could send a prescription and get food prepared for special diseases." She also gave physicians classes in dietetics and lectured 4th-year medical students at the University of Pennsylvania [*1*].

In October 1917, under the leadership of Lenna Cooper and Lulu Graves, dietitians met and organized the American Dietetic Association, which immediately concerned itself with qualifications and standards of training for members of this new profession.

The demands of the Second World War gave even greater impetus to the recognition of the work of the dietitian: almost 2000 dietitians were commissioned by the armed services [*1*]. By the turn of the century, through annual meetings, the provision of quality education, networking opportunities and new products and services, and with nearly 70 000 members, the American Dietetic Association had become the world's largest organization of food and nutrition professionals.

Today, the American Dietetic Association is led by a board of directors comprised of national leaders in nutrition and health. "Leading the future of dietetics" is the mission of the association; its vision resides in its members as being the "most valued source of food and nutrition services." The role of the association does not end at the national level. Fifty state dietetic associations, along with the District of Columbia, Puerto Rico and the American Overseas Dietetic Association (comprised of American-trained dietitians who are living and working abroad) are affiliated.

Being the world leader in dietetics, the American Dietetic Association offers an array of services, including a website and the association journal. The website, www.eatright.org, contains a wealth of nutrition information. The journal is the most widely read peer-reviewed periodical in the dietetics field and can be accessed via the website at www.adajournal.org. In addition the association runs a public charity, the American Dietetic Association Foundation, established in 1966 to improve the nutritional health of the public by providing support for research, education and public awareness programmes. The foundation is also a large grantor of scholarships in the nutrition and dietetics fields. For government and public issues, the American Dietetic Association's government affairs office, based in Washington DC, works with state and federal legislators, departments, and agencies on public policy issues affecting the practice of dietetics. The association's position statements are derived from the

latest available research, addressing issues such as children's health, food technology and safety, public health, consumer education, health care reform, nutrition in the elderly and health care provider education.

The Commission on Accreditation for Dietetics Education is the association's accrediting agency for education programmes preparing students for careers as registered dietitians or dietetics technicians. It serves the public by establishing and enforcing eligibility requirements and accreditation standards that ensure the quality and continued improvement of nutrition/dietetics education programmes. Registered dietitians have to study a wide variety of topics focusing on food, nutrition, and management. The purpose of registration is to protect the nutritional health, safety and welfare of the public by encouraging high standards of performance in the profession.

More than 75 000 dietitians and dietetic technicians from the USA and the rest of the world have taken the registration examination over the past few decades.

Dietetics in Asia

In Japan, hospital dietitians were studied by Nakamura of the Department of Nutrition in St. Marianna University, Yokohama [*24*]. Dietetics started in 1925 with the foundation of the first dietetic school and the graduation of the first Japanese dietitians a year later. The Japanese Dietetic Association was established in 1945. In 1962, the old dietetic education system was revised and a new system offering a 4-year study programme was introduced to endorse the growth of registered dietitians. The law in Japan defines a registered dietitian as a dietitian who is registered through a national examination by the government in any nutrition-related area.

Though changes have been made to improve the quality of food service in Japan, attempts to change or improve dietitians' duties were not obvious. The main duties were to plan menus, prepare and cook meals, store ingredients and provide food guidance. Dietitians in Japan were never involved in any clinically-related nutrition care or assessment. According to Nakamura there are many food service dietitians in Japan, however, there are no clinical dietitians.

Tarvady described nutritional care in Indian hospitals [*25*]. The nutrition and dietetics branch of study was created in 1980, yet the profession did not progress much because dietitians, who were mostly women, had no access to hospitals or medical universities to support their teaching and learning programmes. Moreover, dietitians were not able to receive the dignified status that other members of the heath care team usually obtained.

Later, the Department of Clinical Nutrition at the College of Allied Health Sciences initiated and implemented a 1-year postgraduate diploma course in clinical nutrition that gives practical hands-on training. The course content was inspired by the certified nutrition support dietitian syllabus of the American Society of Parenteral and Enteral Nutrition. The department established links with the Nutritional Science Education and Research Foundation in New York and created the first Regional Training Centre in Nutrition Support Systems.

Dietetics in Africa

The actual shape of hospital dietetics in this continent can be depicted from a survey conducted by Calabro, who surveyed 61 counties including Gambia, Malawi, Nigeria and Sudan [*26*]. The results revealed that professional associations, credentialing

requirements and a code of ethics did not exist in most countries and that 60% did not have academic programmes for dietetics. Clinical dietetics was the most frequently selected area of practice, teaching was the second most common and food services the third most common. The author concluded that, with only a few dietitians in each country, the profession badly needed to be developed [*26*].

Although there is no extensive literature on the condition of hospital dietetics in Africa, Fairfull, an American volunteer dietitian who went to Liberia with the aim of making significant contribution to dietetics in that country, gave a brief description of dietetic practice in Africa in 1987 [*27*]. Her observations and activities were carried out in 2 hospitals, ELWA Hospital, and JFK Hospital. JFK Hospital was better equipped and had 2 dietitians with training whereas ELWA Hospital had no dietitian, only a missionary kitchen employee, trained as a registered nurse who served primarily as a purchasing agent.

Dietetics in Latin America

According to Mackinnon, the outstanding figure of South American dietetics was Dr Pedro Escudero of Argentina, the founder of the National Institute of Nutrition and the School of Dietetics in Buenos Aires [*28*]. He had looked at the European and American models and selected from them what suited the needs of his country. The School of Dietetics was established in 1938 as an autonomous institution of the Argentine government, and the requirements for entrance were the same as those for the National University. The course of study offered a good foundation in biochemistry and physiology, and the students were to become medical nutritionists (*medico-dietologo*), the equivalent of internists, specializing in diet therapy and group feeding.

At the same time, Brazil witnessed the foundation of a 1-year course in dietetics. Peru established its school of dietetics during the 1940s at the Obrero Hospital in Lima, and Uruguay and Venezuela have had schools for about the same length of time. During this period, the Institute of Nutrition in Colombia also started a 4-year course with a university affiliation to train nutritionists and dietitians. There was no effort made in Central America as regards the development of dietetics as a profession until 1960 when the Institute of Nutrition of Central America and Panama in Guatemala started a course for dietitians and nutritionists, drawing on North American models.

Following a conference held in Caracas in 1966, supported by the Pan-American Health Organization and with the assistance of the Venezuelan government, on the training of public health nutritionist-dietitians, 13 of the 20 participating schools, which formerly had 2–3-year dietetic training programmes, started offering a 4-year university degree course. In addition, the general plan of the university programme for nutritionist-dietitians recommended at the Caracas conference included a period of practical experience under supervision in a health centre or a hospital. Most of these new degree programmes in nutrition and dietetics were affiliated to university schools of public health and as such had the assistance of the medical faculty for their instructional programme, and had the university hospitals for practical experience.

During the 1970s, there were already 8 dietetic associations in Central and South America with the Central American Association covering 6 countries. Moreover, 7 associations at that time reported a total

membership of 1515. Some time later, other specialized associations were established in the region. The Latin American Federation for Parenteral and Enteral Nutrition was created in 1985 in Buenos Aires, Argentina. This society incorporates the health personnel working in clinical nutrition in Latin America. It organizes an international congress every other year where advancements in the field, as well as clinical and basic research in nutrition from the region, are presented.

Jonkers-Schuitema et al. provided information on the current standing of dietetics in Latin America [*29*]. Towards the end of the 1970s, Dr Jose Felix Patino at Hospital de la Samaritana in Bogotá started the first nutrition team in Colombia as a branch of the department of surgery. In 1986, some members of this team, with the support of the Colombian Surgical Society, founded the Colombian Association for Clinical Nutrition. The society main's activities were education, with the subsequent development of educational courses and congresses. Efforts were also directed at modifying the curricula in schools of nutrition and dietetics to include more training in clinical nutrition and to move the dietitian into clinical work with critically ill patients. Nutrition in Colombia was later directed more towards community activities, leaving inadequate resources for clinical nutrition and hospital programmes. With the launching of the new health system, however, where health care is paid by private companies, costs of approved basic therapy are covered, including clinical nutrition support.

In summary, the field of nutritional support in this part of the world is growing. This growth is supported by many educational activities and promoted by the Colombian Association for Clinical Nutrition. Clinical trials as well as papers on nutrition are being presented at every meeting and more individuals are looking for additional training in order to be better qualified.

Dietetics in Europe

With the establishment of an official definition by the International Labour Office in Geneva, the profession of dietetics was recognized among the paramedical professions and coded under group 0.69 [*30*]. Calabro investigated the profession in 12 European countries: Austria, the Czech Republic, Germany, Greece, Ireland, Italy, Luxembourg, Poland, Slovakia, Spain, Switzerland and the United Kingdom, [*26*]. High scores for overall professionalization of dietetics were found in these countries. Professional associations existed in most; dietetics was recognized as job title and clinical dietetics was a common area of practice. In addition, all these countries had academic programmes and dietetic curricula which included a mandatory period of practical experience before students could embark on professional practice. Unfortunately, few descriptions of dietetic practice in individual European countries exist in the literature.

In Britain, the British Dietetic Association was set up in 1936, with the majority of members being clinical dietitians. It offers continuous training and facilities to dietitians. The association now has more than 5000 members, mostly qualified dietitians holding a degree or postgraduate diploma recognized for registration by the Health Professions Council.

Except in the Netherlands, one of the early founders of the profession, dietetics education in European countries was at a lower level than that in the United Kingdom, Ireland and the Scandinavian countries. In most European countries, the dietitian's major tasks are still food preparation and guidance [*29*].

Dietitian training has existed in the Netherlands since 1935. This country of 15 million inhabitants currently has 5000 trained dietitians (2% men), half practising in the profession. Academic training is usually 4 years, including a 6-month period of practical, hands-on training. There are 4 colleges of nutrition and dietetics, located in Groningen, Nijmegen, the Hague and Amsterdam. The universities of Maastricht and Wageningen have Master's programmes in nutrition [*29*].

Since the first International Congress of Dietitians, held in Amsterdam in 1952, Dutch dietitians have always been in contact with colleagues abroad. In 1993, the Dutch Association of Dietitians signed a reciprocity agreement with the American Dietetic Association. Accordingly, Dutch dietitians are qualified to take the registration examination offered by the Commission on Dietetic Registration to become a registered dietitian in the United States [*29*].

Dietetics in the Netherlands stands on the threshold of a new era. After 60 years this profession has risen from a health professional who evaluates and controls food and diet preparation to a health professional who is an important component of health care. Today's dietitians work in various fields of dietetics and nutrition, including university hospitals, community hospitals, nursing homes, regional health work, private practice, advice and prevention bureaux, research institutions, education, industry and government. In addition, the Dutch Association of Dietitians provides professionals with protocols and guidelines that promote quality assurance, continuous appraisal and improvement of the profession.

Dietetics in the Middle East

Turnlund and Tannous studied dietetic practice in the Middle East in 1983 [*31*]. Of the 15 hospitals surveyed, 2, both in Saudi Arabia, had trained dietitians. One of these hospitals had registered dietitians trained in the United States, the other had dietitians registered in Great Britain. None of them spoke Arabic, so it was recognized that there was a need for Arabic-speaking trained individuals. In Lebanon only 1 hospital had dietitians, and 9 of the 15 hospitals surveyed employed a person with some background in nutrition as head of dietetics and/or food service.

An evaluation of the nutritional adequacy of normal diets given to patients was made according to the 4 basic food groups; 7 hospitals supplied an adequate diet and only 3 had their own diet manual. Through this survey, it was noticed that only limited counselling was given to patients, either during their hospital stay or at discharge. The authors acknowledged that hospitals in the Middle East area needed Arabic-speaking dietitians, familiar with the food habits of the countries in which they were working. Dietetics training programmes in the area were also among the recommendations [*31*].

Education and training in dietetics in Lebanon

In Lebanon, university training in dietetics started in 1981 when the American University of Beirut developed a nutrition and dietetics programme aimed at providing dietitians for the country and the Middle East as a whole. Academic requirements were based on the standards of the American Dietetic Association. Up until 2003 this was the only university in Lebanon offering an undergraduate programme in nutrition and dietetics. Active dietitians in Lebanon are almost all graduates of the American University of Beirut or have had training in the USA or Europe. Besides nutrition courses, the programme includes courses

in biology, chemistry, biochemistry, sociology and psychology. The 3-year programme is usually supplemented by an 11-month supervised internship in the dietary department of any hospital in Beirut. Master's degree programmes in nutrition are also offered.

The Lebanese Dietetic Association was founded in 1993. It is considered a reliable reference for scientifically based nutrition information in the country. With nearly 200 active members, it is currently working on forming a credentialing body responsible for establishing and enforcing standards and qualifications for dietetic registration. Currently, dietitians and nutritionists are employed in a variety of situations. Some work as members of the medical team treating persons with illnesses or injuries by providing therapeutic nutrition services. They are called clinical or therapeutic dietitians, and they constitute a vital component of health care teams in hospitals, nursing homes, health maintenance organizations and other healthcare facilities. They assess, evaluate, educate, and plan diets for patients in need. Each hospital in Beirut has to have at least 1 clinical dietitian. In addition, some hospitals in Beirut have specialized dietitians such as a diabetic specialist dietitian, a paediatric dietitian or a renal dietitian.

Nutrition, health and fitness have become major concerns in Lebanon, and in Beirut in particular. As a result, community nutritionists/dietitians are becoming a common sight on television and are now more widely available in health clubs. They are responsible for teaching, monitoring and advising people on proper nutrition to improve their quality of life.

Dietitians in education and research dietitians are also available in Lebanon. They usually have a higher education degree. The former work in colleges, universities and community or technical schools, teaching future doctors, nurses, dietitians, and other health professionals the science of foods and nutrition. They also conduct experiments to solve critical nutrition questions and provide dietary recommendation to the public.

The future of dietetics

Trends

Throughout March and April 2002, the American Dietetic Association conducted a scanning process and compiled a list of more than 100 important trends, issues and events that are likely to shape the future of dietetics, dietetics professionals and dietetics associations [*32*].

New opportunities for the profession were recognized by the 2002 environmental scan. Population growth in the USA means more people need dietetics services. This applies to the world population as well, including developing countries. The increasing cultural and ethnic diversity of the USA implies that significant numbers of people may be underserved. There will be a greater need for services as a result of new information about the role of diet in health care, new understanding of the contribution of diet to chronic problems and the demands of an ageing society. Finally, the growing need for dietetics professionals is driven by a growing public interest in nutrition, food safety and the potential of functional food to prevent illness. However, dietetics experts are faced with new sources of competition from web-based information services, food producers, nutritionists and alternative medicine practitioners, among others.

On the 85th anniversary of the American Dietetic Association, the board of directors shared their insights by looking at their vision of the association in the year 2017, the 100th anniversary [*32*]. They

predicted multiple interactions in managing obesity issues, nutrigenomics and the delivery of information and food directly to the home. The future of the association will be closely involved with online communication and commerce. Interpretation of the continually evolving daily recommended intake with regard to particular genetic profiles, specific preferences and lifestyle is expected to be one of the new trends too. Extension of the scientific base of dietetic recommendations is also on the agenda.

Challenges

Given the current trends, the profession is facing technological, social, political, global and environmental forces that are significantly reshaping the world food system. Dietetics professionals are destined to play a role in the future of the food system as advocates of food safety, quality, security and healthfulness.

The emerging modern lifestyle, with its stress on time, changing eating habits, lack of physical activity and busy families with long working hours, puts a lot of pressure on the food system to meet dietary needs. The home is no longer the centre of food and eating. Furthermore, eating habits are associated with leading causes of illness and death such as cardiovascular disease, some cancers, diabetes, hypertension and obesity, a fact that raises the stakes for the dietetics profession.

Keeping pace with science and technology is a challenge in itself for dietetics professionals. Affording the means to learn and interpret new developments effectively as and when needed should be an important component of professional development goals. With the advancement in information technology, dietitians could adopt the Internet for client communications, learning and promotion, taking into account benefits and privacy issues.

Moreover, with the rise of homeopathy and other types of alternative medicine, the public has more options for nutritional guidance. The competitive space of the dietetics profession is being seriously challenged. Dietetic associations must help their members to keep up with this competition through the sophisticated delivery of nutrition and health related information from a variety of sources by building up the dietetics brand. Dietetics professionals and their associations should also exert more efforts to increase diversity in the profession and work cross-culturally.

According to the American Dietetic Association, obesity is a "crisis-opportunity." Dietetics professionals and their associations are uniquely prepared to take the lead on this issue and launch joint projects to bring it to the forefront of public attention. Individuals and societies need to hear and see the bottom-line numbers on what excess weight is costing, and be able to get ongoing support for a healthier lifestyle. More people need nutrition counselling than before; they have a greater, but flawed, knowledge of nutrition and have chronic needs for improving their diets. This ought to be a growth era for dietetics.

Planning and preparation

Following a thorough discussion about the implications of the opportunities and challenges, the American Dietetic Association put forward a strategic plan aimed at serving the public as well as dietetics as a profession [*33*]. The goals for 2004–08 include facilitating research supporting the dietetics profession, empowering members to compete successfully in a rapidly changing environment and proactively focusing on emerging areas of food and nutrition [*33*].

To sum up, the dietetics profession is shaped by powerful trends as well as faced

by even stronger challenges. As the world changes rapidly, the way dietetics professionals deliver services must change to keep pace. Under this pressure, dietitians have the opportunity to transform their field into a cutting edge profession that addresses emerging and evolving needs of their societies. However, there is nothing that automatically gives this opportunity to dietitians [*32*]. They will have to shape their destiny and this can only be achieved by a proper and strategic planning and preparation. And as the Japanese proverb says, "Vision without action is a dream; action without vision is a nightmare." Thus, to be a proper action, any action must be based on a proper vision and strategic planning.

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Invited paper

Regional overview of maternal and child malnutrition: trends, interventions and outcomes

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SUMMARY The proportions of underweight, wasted, and stunted children, as well as the infant and under-5 mortality rates, have all exhibited downward trends in the Region over the past 2 decades. This is in part attributable to maternal and child nutrition intervention programmes, especially those in which women were actively involved. Programmes which support and promote breastfeeding, such as the Baby Friendly Hospital Initiative, have also contributed to this trend, although the number of baby friendly hospitals varies considerably between countries. Available information also shows that anemia is quite common among women, many of whom also have a low weight and stature and seem to suffer from osteoporosis. In several countries of the Region a number of micronutrient deficiency control programmes are in progress, such as iron supplementation for pregnant women, fortification of flour and iodization of salt. Iodine deficiency disorders are under control in 2 countries of the Region and legislation for salt iodization is in place in 17 countries. Prevalence of severe malnutrition in children is much lower than that of milder levels, thus, promotion of the nutrition status of mildly to moderately malnourished children could lead to a sizeable reduction in child mortality.

Introduction

The Eastern Mediterranean Region of the World Health Organization comprises 22 countries extending from Pakistan in southern Asia to Morocco in North Africa. These countries are ecologically, economically, and socially very different and at various stages of development. Per capita GNP ranges from US$ 130 to US$ 18 270. They also vary considerably with regard to the health and nutrition situation and achievements in combating malnutrition and promoting health and nutrition of the people. Many of them can be said to be food-secure on an average basis [*1*], although significant intra-population differences exist. In this review, an overview of the nutrition status of mothers, children under 5 years old, trends and relevant intervention projects and programmes is presented.

Malnutrition

Trends

Growth faltering and malnutrition usually start at around the age of 6 months, mainly because complementary feeding is either begun late or is not done properly. Table 1 shows the trend of child malnutrition and mortality in the Region in the past 1–2 decades.

The proportions of underweight, wasted and stunted children, as well as the infant and under-5 mortality rates have all exhibited downward trends in the Region

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Table 1 **Child mortality and malnutrition in the Eastern Mediterranean Region over the past 2 decades (sources [*3–5*])**

Variable	Mortality rate per 1000 live births		Moderate & severe malnutrition in children under 5 years		
	Infants	< 5 years	Underweight %	Wasting %	Stunting %
Initial	57	78	17	8	31
Year	**1992**	**1992**	**1980–92**	**1980–92**	**1980–92**
Final	46	58	14	6	22
Year	**2002**	**2002**	**1995–2002**	**1995–2002**	**1995–2002**
Change (%)	–19.3	–25.6	–17.6	–25.0	–29.0
Trend	↓	↓	↓	↓	↓

as a whole, although considerable inter-country variation exists. According to de Onis, Frongillo and Blössner, stunting rates in the Region ranged between 7.8% (Jordan) and 36.3% (Pakistan) in the mid- to late 1990s [*2*]. The downward trends can at least partly be attributed to implementation of programmes such as breastfeeding promotion, mother and child nutritional interventions, community-based projects and better health service coverage (some of these programmes will be discussed briefly).

With regard to low birth weight, the picture is different; the prevalence of low birth weight increased from around 10% in 1990 [*3*] to around 11% in 1997 [*4*], stayed constant until 2000, and increased again to around 14% at the turn of the century [*5*]. Since birth weight is an indication of the mother's nutrition during pregnancy, an upward trend for the prevalence of low birth weight in a community would indicate, at least indirectly, a worsening of women's nutrition and feeding behaviour during pregnancy.

Anaemia, mainly due to iron deficiency, is a widespread nutrition and public health problem in all countries of the Region, irrespective of family economic status and income level. The prevalence of moderate plus severe forms among women and young children is 25%–60% [*6*]. According to Aoyama, the overall prevalence among women ranges between 6% (Libyan Arab Jamahiriya) and 17%–79% (Egypt) [*1*]. The major causes and contributing factors are low dietary iron bioavailability, intestinal parasite infestation and short birth spacing. In addition, general observations and limited data indicate that sizeable proportions of women also suffer from osteoporosis and have a low body weight and small stature.

Although mild and moderate forms do exist, clinical vitamin A deficiency does not appear to be a major problem in the Region as a whole owing to high consumption of green leafy vegetables, a rich source of pro-vitamin A (β-carotene). Deficiencies of folic acid, zinc, and vitamin D have also been observed [*7*], however, not much detailed information is available on them.

Nutrition transition

Nutrition transition is occurring in many counties of the Region. In addition to undernutrition, overnutrition (chronic nutri-

tional conditions and diseases such as overweight, obesity, cardiovascular disease, diabetes, hypertension and cancer) is widespread as a result of socioeconomic and lifestyle changes such as low level of physical activity, imbalanced diet, stress, etc. Obesity, a disease in itself and a risk factor for several other chronic diseases, afflicting up to 40% of the population as a whole, seems to be more prevalent among women than men. In many countries for which data are available, overweight and obesity (based on weight for height) are also prevalent among children and adolescents and are on the increase. According to de Onis and Blössner, the proportion of overweight, based on the National Center for Health Statistics standards, in children under 5 in 12 of the countries of the Region ranged between 0.9% (Oman) and 8.6% (Egypt) in the mid- to late 1990s [*8*].

Intervention projects and programmes

Not much published information is available on the maternal and child nutrition intervention projects and programmes in the Region. Allen and Gillespie, in an excellent publication, reviewed thoroughly and critically the nutrition intervention programmes conducted in many countries, including some of the countries of the Eastern Mediterranean Region [*9*]. They showed that, for example in Pakistan, those pilot projects aiming at improvement of maternal and child nutrition in which women were actively involved had greater chances of success. In these projects, both macro-level (poverty alleviation, food fortification, etc.) and micro-level (nutrition and nutrition-related services, professional training, etc.) approaches were used, and the public sector, the community as a whole, nongovernmental organizations, hospitals, universities and international organizations were involved. Some of the pilot projects have been reasonably successful. Large-scale projects at the national level should now be designed, implemented and evaluated.

On the other hand, in Oman, despite striking success in child survival and development, a community-based nutrition intervention project using the Triple-A approach (assessment, analysis, action) could not bring about an equally striking improvement in the nutrition status of children under 5 years old [*10*], although it did considerably reduce the number of underweight children [*11*].

Another example is from the Islamic Republic of Iran. Following a successful community-based project in Sibak village [*12*], another project using the Triple A approach was conducted in 3 geographically, ecologically and socioeconomically different rural regions in 3 provinces between 1996–1999, aiming at reducing malnutrition in 6–35-month-old children [*13*]. Nutritional and non-nutritional strategies included growth monitoring, demonstration of complementary food preparation, home gardening, and income-generation. By the end of the period prevalence of underweight had decreased from 21%–38% to 10%–15% ($P < 0.0001$) and stunting prevalence had decreased from 25%–41% to 12%–15% ($P < 0.0001$). Further analysis of the data showed the main factors in the success of the project to be political commitment at the highest level in the respective provinces, applied health and nutrition education, intersectoral collaboration and community involvement. The project is now being expanded to other provinces.

Finally, assessment of maternal and child nutrition status in a health care programme in Saudi Arabia showed the nutrition status of the mothers and 0–2-year-old

children to be relatively satisfactory, 90% of the children having a normal weight and height [*14*]. No initial assessment, i.e. at the start of the programme, had, however, been made, therefore no final conclusion could be drawn about its effectiveness and impact.

The Baby Friendly Hospital Initiative, launched jointly by the United Nations Children's Fund and the World Health Organization in 1991–92, with the aim of supporting and promoting breastfeeding in different countries, has been successful in its goals and objectives in the Region [*15*]. The national breastfeeding authorities control the relevant measures and programmes using global criteria. As a result of these efforts, more mothers now breastfeed their infants in the Region as a whole. The proportion of children exclusively breastfed for 3 months is over 40%. The proportion breastfed for 6–9 months with complementary feeding increased from 38% in the period 1990–1996 to 45% in the period 1995–2002, and about one third are now breastfed for 20–23 months.

Two points are worth mentioning here. First, the number of baby friendly hospitals varies considerably in the countries of the Region. While a few countries still have none, the number generally ranges between 1 (Afghanistan) and 376 (Islamic Republic of Iran). Second, the breastfeeding duration and rate are actually declining in some countries of the Region, particularly in the rural areas, e.g. in Kuwait [*16*] and Libyan Arab Jamahiriya [*17*]. Serious efforts will be needed to reverse the trend.

Micronutrient deficiency control programmes

Anaemia control projects and programmes, e.g. iron supplementation and fortification, have been and are being conducted in several countries of the Region. These are in many cases components of other programmes such as primary health care. For example, iron supplements are distributed routinely to pregnant women. In several countries iron and vitamin drops are also given to infants.

Currently, Egypt, the Islamic Republic of Iran and Saudi Arabia have started fortifying wheat flour with iron (30 ppm) [*18*]. Other countries are in the process of planning this strategy; some are also considering the feasibility of fortifying oil or flour with vitamin A and flour with folic acid [*18*]. It is probably too early to judge the efficacy and efficiency of this. Anaemia is a true "multi-dimensional" phenomenon; to control it several strategies other than increasing iron intake are absolutely essential, including public health education, promotion of breastfeeding, promotion of sound dietary practices, birth-spacing, improved environmental health and sanitation. Another problem is that the major source of iron is foods of plant origin, whose iron bioavailability is very low.

With regard to vitamin A, some small-scale projects have been conducted in the Region to control deficiency. Although, as already mentioned, clinical vitamin A deficiency is not widespread, it would be justifiable to have programmes aiming at increasing the average intake of this vitamin by women and children since it strengthens the immune system and thus helps prevent and control infections, which are a public health problem in the Region. In 2000, about 70% of the children 6–59 months old were in vitamin A supplementation programmes [*19*].

Control programmes for iodine deficiency disorders (IDD) are not usually targeted to specific age or sex groups, e.g. women or children, but rather to whole populations. Successful IDD control pro-

grammes would result in the promotion of iodine status in, along with other groups, women, adolescent girls and children. Consequently, improvements in their physical and mental health will occur**.** The Region has been very active in this area over the past 2 decades, with support from the World Health Organization, the United Nations Children's Fund and the International Council for the Control of Iodine Deficiency Disorders [*20*]. Not all countries in the Region, however, have national control programmes. In 2 countries, the Islamic Republic of Iran and Tunisia, IDD has been officially declared by the World Health Organization to be under control [*19*], and in Jordan, Lebanon, the Syrian Arab Republic and Yemen it is said to be almost under control. Seventeen of the remaining countries have ongoing programmes for universal salt iodization and 16 have appropriate legislation for this. In the Region as a whole, about 51% of households currently consume iodized salt [*5*].

General comments and recommendations

In developing countries in general, 50% of child deaths are associated with malnutrition [*21*]. On the other hand, the prevalence of severe malnutrition is usually much lower than that of mild and moderate forms; for example, only 4% (less than one-third) of the final underweight cases (total = 14%) shown in Table 1 are severely underweight and the other 10% are moderately so. Therefore, in addition to combating severe protein–energy malnutrition, promotion of the nutrition status of mildly to moderately malnourished children is also quite justifiable since it will lead to a reduction in child mortality.

In many cases, child malnutrition is related more to poor child care practices and infections, e.g. intestinal parasites, than to a low food intake as such [*22*]. This should be borne in mind when designing intervention programmes.

Special attention should be paid to the following when designing strategies and policies: intersectoral and intrasectoral collaboration, nutrition surveillance, monitoring and evaluation, inter-country collaboration, political commitment, technical and technological capacity and development of competence, community involvement, and proper legislation (e.g. for food fortification). In many areas, applied research is essential so that more effective intervention programmes can be designed and implemented.

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Invited paper

Managing nutritional programmes in developing countries

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SUMMARY Improving community nutrition in developing countries requires a detailed epidemiological picture of the prevalent nutritional problems in different regions and age groups. This makes it possible to identify priorities, sensitize policy-makers, establish political commitment and design appropriate community programmes for income generation and education for the best use of food resources. Experiences acquired from community-based nutritional programmes show that ownership of a programme by the community and using a tailor-made approach are essential factors in the successful implementation of programmes. A multifaceted approach is needed, involving a range of sectors—agriculture, commerce, education and health—and commitment at all levels from government to communities and individuals.

Introduction

Current evidence suggests that developing countries are experiencing a transition phase in the epidemiology of nutritional disorders, and that most countries of the Eastern Mediterranean Region are entering this phase rapidly. In developing countries, there is a high prevalence of undernutrition (protein–energy malnutrition, and micronutrient deficiencies), which is most critical in the fetal and neonatal stages, as well as the under 5-year-old age group. On the other hand, with increasing urbanization in these countries, food consumption patterns are changing, physical activity is decreasing and metabolic disorders such as obesity, cardiovascular diseases, diabetes and cancer are also rising. It is not unusual in developing countries to see obese mothers who are caring for malnourished children. This shows that these countries face a bilateral problem, with a need both for decreasing malnutrition and micronutrient deficiencies, and for combating overnutrition by improving food consumption patterns and modifying lifestyles. In either case, the approach to planning and implementation of intervention programmes to improve nutrition are the same. This paper reviews strategies for managing nutritional programmes with examples of successful schemes from around the world.

Effective planning

Like other health programmes, the management of nutritional programmes should follow 3 consecutive stages: planning, implementation and evaluation. In the planning phase, 5 activities should be carried out: recognizing the situation; identifying problems and priorities; identifying goals; examining obstacles and difficulties; and devising a comprehensive action plan. Thus identifying and bringing together all the organizations and individuals who will play a part in the programme, to gain their cooperation and determine the goals of the programme, will be followed by a situation analysis to provide a general picture of the

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types and etiology of nutritional problems in the region.

Nutritional problems need to be tackled from a variety of angles. Holding brainstorming meetings and advocacy workshops with a whole range of sectors, including agriculture, commerce, education and health, as well as the community, is a effective method of analysing the problems in a region and promoting responsibility for solving them. Experiences of different countries have shown that if all members of communities participate in the problem-solving process, acquiring their cooperation in planned interventions is easier. After gathering the needed data and analysing the reasons for nutritional problems, the appropriate interventions, which are usually multi-faceted, should be designed and implemented. The selected approach may not be confined to the health sector and other sectors may have an even more important role to play.

Communication for behavioural change

Communication for behavioural change (CBC) is one of the main strategies in improving community nutrition for increasing peoples' knowledge and motivation for change and is used for achieving different nutritional goals, such as improving complementary nutrition methods and increasing the acceptance of food supplements and the consumption of fortified foods. Women, especially mothers, are the key target group for modifying food habits for the health of both themselves and their children, and this is especially important in rural areas where mothers experience hard physical labour, multiple pregnancies and inadequate diets. Communication strategies have to include fathers too. In many areas, due to cultural reasons fathers have a higher share of the household's food in terms of quality and quality than other family members, especially women. In such cases, educational programmes for men are needed that focus on the nutritional needs of women and children.

Evaluation of CBC programmes on a large scale, especially those aiming at mothers and others who care for children, has shown they were effective in improving the nutritional status of children. One CBC programme, the Heart Model, has been implemented in Viet Nam, Bangladesh and Haiti [*1*]. It was part of a comprehensive intervention programme for growth monitoring, iron and vitamin A supplementation, de-worming and infection treatment. In this approach, mothers participated in educational sessions held in their own homes or visited rehabilitation centres for 2 weeks and were trained in preparing nutritious meals for their malnourished children using locally available foods. The programme has been successful in preventing mild to moderate malnutrition among children in Haiti and Viet Nam.

In the Islamic Republic of Iran, nutrition education was first implemented in 1995, in a rural area of Chahar-Mahal and Bakhtyari province [*2*]. In this programme, mothers who had children under 2 years old were educated in their homes using cooking demonstrations by community health workers and trained volunteer rural grandmothers. Raw materials for preparing baby foods were provided by mothers and the cooked meals were distributed among their children in health houses or the mother's home. The success of this programme in improving the nutritional status of rural children lead to its implementation across the whole health network of the country. Experiences of this programme have

shown that practical nutrition education for mothers also provides opportunities for education about other issues such as growth monitoring, breastfeeding, nutrition in diarrhoea and other diseases.

Promoting intra- and inter-sectoral communication

Intra- and inter-sectoral communication is another key aspect of managing nutrition programmes. In the inter-sectoral approach, all health programmes affect the nutritional status of the community in some way. For example, control of diarrhoeal diseases and acute respiratory infections, healthy mother programmes, family planning, environmental modifications, vaccination, food safety programmes and controlling infectious and parasitic diseases are measures that should be done in parallel with nutritional services for improving the nutritional status of the community. It has become clear that there is a direct relation between the quality of drinking water supplies and the nutritional status of children, as contaminated water supplies increase the prevalence of diarrhoea and diarrhoea leads to nutritional deficiencies [*3*]. However, improving the quality of water supplies does not necessarily reduce the prevalence of malnutrition among children. In this same way, nutrition education alone does not improve nutritional status.

Investing in women's literacy and education

Experiences of different countries are that investing in literacy and health education, family planning and improving the quality of women's life has resulted in a sustainable improvement in the nutritional status of communities.

It has been shown that the mother's education has an even more positive effect on children's growth than the economic situation of the family. A study by the United Nations Children's Fund (UNICEF) of 23 nutritional projects in South-East Asia showed that the literacy of mothers is an essential factor in children's growth and improves nutritional status of children more rapidly than other interventional factors [*4*]. In an intervention plan to reduce malnutrition among children in rural areas of 3 provinces of the Islamic Republic of Iran over 3 years, a literacy programme for rural women resulted in a 10% increase in the number of literate women (3% increase in the total number of literate people nationally). This was thought to have played an important part in reducing malnutrition measures among children in the region before and after the intervention [*5*].

Education about nutrition is another key factor in mothers' ability to provide appropriate care of family members. In the Iranian programme mentioned earlier, nutritional messages based on women's daily needs were included in literacy classes to reinforce the effect of the literacy education and increase the women's motivation for participating in classes [*5*]. Several studies have shown that education of mothers about nutrition not only decreases the proportion of underweight children, but also decreases child mortality [*5–7*]. It also has positive long-term effects on the children's future development.

Integrating nutritional and health interventions

In view of the multidimensional nature of nutritional problems, programmes and activities that do not directly relate to nutrition also need to be considered in designing in-

terventions for improving the nutritional status of communities. These include providing safe drinking water, modifying the environment, family planning, integrated management of childhood illnesses and other mother and child health programmes, modifying lifestyles and increasing physical activity. In most nutritional projects, in different settings, these measures have been included in nutritional interventions [*8*].

An example of community-based intervention can be found in Tanzania, where the programme is characterized by strong community participation and management by the public sector [*6*]. In Tanzania, the management systems emphasized improving mothers' knowledge about growth monitoring, and using and interpreting growth charts. Integrated measures were also implemented for increasing the access of people to foodstuffs, health care services and education. This programme resulted in a higher productivity of personnel in the related sectors, when they saw how their efforts were effective in improving the nutritional status of people.

The North Karelia project in Finland is an example of a comprehensive intervention for reducing the prevalence of cardiovascular diseases [*9*]. Over a 25-year period, the project succeeded in decreasing the mean serum cholesterol and mortality from coronary heart disease among men aged 35–64 years old by 18% and 73% respectively. This was achieved through cooperation between related sectors, long-term nutrition education, cooperation with volunteer organizations and food industries, promotion of food labelling policies, supporting research and international cooperation.

In the Islamic Republic of Iran a successful programme for reducing iodine deficiency disorders (IDD) was integrated into the primary health care system from 1989 [*5*]. Community health workers (*behvarz*) provided education to food retailers, members of the community and rural schoolchildren about IDD and the importance of consuming iodized salt. Consumption of iodized salt in rural areas was monitored by *behvarz* at the time of the annual census, through testing household salt with iodine meters. The *behvarz* also tested salt that children brought from their homes and contacted rural schools twice a year to identify households that did not consume iodized salt. The programme monitoring now operates at 3 levels: production, distribution and consumption. Monitoring the iodine content of urine of 8–10-year-olds is now made once a year and any required interventions are designed by inter-sectoral committees at district and province level. Integrating this programme into the primary care system and defining the duties of related sectors, including the environmental health department, food safety department, health centre laboratories, *behvarz* and provincial nutritionists, were important for the success of the programme. Involving different sectors inside and outside the health sector in the programme, clarifying the duties of each sector through a national committee and the existence of an effective community health network have undoubtedly contributed to the success of this IDD prevention programme.

Another participatory programme in the Islamic Republic of Iran, this time for reducing malnutrition, was performed from 1996 to 1999 in rural areas of 3 provinces [*10*]. It is an example of health and nutritional interventions with concomitant health and nutritional measures, including: promoting growth monitoring of children and involving mothers in using and interpreting children's growth charts; education

about breastfeeding and complementary feeding; promoting family planning; improving sanitation and providing safe drinking water; controlling diarrhoeal diseases and education about nutrition in diarrhoea; promoting home gardening for raising vegetables; and facilitating income-generating schemes for households such as loans for livestock raising, bee keeping, carpet weaving and confectionery making. Evaluation of this programme after 3 years showed that malnutrition, according to indicators for moderate and severe underweight and stunting, had decreased by 50%.

The Islamic Republic of Iran is experiencing a transition in nutritional status and so the prevalence of metabolic disorders such as obesity, cardiovascular diseases, diabetes and cancers is rapidly increasing. Thus measures have been integrated into a new national programme that includes mass media campaigns for modifying food consumption patterns and promoting physical activity, and encouraging the food industry to produce low fat, low salt and low sugar products. An evaluation of the programme is planned, to determine the effectiveness of such large-scale interventions.

Flexibility is an important factor in nutritional intervention programmes. Nutritional interventions should be tailored to each region's problems. For example, illiteracy of women may be the main reason for children's malnutrition in a rural area, so increasing women's literacy will be the priority of that region. Flexibility in managing nutritional programmes is possible only when programming and policy-making are implemented in a decentralized or regional manner. This facilitates the active involvement of the target groups in planning, implementing and evaluating nutritional interventions.

Involving the community

Participation of community and family members in nutrition improvement programmes is successful only when they take on the responsibility of health, nutrition and social welfare in the community, and acquire the necessary skills to share in the process of their own development and that of the community. Communication is vital when involving the community, because public participation is necessary for implementing interventions, from the problem-determining phase through to offering solutions, implementation, supervision and evaluation. The community can play an important role in analysing problems and determining their own needs ("down-to-up" planning) and this has been shown to be important in the success of nutrition interventions. Community members should be informed about the problems and be encouraged to offer regional and national resources in planning, implementing and supervising nutritional programmes [*11*].

Different community groups, such as students, religious leaders and volunteer groups, can be involved in community nutrition improvement programmes. In the participatory programme for reducing children's malnutrition in the Islamic Republic of Iran, provincial health centres and agriculture and education ministries cooperated to facilitate and encourage schoolchildren to raise vegetables in school gardens [*5*]. This innovative way of promoting the consumption of vegetables and fruits aims to increasing the population's access to healthy fresh food in regions where these may not be adequately available. A further benefit is that students will transfer nutritional messages to their family members.

Another example of utilizing volunteer groups can be found in the Islamic Repub-

lic of Iran [*2*]. Women volunteers are educated about breastfeeding, complementary nutrition, nutrition of preschool children and other health-related issues by health sector personnel and nutritionists. Then each woman covers 50 households in her region for nutrition and health programmes and undertakes the necessary follow-up. A similar programme is implemented in Thailand where rural health volunteers are educated by health sector personnel and convey nutritional and health information to 10–15 rural households [*7*].

The best method of community participation in nutritional intervention programmes is bottom-up planning. A significant example of this can be seen in Thailand where a "basic development needs" strategy has been considered [*7*]. Members of the community, with the help of the public sector, gather information, identify problems, suggest solutions and implement interventions. Facilitating communities in participation in health improving programmes pays back the investment in time and resources. Community participation can be in two forms: providing some elements of the required resources or direct involvement in the decision-making process.

Involving women's NGOs

There are several successful examples of the involvement of nongovernmental organizations (NGOs) in nutritional programmes around the world. As the prime carers of the family, women have an essential role in all aspects of nutrition and women's societies can participate in educating mothers in the fields of family planning, breastfeeding, pregnancy care and nutrition of children and other vulnerable groups.

In the Islamic Republic of Iran, nutrition education and weekly iron supplementation of high-school girls, has been implemented by cooperation and financial support from a women's participation centre through the health network of the country [*12*]. Under the supervision of school authorities, high-school girls receive one ferrous sulfate tablet a week for 16 weeks per year and nutrition education programmes are given by teachers and school health officers.

The South-Asia Regional Office of UNICEF studied 23 community-based intervention programmes in 1995 [*4*]. The study showed that the success factors of the programmes included: individual and community innovations in evaluating nutritional problems; active participation of the community in identifying problems and selecting solutions; forming volunteer local committees and supporting them through the public sector; capacity building through continuous education of public sector personnel and volunteers, especially women; involving NGOs; and appropriate management and powerful leadership [*4*].

Implementing poverty reduction programmes

Poverty is the main factor in malnutrition and it follows that poverty reduction programmes can affect the nutrition situation of a region. Nutritional objectives should be clearly considered in these programmes, otherwise there is no guarantee that increased incomes will be spent in improving nutritional status or will support the groups that are most at-risk of malnutrition.

There is evidence of economic growth linked to a decrease in children's malnutri-

tion in many countries [*13*]. In the Islamic Republic of Iran, between 1995 and 1998, underweight decreased from 16.0% to 10.5% among girls, and from 15.5% to 12.5% among boys [*14*]. Creating access to educational health facilities and developing structures which can mobilize the potential resources for the benefit of all, is a sustainable strategy for reducing poverty. Meanwhile, performing short- and medium-term programmes for reducing poverty in nutritional interventions is the essential condition for success of nutrition improvement programmes.

Offering food aid and supporting families with malnourished children through the cooperation of NGOs involved in food relief is one poverty reduction strategy. In Malaysia, a package of essential foods and iron and multivitamin supplements is distributed every month to poor households with malnourished children. Meanwhile, school milk programmes, which include distributing milk among primary-school students of poor rural and urban areas on specific days of the week, is another method of reducing micronutrient deficiencies among poor and vulnerable groups [*15*].

A similar programme is currently being carried out in the Islamic Republic of Iran. In this programme, growth-retarded children are identified through growth monitoring and screening in the primary care system and introduced to the Imam Khomeini Relief Committee, an NGO that supports poor families. A basket of food, the contents of which are defined by primary care nutritionists, is delivered free to the families of malnourished children. The experience of this programme highlights the fact that all the family members, and not only the malnourished child, need support and food aid. Inevitably, the food packages are consumed by all the family members and the effectiveness of the programme in terms of help for a particular child is reduced.

Establishing and maintaining political commitment

Political commitment is the essential prerequisite for achieving the goals of large-scale nutritional programmes. To establish such a commitment, the extent and kind of problems should be recognized. Unfortunately, there are established perceptions among decision-makers and senior managers in many countries that malnutrition is simply a result of food insufficiency or that it is a medical problem, which only the health sector can deal with. The results of situation analyses should be disseminated to all levels, including the highest political positions, through seminars, workshops, publications and the mass media.

A national commitment to nutritional objectives is needed, including assigning specific resources to nutritional programmes and a willingness of government and other sectors to accept new administrative structures for tacking malnutrition, in order to facilitate the implementation of coordinated and centralized activities. Inter-sectoral coordination and mobilization for educating personnel in different sectors is an example of national commitment to achieving nutritional objectives.

Acceptance by policy-makers of a country of the importance of nutrition in health and development means that it will be considered in food regulations and support and subsidy systems. It can also lead to the establishment of a national network for identifying nutritional vulnerable groups and at-risk areas and the facilitation of inter-sectoral participation for achieving nutritional objectives. Thus establishing effective relationships with policy-makers

is a vital part of the successful management of nutritional programmes. So too is the establishment of food and nutrition surveillance systems, which can record and analyse positive and negative changes in nutrition measures, such as malnutrition among children and food-related metabolic disorders, and monitor the production, supply and consumption of food. Food and nutrition monitoring systems can be established in any part of the community health system. The important point is that the system should be multi-sectoral, gathering information from different sectors and disseminating it to all sectors involved. Finally, food subsidies, as a part of a government's supportive umbrella, have an important role in improving the nutritional status of communities. The effectiveness of food subsidy programmes can be increased in two ways: by targeting vulnerable groups and by ensuring that subsidised foods provide essential micronutrients as well as meeting energy requirements.

Strategies for reducing micronutrient deficiencies

Supplements

Micronutrient supplementation programmes for at-risk groups, integrated into the primary care system, are an important way to tackle nutritional deficiencies. The common deficiencies in developing countries are in iodine, iron and vitamin A. Zinc deficiency should be considered in countries that face nutritional stunting of under-5-year-olds. Pregnant and lactating women and under-2-year-olds are the priority groups in supplementation programmes. If provision of supplements is possible, other at-risk groups such as the 2–5-years-olds and adolescent girls can be included. The effectiveness of providing weekly iron supplementation for preschool children [*16,17*] and pregnant women [*18,19*] has been demonstrated in many countries.

Fortification of staple foods

Fortification of staple foods with micronutrients is the main strategy for controlling micronutrient deficiencies, and through integration into the primary health care system have had useful results in the Islamic Republic of Iran. Quality control and monitoring iodized salt and fortified flour with iron and folic acid can be easily achieved by involving the related government sectors (food safety, food and drug control laboratories and environmental health) and also by educating the community and health personnel through the primary health care system. In fact, the primary health care system should be the entry point for all nutrition education programmes.

Promotion of special foods

An alternative to food fortification and supplements is the promotion of foods rich in certain vitamins or minerals. In Thailand, the Ministry of Health, with the help of the Institute of Nutrition at Mahidol University (INMU), promoted raising and consuming ivy gourd plant as a rich supply of vitamin A precursor. Using an extensive social marketing project, people were encouraged to use it in different foods. Studies in Thailand show that adopting nutrition education and food diversification strategies based on local food supplies of vitamin A, food fortification and vitamin A supplements has caused a considerable increase in serum retinol of preschool children [*20*].

Cooperation with the food industry

Encouraging policy-makers to support fortified food producers through assigning subsides, and acquiring the cooperation of the food industry is essential for the conti-

nuity of fortification (nutrition) programmes.

Again, the food industry needs to be aware of a country's health objectives and be encouraged to produce more low fat, low salt and low calorie products. Paradoxically there is also evidence of an emerging problem of nutrition-related chronic diseases in developing countries, which are linked to increasing wealth and consumption of factory-produced and non-traditional foods and carbonated beverages [*21*]. So-called "fast foods" are believed to increase the risk of obesity and cardiovascular diseases due to their high fat content and to lead to different kinds of micronutrient deficiencies. Carbonated beverages intensify calcium deficiency, especially where there is insufficient calcium intake, due to their high phosphate content that disturbs calcium absorption.

Conclusions

Improving the nutrition of the community in developing countries requires a detailed epidemiological picture of the prevalent nutritional problems in different regions and age groups. This will make it possible to identify priorities, sensitize policy-makers, establish political commitment and design appropriate community programmes for income generation and education for the best enjoyment of food resources. Experiences acquired from community-based nutritional programmes show that ownership of a programme by the community and using a tailor-made approach are essential factors in the successful implementation of programmes [*13*].

The best way to increase the effectiveness of nutritional programmes is by integrating the two strategies of reducing poverty and increasing the nutritional knowledge of the community. Increasing household incomes, along with improving peoples' skills at managing household resources and adopting appropriate patterns of food consumption, increases the return on investing in the field of social development. Increasing the nutritional knowledge of the community also improves peoples' skills in managing household resources, caring for children, forming children's lifelong eating preferences and improving women's health. These in turn facilitate community participation and impact on food and nutrition policies.

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Invited paper

Nutrition in humanitarian crises

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SUMMARY It is anticipated that humanitarian crisis situations will continue to occur in countries of the Eastern Mediterranean Region affecting large segments of vulnerable populations. Subsequently the magnitude and effectiveness of the humanitarian response, particularly for food and nutrition, must be based on best practices and sound information of affected populations. To bridge the burgeoning gap between the food and nutrition needs of affected populations and the available resources, four key areas need to be addressed by the humanitarian agencies: adequate knowledge and skills in public health nutrition; effective coordination between humanitarian organizations when conducting nutritional assessments and interventions; efficient and appropriate delivery of services; communication, awareness and advocacy. This paper discusses approaches to how these may be improved.

Introduction

The purpose of this paper is to synthesize experiences and observations in food and nutrition interventions, gathered over the past several years as part of engagement in a number of humanitarian crisis situations afflicting the countries of the World Health Organizations (WHO) Eastern Mediterranean Region. These include the recent crisis in Darfur and the war in Iraq, as well as chronic situations such as those in Somalia and Palestine. We do not purport to address all the food and nutrition-related issues that may arise in any major humanitarian crisis situations, but only focus on four key technical and programmatic food and nutrition interventions – adequate knowledge and skills in public health nutrition; effective coordination between humanitarian organizations for nutrition assessment; efficient and appropriate delivery of services; communication, awareness and advocacy – and provide some suggestions for improvement.

We recognize the significant role that the national and international humanitarian relief organizations play in alleviating the suffering of affected populations in any humanitarian crisis. Their services are often delivered against serious security constraints and amidst very trying environmental conditions and we are deeply appreciative of the exceptional work they do.

Background

In recent years, humanitarian crisis situations have been characterized by political instability, armed conflicts, large population displacements, food shortages, social disruption and collapse of the public health infrastructure [*1–3*], and have resulted in increases in mortality above the usual levels due to a combination of disease, malnutrition and aggression [*1*]. In such situations, often referred to as emergencies or crises,

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serious disruption in the functioning of a society and its basic social services prevents the affected population from coping on its own [*4*].

With the recent security and political developments in the world and the growing vulnerability of populations, it is unlikely that there will be a reduction in the frequency of humanitarian emergencies in the coming years. Therefore, countries and organizations need increasingly to gear themselves to addressing effectively the major health challenges that arise from crises situations [*1,4*].

Technical expertise

The knowledge, skills and experience of staff from the humanitarian relief organizations that provide nutrition services are often a key factor in implementing technically sound programmes [*4*].

For many reasons, humanitarian organizations often experience a rapid turnover of their technical staff in the field, hence challenging the sustainability of programmes and interventions. Additionally there is a dwindling number of qualified nutrition experts interested in working in humanitarian crisis situations. The global rise and magnitude of humanitarian crises with the corresponding demand for nutritionists, together with insecure and/or poorly-supported working environments have also contributed to the oft-encountered situation where important technical decisions on nutritional requirements are taken by agencies or organizations working within the crisis setting with very little coordination and collaboration (unpublished reports, 2003–2005).

In the foreseeable future, public health nutrition experts will continue to be required during the initial phase of any humanitarian crisis as nutritional status is an appropriate indicator of the severity of the crisis. Subsequently, the humanitarian relief community should make every effort to ensure that a pool of trained national staff from the relevant ministries of the affected country is prepared in the basic principles and practices of public health nutrition. This will ensure that a cost-effective and sustainable back-up system will be in existence. It will also develop the national capacity to respond, albeit partially, to similar humanitarian crises in the future. Sustaining local capacity so that standards are applied for nutritional assessments, monitoring and health activities in a crisis setting requires the commitment and willingness of all stakeholders prior to the onset of a crisis.

Assessments

A valuable indicator of a population's health during the emergency phase of a humanitarian crisis is the crude mortality rate [*5*]. Other important public health indicators for use in humanitarian emergencies are the under-five mortality rate and acute malnutrition rate among children under the age of five years, since children in this age group are the most important vulnerable group during emergencies [*1,6*]. Although food scarcity remains the major cause of malnutrition during most emergencies, concurrent illnesses – especially chronic or recurrent diarrhoea, and micronutrient deficiencies, such as scurvy, xerophthalmia, pellagra and beriberi – may also contribute to significant morbidity and mortality [*7–9*].

The purpose and need for undertaking assessments is to enable humanitarian aid agencies both to identify and monitor health needs of affected populations during a crisis and to assess the effectiveness of interventions. Experience has taught us that

agencies and organizations in the past have not adhered to similar protocols thus jeopardizing comparability and accurate assessment of the severity of the situation.

Two screening procedures – measurement of mid-upper arm circumference and determination of weight-for-height – are recommended to identify malnourished children and refer them for appropriate feeding interventions [*6,10*].

Several authors have suggested that humanitarian agencies also take cognizance of the nutrition needs of other population groups, such as pregnant and lactating women, that are equally susceptible to acute malnutrition [*6,9,11,12*]. Some cut-off measures to identify adult males and females for routine food supplementation or special feeding regimens have also been proposed [*13*], while other authors [*14*] have pointed out the lack of uniformity and representativeness of the different anthropometric indicators used to classify adolescents and adults into various grades of under-nutrition.

For decision-making, weight-for-height remains the most accurate indicator for data collection and assessment of the nutrition situation [*6*] and has been accepted at the international level. Yet, a plethora of methods and indicators continue to be used to assess the nutritional status of affected populations in humanitarian crisis situations. Although information gathered from such assessments is often available in abundance, it does not provide any precise immediate or prospective time-trend understanding of the overall crisis situation because of the diversity of the methods used to collect data.

To avoid these practices, it is important that at the outset of any humanitarian crisis, where the nutrition status of the population has been compromised, members of the international and national humanitarian aid community immediately assist the national nutrition authority to establish a standardized protocol for all nutrition assessments, interventions and monitoring of their impact.

Coordination of actors

In the early phase of any humanitarian crisis, a number of international and national organizations arrive, mandated and equipped to provide humanitarian assistance of varied amount and quality. Food delivery begins at the early stages, but the assessment of the population's nutrition status, and monitoring of the evolving situation and impact of the interventions progress at a much slower pace, often complicated by the lack of coordination between all the stakeholders.

To ensure that valuable time and resources are not squandered, it is essential that at the very beginning of any humanitarian crisis, adequate support be provided to the national authorities (including the national nutrition/humanitarian authority) to establish a coordination mechanism. This mechanism will ascertain the interventions, the agencies that will undertake them and the indicators that will be used to assess the impact and effectiveness of the interventions, thus preventing duplication of efforts and gaps emerging.

For the mechanism to be effective and sustainable, a lead agency and relevant ministry should serve as the coordinators of information and actions. In any major humanitarian crisis, food and nutrition interventions and their sustainability remain well beyond the capability or capacity of a single international organization. Interaction and coordination with other sectors and agencies is essential. It is usually the national authority with the support of international organizations that has the potential reach,

capacity and longevity to ensure effective food and nutrition interventions in humanitarian crises. Therefore, all stakeholders should work collectively to provide an enabling environment where information and actions are coordinated with the aim of getting sufficient and appropriate assistance to those most in need.

Nutrition interventions

The conventional nutrition interventions recommended by WHO in any humanitarian crisis consist of inpatient therapeutic centres for severe malnutrition cases and outpatient supplementary feeding centres for moderate malnutrition cases. WHO regards severe malnutrition as a life-threatening emergency that requires immediate and urgent medical care and supervised inpatient feeding for the first week or so of treatment [*15*].

In recent years, several nongovernmental organizations have reported that the community-based therapeutic care (CTC) approach, where community members report the occurrence of malnutrition early, results in patients with malnutrition presenting earlier and are hence easier to treat. It is important to note that CTC is complementary to therapeutic feeding centres and includes three modes of treatment – dry take-home supplementary care for people with moderate, uncomplicated malnutrition, outpatient therapeutic care for those with uncomplicated severe malnutrition and inpatient care for those with severe or moderate malnutrition with complications or life-threatening illnesses [*16–18*].

The concept of CTC in its entirety has strong merit and logical applicability in emergency situations. However, our recent experience has shown that organizations providing care to malnourished populations tend to focus on providing ready-to-eat therapeutic food supplements to severely malnourished children on an outpatient basis without due attention to their follow-up or to the maintenance of suitable inpatient care for those with severe malnutrition (unpublished reports, 2003–2005).

This partial approach, probably adapted to the capacity of the organization delivering such services and for convenience, is inappropriate. Management of severe malnutrition is a medical emergency and cannot be approached in an *ad hoc* fashion. We must emphasize that unless an organization is prepared to cover the three aspects of CRC, including appropriate follow-up of outpatient and inpatient malnutrition cases, it should not be involved in the management of malnutrition in children.

As regards the actual food aid that is often provided to the affected populations in a humanitarian crisis, it is necessary to pay due attention to the introduction of food aid as well as to its timely withdrawal. A common criticism of food aid is that it encourages changes in food patterns, towards imported food and away from locally produced foods, and undermines to some extent traditional coping mechanisms [*19–21*]. In areas that are prone to drought, farmers and rural communities have, over time, developed sophisticated coping strategies that are characterized by considerable resilience and accumulated skills, including knowledge of wild foods and kinship networks [*22*]. It is important that such skills are not lost.

The occurrence of micronutrient deficiencies and the persistence of underweight among populations in humanitarian crises, raises questions about the quality of relief food, especially when food aid is a mainstay or the only supply and relief programmes last for years. In many instances, the procedures for establishing the food needs of vulnerable populations or the de-

gree of food security – an indicator for determining when food aid could be phased out – lack reliable methods or guidelines [*4,19,23–25*].

Other nutrition-related issues concerning food aid are the appropriateness and safety of the food items for human consumption at the point of purchase, during transit and storage, and at the point of actual consumption on arrival in the recipient countries [*19*]. The cultural acceptability of the food is also an issue as is its palatability.

Appropriate monitoring of food aid to the beneficiaries remains a problem in most humanitarian crises. Organizations involved in food aid often lack the operational capacity to run a monitoring system with their own personnel and there is heavy reliance on locally recruited staff or prominent members of the affected population, a practice that is fraught with irregularities and lack of transparency. Furthermore, an organization's concept of its monitoring system may be weak as such institutions tend to be more interested in the delivery of food supplies and in the food distribution process than the access to and use of such food items by the beneficiaries.

Communication, awareness and advocacy

It has been our experience that in countries encountering humanitarian crisis situations, the prevalence of different forms of malnutrition was at a higher level even before the onset of the crisis. Any subsequent increase in the different forms of malnutrition due to the deteriorating humanitarian situation may not draw the required response from either the national authority or the international community. When nutrition is not perceived as a priority [*4*], it will not receive the prominence needed to galvanize action to tackle the situation. It is essential therefore to promote, support and advance the cause of nutrition.

An effective communication channel between the national nutrition/humanitarian relief authorities and the national health authority/policy-makers needs to remain open at all times [*4*]. Humanitarian organizations can provide the necessary technical support and resources to these technical bodies to ensure that policy-makers at the national level and the international community are regularly provided with easily understood assessments of the situation and recommendations that can be implemented.

Conclusion

The primary objective of humanitarian aid agencies and organizations is to alleviate the suffering of those most affected in a crisis situation. This objective can only be truly achieved if all partners work in harmony towards common goals with similar tools, standards and guidelines. This entails using the best practices and lessons learnt from previous crisis situations to ensure effectiveness and appropriateness of relief interventions. The area of food and nutrition provides an ideal opportunity for relevant organizations to streamline strategies in assessment, coordination and delivery of services to meet objectives. As humanitarians, it is our responsibility to learn from previous experiences, and apply the knowledge gained to anticipate and prepare for future emergencies so as to aid better suffering populations who require assistance. We must maximize cooperation and harness all appropriate tools and strategies to deal effectively with the immediate crisis while at the same time working towards a speedy and long-lasting recovery.

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Through its years of experience in responding to major disasters, WHO has developed a set of core health commitments to be addressed and upheld during a disaster. Two of these relate to nutrition, namely:

1. Establishment of epidemic and nutritional surveillance by strengthening national health surveillance systems and integrating information from external partners so that the earliest possible action can be taken against communicable diseases, common childhood illnesses, malnutrition, conditions related to childbirth and damage to mental health.
2. Prevention and treatment of malnutrition by ensuring actions taken by all partners to support nutrition during an emergency are technically sound, guided by international standards and well evaluated.

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Invited paper

Iron deficiency anaemia – an old enemy

K. Bagchi[1]

SUMMARY Anaemia has remained a widespread public health problem in countries of the Eastern Mediterranean Region. Prevalence figures vary from a low of 17% to a high of over 70% among preschool children; from 14% to 42% among adolescents and from 11% to over 40% among women of childbearing age. Although the prevalence of anaemia has often been used as a proxy indicator for iron deficiency anaemia, this approach is not valid in settings where the etiology of anaemia is complex or unknown or where other micronutrient deficiencies of folate, vitamin B_{12} and vitamin A can co-exist. An integrated, multifactorial and multisectoral approach has to be adopted comprising targeted interventions to provide iron supplements to especially vulnerable segments of the population, in particular pregnant women; food-based approaches to increase iron intake through food fortification and dietary diversification; and other measures combined with iron interventions where other causes of anaemia are prevalent.

Introduction

Anaemia remains a widespread public health problem with major consequences for human health as well as social and economic development. Although estimates of the prevalence of anaemia vary widely and accurate data are often lacking, it can be assumed that significant proportions of young children and women of childbearing age are anaemic [*1,2*].

The important health effects of anaemia, i.e. increased risk of maternal and child morbidity and mortality due to severe anaemia, have been well documented. In addition, the negative consequences of iron deficiency anaemia on the cognitive and physical development of children and on the work productivity of adults are of major concern [*3*].

Although iron deficiency anaemia remains a considerable public health problem, one should also keep in mind that, in addition to iron deficiency, anaemia also results from malaria, general inflammatory disorders or nutritional deficiencies of folate and vitamin B_{12} as well as HIV/AIDS [*4*].

Anaemia in the Eastern Mediterranean Region

Over the years, significant progress has been made in improving the health and nutrition status of the people of the Eastern Mediterranean Region. The proportion of underweight, wasted and stunted children, as well as infant and under-five mortality rates, have all decreased as a whole, but with some inter-country variations [*5*].

In spite of this development, anaemia, particularly attributed to iron deficiency, among infants, preschool children and women of childbearing age has remained a widespread public health problem, irrespective of the family economic status and

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income level in most countries of the Region [*6*]. The overall situation of anaemia in countries of the Region was studied in 1995 [*7*] although the terms anaemia and iron deficiency anaemia were used interchangeably. The prevalence rate of anaemia was reported to be moderate in magnitude when compared with other developing regions, which could be partially due to under-reporting and lack of nationally representative data. A few countries had up-to-date national-level data on anaemia while available information in the majority of the situations was based on *ad hoc* surveys or small-scale studies on specific population groups.

The prevalence of anaemia in women of childbearing age ranged from around 20% in Jordan, parts of Egypt and parts of Oman to more than 60% in countries like Djibouti. Preschool children were more affected than women, with reported prevalence in excess of 60% in many countries [*7*]. Low intake of total dietary iron, proportionate high consumption of non-haeme iron, poor iron absorption due to iron-absorption inhibiting factors, such as tannins in tea and phytates in unleavened bread, were identified as the common causes of anaemia, in addition to high birth rates, short birth intervals and concurrent parasitic infections. The importance of genetic factors, particularly thalassaemias, remained another possibility but required further research for any conclusion to be drawn [*7*].

All subsequent assessments of the public health importance of anaemia carried out over the next decade have continued to report high prevalence of anaemia, mostly attributed to iron deficiency [*8–10*], with similar causative factors as reported earlier [*7*].

A review of published studies from countries of this Region indicates the persistence of anaemia (presumably iron deficiency anaemia) in different age groups.

Among infants from 6 months onwards, a high prevalence of anaemia is reported, with iron deficiency anaemia being the single most important cause [*11,12*]. The prevalence of anaemia in preschool children has also remained high, varying from 29% to over 60% [*13,14*], although occasional reports do indicate a decline in the prevalence of anaemia in this age group [*13*]. Among preschool children, the magnitude of anaemia is reported to be associated with birth order (thereby indicating a gradual depletion of the iron stores of mothers after repeated pregnancies), low dietary iron intake, socioeconomic status and literacy level of mothers [*13,14*].

Among women of childbearing age, from both rural and urban backgrounds, the prevalence of anaemia has ranged between 20% and 70%, again mostly attributed to iron deficiency [*15–18*], in addition to deficiencies of folic acid and vitamin B_{12} [*11*]. Income, literacy and family size are factors that affect total iron intake and anaemia status [*15*]. Women with anaemia are reported to have high fetal mortality [*19*] and deliver babies with lower birth weight, and low haemoglobin and serum ferritin levels as compared to non-anaemic women in different gestational age groups [*11,17*].

Most studies on adolescents have reported prevalence rates for anaemia ranging from 30% to 55% with the milder form of anaemia predominating (>80%) [*18–23*]; occasional reports have indicated improvement in anaemia status in this age group [*23*]. The high prevalence of anaemia among adolescents has been attributed to increased needs for iron due to rapid growth and menarche, low intake of iron-rich foods, inappropriate dietary choices, intestinal parasitic infestation and

frequent consumption of tea with meals, all or in various combinations [*18,19,22,24*]. The prevalence of anaemia declined sharply in boys after the age of 16 years coinciding with the end of a growth spurt while the prevalence of anaemia among girls started to rise after the age of 18 years as they proceeded to marriage and childbearing [*19,22*].

The Nutrition Unit of the World Health Organization's Regional Office for the Eastern Mediterranean compiled basic information on the overall nutrition situation in the Member States through a questionnaire survey. This information is presented in Table 1 [*25*]. The information does not identify the different types of anaemia or the methodologies used to determine these data. Prevalence data of anaemia in a number of age categories from several Member States are also not available. No definite pattern in the prevalence of anaemia can be discerned from Table 1 other than the fact that anaemia affects all Member States and all age groups. Anaemia varied from a low of 17% in Saudi Arabia to a high of over 70% in Yemen among preschool children; from 14% in the United Arab Emirates to 42% in Pakistan among adolescents; and from a low of 11% in Egypt to over 40% in the Syrian Arab Republic and Oman among women of childbearing age. The comparatively low prevalence of anaemia among adult males noted here may be attributed to the high iron intake in the form of meat as reported in countries of this Region [*26*].

Table 1 **Prevalence (%) of anaemia in different age groups from selected countries of the Eastern Mediterranean Region [*26*]**

Country	Population group							
	Infants 0–6 months	Children 6–59 months	Children 5–14 years	Pregnant women	Lactating women	Women of child bearing age	Adult men	Elderly (males & females combined)
Bahrain		48.3	41.6	33.5		37.3	20.9	58
Egypt		25		26	19	11		
Jordan	8.8		15.3	35	35	28		
Islamic Republic of Iran		15–30		20–43		33.4	7.9–9.9	20–25
Lebanon		23		25				
Morocco		35.4		45.5		30.1	9.9	
Oman			41	38		40		
Pakistan		60	42	45	22.5	30	30	
Palestine		52.8		44.7		36.2		
Saudi Arabia	14.8	17.2	15.9			18.3	15.8	
Syrian Arab Republic		23				40.8		
United Arab Emirates		34	14	14				
Yemen		73.5						

In Table 2, information from 1995 [*7*] and 2002/2003 [*25*] is compared. In spite of the lack of matching information in several age categories between 1995 and 2002, it would seem that the prevalence of anaemia has not changed over the years.

Member States have become aware of this persisting public health problem and in recent years some efforts have been made to identify the prevalence of anaemia with precision through national anaemia/micronutrient surveys. The national survey on anaemia in Jordan in late 2002 reported that 20.3% of children between 12 and 59 months of age were anaemic, 50% of whom had iron deficiency anaemia [*28*]. In women of childbearing age, the prevalence of anaemia was 32.3% with 70% of anaemia being due to iron deficiency; the survey did not identify the other causes of anaemia. The survey also reported that in children between 12 and 59 months and in women of childbearing age, while the haemoglobin levels were within normal range, serum ferritin levels were low, thereby indicating that haemoglobin was not a sensitive measure of iron deficiency [*27*].

A cross-sectional study of Bahraini women in the age group 14–49 years was carried out in early 2002, 6 months after the initiation of the national programme of fortifying wheat flour with iron and folic acid [*29*]. Using the dual criteria of haemoglobin and serum ferritin, the survey reported that the prevalence of overall anaemia was 51.3% among the women, 24.5% of which was due to iron deficiency. The authors concluded that there was no significant difference in the prevalence of anaemia between this survey and the national nutrition survey conducted before the initiation of the national fortification programme [*28*].

Table 2 **Comparison of anaemia prevalence (%) between 1995 and 2002/2003 in selected countries of the Eastern Mediterranean Region [*7,26*]**

Country	Children 6–59 months		Pregnant women		Women of childbearing age	
	1995	2002	1995	2002	1995	2002
Bahrain	34	48.3		33.5	40	37.3
Egypt	75–90	25	21–5	26		11
Jordan				35	23.4	28
Islamic Republic of Iran	>30	15–30	20–50	20–43		33.4
Lebanon		23				
Morocco	27–47	35.4	20	45.5		30.1
Oman	60		54	38	15–48	40
Pakistan	65	60	45			22.5
Palestine	58–76	52.8	23–44	44.7		36.2
Saudi Arabia		14.9	11–19	15.9		18.3
Syrian Arab Republic	53	23	49			40.8
United Arab Emirates	28–76	34	22–62	14		
Yemen	17–66	73.5			5–36	

Conclusions

Greater food availability does not necessarily equal better nutrition or health status. Nowhere can this be better demonstrated than in the case of anaemia, which continues to occur in all strata of people in Member States of the Eastern Mediterranean Region [*2,25,28*].

Because of the comparative ease of determination of haemoglobin concentration, the prevalence of anaemia has often been used as a proxy indicator for iron deficiency anaemia [*2,29*]. While this approach may be useful where iron deficiency is known to be the major cause of anaemia, it is not valid in settings where the etiology of anaemia is complex or unknown or where other micronutrient deficiencies that can cause anaemia co-exist. Other nutritional deficiencies other than iron, such as folate, vitamin B_{12} and vitamin A, can also cause anaemia, although the magnitude of their contribution is unclear [*2,11,27*]. In addition, the impact of haemoglobinopathies on anaemia prevalence needs to be considered among some populations [*2,7*]. Infectious diseases, in particular malaria and helminth infections, and other infections such as tuberculosis and HIV/AIDS are important factors contributing to the high prevalence of anaemia in many populations [*2,30–32*].

The recent joint statement by the World Health Organization and the United Nations Children's Fund on an integrated approach for effective anaemia control [*2*] states that "only by recognizing the complexities associated with anaemia can effective strategies be established and progress made."

The integrated, multifactorial and multisectoral approach mentioned in the joint statement will comprise: targeted interventions to provide iron supplements to especially vulnerable segments of the population, in particular pregnant women; food-based approaches to increase iron intake through food fortification and dietary diversification; other measures combined with iron interventions where other causes of anaemia are prevalent; integration of intervention strategies into the existing primary health care system and existing national food and nutrition programmes. Such an approach will be evidence-based and take into account the specific etiology and prevalence of anaemia in a given setting and population group [*2*].

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Invited paper

Experiences in the prevention, control and elimination of iodine deficiency disorders: a regional perspective

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SUMMARY Before 1987, iodine deficiency was not considered an issue of major importance in the countries of the Eastern Mediterranean Region (EMR). Progress began with a systematic national study of goitre and other iodine deficiency disorders (IDD) in the Islamic Republic of Iran in 1983. Following a major review of the prevalence of IDD in member states, ***Guidelines for national programmes for the control of iodine deficiency disorders in the EMR*** were published by the World Health Organization (WHO) in 1988. This paper discusses progress towards elimination of iodine deficiency by reviewing the status of IDD in the countries of EMR and programmes for prevention and control of IDD with particular reference to the Islamic Republic of Iran, the first country to be declared IDD-free by WHO.

Introduction

Although a high prevalence of goitre and severe iodine deficiency in the Chitral and Gilgit regions of Pakistan was first reported as far back as 1908 [*1*], prior to 1987 iodine deficiency was not considered an issue of major importance in the countries of the Eastern Mediterranean Region (EMR). Despite the high rates in many areas of many countries of the Region (for example, Mosul province in Iraq, Shahryar in the Islamic Republic of Iran, and in most regions of Lebanon), goitre was regarded as being strictly restricted to certain geographical areas and thus not considered as an important public health problem [*2,3*]. Therefore, surveys in EMR countries had been limited to one or two endemic areas. This changed in 1983, when the Islamic Republic of Iran began to systematically study the prevalence of goitre and other iodine deficiency disorders and in 1989 conducted a national survey of iodine deficiency disorders (IDD), which revealed hyper-endemic and endemic goitre in all provinces of that country [*4*].

Progress in monitoring and control of IDD

A major landmark in IDD control in the EMR was a review of the prevalence and control measures of IDD in EMR member states in 1987 [*2*]. For the first time, member states were alerted to the fact that, in a number of countries of this Region, IDD was a major public health problem meriting serious consideration and urgent action. Table 1 summarizes the major activities related to IDD in the last 15 years.

In order to respond to the growing interest of the member states, the EMR Office (EMRO) of the World Health Organization (WHO) convened an inter-country consultation of experts in December 1987 to collect more information, exchange ex-

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Table 1 **Major iodine deficiency disorder (IDD) activities in the Eastern Mediterranean Region (EMR) since 1987**

Year	Activity
1987	Review of IDD in EMR member states
1987	Inter-country consultation about IDD convened by WHO-EMRO
1988	Publication of EMRO guidelines for national IDD control programmes
1989	First Regional IDD survey and start of IDD control programme in Islamic Republic of Iran.
1990	Inter-country workshop in IDD (Tehran)
1990	Discussion of IDD at 37th session of WHO-EMRO Regional meeting
1992	Training workshop for laboratory staff (Damascus)
1994	UNICEF Middle East North Africa Regional IDD workshop (Tehran)
1995	First Regional meeting of salt producers (Jordan)
1996	Iodine sufficiency achieved in Islamic Republic of Iran
1999	Symposium/workshop on assessment and monitoring of IDD (Tehran)
2000	Regional meeting for promotion of iodized salt (Dubai)
2000	Islamic Republic of Iran and Tunisia declared IDD-free countries. Salt iodization started in 17 countries. Universal salt iodization achieved in 6 countries
2001 & 2002	First and second IDD Regional training course on monitoring and evaluation of IDD elimination (Tehran)

periences and develop guidelines that would assist countries to define the problem and mount national control programmes. These guidelines were published (in Arabic and English) in 1988 as *EMRO Technical Publication No. 12*, entitled *Guidelines for a national programme for the control of iodine deficiency disorders in the EMR*.

In 1990, an inter-country workshop on IDD was held in Tehran to exchange experiences and to develop approaches. Subsequently, a technical paper was presented to the 37th session of the WHO Regional Committee for the Eastern Mediterranean, alerting the ministers of health of all countries in the Region to the devastating effect of IDD on brain development and cognitive function. Since then, WHO, often jointly with UNICEF and the International Council for the Control of Iodine Deficiency Disorders (ICCIDD), has made great efforts to support countries in their efforts to deal with this very important deficiency.

A number of important workshops and training courses have been held. A WHO tri-Regional travelling seminar was organized with EMRO and the South-East Asia and Western Pacific Region Offices in India and Nepal in 1991 to observe salt and oil iodization in practice. The first meeting on universal salt iodization for salt producers in the EMR Region was held in Jordan in 1995 and a number of technical consultancies were conducted. Among these, UNICEF held a Regional IDD workshop in

1994 in Tehran and WHO held a symposium workshop on assessment and monitoring of IDD in countries of EMR in 1999, also in Tehran [*5*].

In 1988, the Islamic Republic of Iran carried out the first national IDD survey in the Region, which revealed a high prevalence of IDD [*4*]. By 1999, Egypt, Jordan, Lebanon, Morocco, Oman and the Syrian Arab Republic had also carried out surveys. The Islamic Republic of Iran and the Syrian Arab Republic were the first countries in the Region to start iodizing salt. The first Regional meeting of salt producers in the EMR, held in 1995, led to the establishment of a Regional association of iodized salt producers.

By late 1998, 13 countries, and by 2004, 16 countries, had initiated salt-iodization programmes and 6 countries had reached the goal of universal salt iodization by demonstrating that at least 90% of households consume adequately iodized salt (Table 2).

The Islamic Republic of Iran was the first country in the Region to become iodine sufficient by showing that more than 95% of households consumed adequately iodized salt and the median urinary iodine level was above 100 µg/L in each of the 26 provinces [*6*]. More recently, Tunisia also achieved satisfactory iodine status and both countries were accorded IDD-free status by WHO-EMRO in the year 2000 [*6*]. In 2001, the Endocrine Research Centre and the Ministry of Health of the Islamic Republic of Iran were appointed by WHO-EMRO to hold an annual training course on monitoring and evaluation of IDD elimination programmes. The first 2 courses were offered in 2001 and 2002 with the participation of 12 and 21 countries of the Region and countries of Central Asia and Eastern Europe respectively.

Table 2 **Progress in control of iodine deficiency disorders (IDD) in countries of the Eastern Mediterranean Region in the year 2004 (adapted from WHO-EMR report [*8*])**

IDD status	No. of countries
IDD a problem	18
Legislation in place	17
Salt iodization begun	16
Universal salt iodization achieved	6
IDD under control achieved	2

Status of IDD in the Region

By 2004, the status of IDD in the EMR countries was as follows:

- IDD under control: Islamic Republic of Iran and Tunisia;
- Mild IDD: Jordan, Lebanon, Libyan Arab Jamahiriya, Egypt, Palestine, Oman, Bahrain, Qatar, Syrian Arab Republic, United Arab Emirates, Kuwait and Yemen;
- Moderate IDD: Morocco, Sudan and Saudi Arabia;
- Severe IDD: Iraq, Afghanistan and Pakistan.

Table 3 shows the most recent information about the IDD status of the countries of EMR. In 8 of 17 countries the median urinary iodine level was ≥ 10 µg/dL and in 11 of 17 countries the proportion of households consuming iodized salt was > 50%. Figures 1 and 2 show the distribution of household iodized salt consumption and median urinary iodine levels in the countries of EMR.

Table 3 **Iodine deficiency disorder (IDD) status in the countries of the Eastern Mediterranean Region**

Country [reference]	MUI (µg/dL)	TGR (%)	House-hold iodized salt use (%)	Salt legislation	IDD monitoring	IDD status	Notes
Afghanistan [***8***]	No data available	No data available	11.4	No	No	Severe	New salt plants being equipped with quality control laboratories. Ministry of Health, with UNICEF support, plans laboratories for testing iodine in salt and urine. A 5-year plan with financial support of WHO-EMRO and IDD coordinator in EMR was due for implementation in 3 stages. Stage 1: assessment of IDD situation over 16 months (2002–3). Stage 2: salt iodization (2003–5). Stage 3: monitoring (2005–6).
Algeria [***8***]	34.7	8	68	Yes	No data available	Unknown	No recent data. IDD previously endemic in some areas.
Egypt [***12***]	> 10	> 5	56	Yes	No	Mild to moderate	Data need to be updated. Salt iodization programme began in 1993 and government has successfully upgraded salt production plants to meet country's iodized salt needs. Major activities for national IDD control programme started in 2001 in 5 governorates and aim to cover all governorates within 2 years.
Iraq [***13,14***]	2.4	24–44	90	Yes	No	Severe	–
Islamic Republic of Iran [***8***]	16.7	9.8	91	Yes	Yes	IDD-free	See main text.
Jordan [***15,*** u/p[a]]	15.4	32.1	98	Yes	Yes	Mild	Needs regular monitoring.
Lebanon [u/p[b]]	9.4	25.7	87	Yes	Just for salt iodine	Mild	Data need to be updated. Universal salt iodinization implemented in1995. National Committee for IDD control formed in 1994.

Table 3 **Iodine deficiency disorder (IDD) status in the countries of the Eastern Mediterranean Region *(continued)***

Country [reference]	MUI (µg/dL)	TGR (%)	House-hold iodized salt use (%)	Salt legislation	IDD monitoring	IDD status	Notes
Libyan Arab Jamahiriya [u/p[c]]	None	None	90	Yes	No information	Mild	Data need to be updated. Universal salt iodization implemented in 1980. National survey planned to evaluate impact of salt iodization.
Morocco [***8***]	8.6	22	41	Yes	No	Moderate	Universal salt iodinization officially endorsed in 1995. Next step is launch of national strategy to increase iodized salt consumption and implementation of monitoring system.
Oman [***8***]	9.5	10	68.5	Yes	Yes	Mild	No national IDD control programme.
Pakistan [***16***]	None	None	30	Recomme-nded	No	Moderate to severe?	Data need to be updated. Little recent evidence of further progress and IDD probably remains a significant problem.
Saudi Arabia [***8,17***]	18	4–30	No	No	No	Moderate	Needs IDD control programme, especially in southern province.
Sudan [***18***]	< 10	22	10	Yes	No	Moderate	Data need to be updated. Needs push for iodized salt. Follow-up information needed on national situation.
Syrian Arab Republic [u/p[d]]	< 10	70	90	Yes	Yes	Mild	Data need to be updated. Survey in 2001 revealed increment in MUI (results not available).
Tunisia [***19***]	15.8	0.58	97	Yes	Yes, but not effective	IDD-free	Data need to be monitored. IDD control programme implemented in 1996. Declared IDD-free in 2000. South-east region had low iodized salt consumption (77.9%).

Table 3 **Iodine deficiency disorder (IDD) status in the countries of the Eastern Mediterranean Region *(concluded)***

Country [reference]	MUI (µg/dL)	TGR (%)	House-hold iodized salt use (%)	Salt legislation	IDD monitoring	IDD status	Notes
United Arab Emirates [***8***]	10	1.5–20	6.5	No	No	Mild	National committee established in 2000. Salt iodization planned in 2001. National screening programme for neonatal hypothyroidism implemented since 1998.
Yemen [u/p[e]***,20***]	17.3	16.8	60	Yes	No data	Mild	Needs regular monitoring. Low level of households consuming iodized salt may prevent goal of IDD elimination.

[a]F. Azizi, unpublished report, 2001.
[b]J. Matovinovic, unpublished report, 1961.
[c]F. Azizi, unpublished report, 1993.
[d]R. Mohan, unpublished report, 1999.
[e]F. Azizi, unpublished report, 1991.
MUI = median urinary iodine level.
TGR = total goitre rate.
u/p = unpublished.



Figure 1 **Household consumption of iodized salt, Eastern Mediterranean Region, 2004**



Figure 2 **Median urinary iodine levels (µg/dL), Eastern Mediterranean Region, 2004**

The Iranian experience

The Islamic Republic of Iran conducts an optimal programme for control of IDD. A sustainable and well-managed iodization programme is functioning in the country with the programmatic indicators set by WHO/UNICEF/ICCIDD [*7,8*].

The programme began in 1988, when reports of hyper-endemic and endemic areas of goitre in different parts of the Islamic Republic of Iran [*9,10*] prompted the Ministry of Health and Medical Education to form the Iranian National Committee for Control of IDD (INCCI). A nationwide survey, performed under the supervision of INCCI, showed that goitre was endemic in all cities and hyper-endemic in the capital cities of 5 provinces [*4*]. Median urinary iodine excretion was < 100 µg/L in all localities and < 20 µg/L in many localities examined [*4,9,10*].

The INCCI prepared a national plan, which detailed objectives and strategies for IDD control. Iodization of household salt supplies began in 1990. Although the production, distribution and consumption of iodized salt increased gradually, a nationwide survey in 1993 showed that less than 50% of the households were using iodized salt [*11*]. INCCI announced universal salt iodization and all salt factories were obliged by law to produce only iodized salt for household use. National surveys in 1994, 1996 and 1998 showed that more than 95% of Iranian households were consuming iodized salt [*11*].

Figure 3 shows the major reduction in the prevalence of goitre from the first Iranian national survey in 1989 to monitoring surveys in the years 1996 and 2001 [*4,7*]. In 1996, in the framework of the IDD monitoring programme, the second national survey was conducted 2 years after the implementation of the new law for mandatory salt iodization [*11*]. The total goitre rate was 54.6% and it was evident that the prevalence of goitre was still high in many provinces. The study was performed when the majority of people had used iodized salt for only for 2 years and the majority of 8- to 10-year-old children had, at the time, passed most of their life without adequate iodine supplementation. It was therefore too early to expect that the consumption of iodine should result in a reduction of goitre prevalence. The latest national IDD survey in 2001–02 showed a significant reduction in total goitre rate to 9.8%. The prevalence of goitre grade 2 in 22 provinces was lower than 5% and in the other provinces the goitre rate did not exceed 10%.

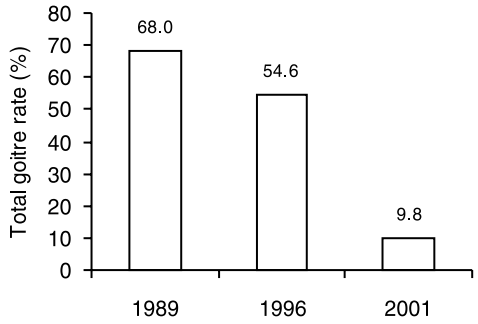


Figure 3 **Total goitre rate in 3 national surveys (1989, 1996 and 2001) in the Islamic Republic of Iran [*4,11*]**

The most sensitive method for the monitoring and evaluation of an IDD control programme is the determination of urinary iodine excretion. The 1996 Iranian national survey showed that the median urinary iodine excretion in schoolchildren (20.5 µg/dL) was at the top of the optimal range (10 to 20 µg/dL) recommended by WHO/UNICEF/ICCIDD [*7,8*] and 85.1% of children had urinary iodine ≥ 10 µg/dL. By 2001, median urinary iodine was 16.7

µg/dL and only 5.8% of the study population had urinary iodine < 5 µg/dL which, based on international standards, is favourable.

According to these criteria, the Islamic Republic of Iran appears to have reached a sustainable IDD control programme since 1996, an achievement that was recognized by WHO-EMRO in the year 2000 [*6*]. Monitoring of the IDD control programme is planned every 5 years to evaluate the sustainability of the programme.

The lessons from the Iranian experience are that implementation of an adequate and sustainable programme of IDD control requires many effective programmatic steps, in particular integration of IDD control into the health network and mandatory iodization of household salt.

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Some facts on iodine deficiency

- Iodine deficiency disorders (IDD) affect over 740 million people, 13% of the world's population, and 30% of the remainder are at risk.
- IDD preys upon poor, pregnant women and preschool children, posing serious public health problems in 130 developing countries.
- Iodine-deficient people may forfeit 15 IQ points.
- Nearly 50 million people suffer from some degree of IDD-related brain damage.
- We have the means to prevent it – small quantities of iodine which can be delivered in a simple, universally effective and in credibly cheap way – IODIZED SALT.

Further information about IDD and its prevention can be found at: http://www.who.int/nut/idd.htm

Invited paper

Food fortification: good to have or need to have?

A. Verster[1]

SUMMARY Only very small quantities of vitamins and minerals are needed for human health but deficiencies can have disproportionately large, often life-threatening, effects. Micronutrient deficiencies lead to a vicious cycle of malnutrition and infection in poorly nourished populations. Fortification of staple foods is the cheapest, most efficient and most effective way to supply large populations with essential micronutrients. This paper reviews the case for fortification of flour supplies with iron and folic acid and concludes that it is the best way to provide daily doses of these nutrients to populations in developing countries, especially for women of child-bearing age.

Introduction

Vitamins and minerals, often called micronutrients, are essential for human physical and mental health and survival. Only very small quantities are needed, but deficiencies can have disproportionately large, often life-threatening, effects.

Only a teaspoon of iodine is needed for a lifetime, but iodine deficiency causes irreversible mental retardation. Only 400 µg a day of folic acid protects an unborn child from neural tube defects such as spina bifida or from anencephaly. Just 6–12 mg of iron a day is enough to help a child develop to its full mental and physical potential. And with 450 µg retinol per day, a child will have a strong immune system and will not be at-risk of losing its eyesight.

Vitamins and minerals are found in many foods, and in principle, a "balanced" diet, based on a combination of plant and animal foods, as advised by various dietary guidelines, should provide sufficient vitamins and minerals, except for iodine.

Yet deficiencies of many important vitamins, such as vitamin A and vitamin D, and minerals such as iron, calcium, zinc and iodine are widespread in many parts of the world. Iodine is a special case, in that this deficiency has geophysical origins, affecting all countries where iodine has been leached out of the soil through flooding and glaciers or where there are tertiary sedimentations that never contained iodine. The high prevalence of anaemia in many parts of the world (Figure 1) suggests that iron deficiency is common and persistent. Vitamin A deficiency is associated with 800 000 deaths worldwide each year. Data from the United Kingdom shows that Vitamin A deficiency is a problem not only in developing countries but also in the industrialized world, albeit less severe. Therefore, a so-called balanced diet may not be so widely consumed as expected, or the yield in vitamins and minerals from these diets may not be as high as previously thought.

This paper will review the case for food fortification with iron and folic acid, and suggest that flour fortification is not just good to have: it is essential for the health of populations.

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Making the case for micronutrients

More than 2 billion people in the world today, nearly all of them in developing countries, suffer from nutritional deficiencies, mainly the lack of micronutrients such as iron, vitamin A, iodine and folic acid [*1*]. Overtly, micronutrient deficiencies can cause irreversible damage to health such as blindness, or contribute to maternal death during childbirth, or to infant and child death as a result of otherwise common childhood illnesses. In most cases, however, micronutrient deficiency causes weakness and greater susceptibility to illness. This vicious cycle of malnutrition and infection, ultimately leading to death, is well known and feared in poorly nourished populations.

Yet the wider impact of micronutrient deficiency on a nation's economy is unknown or unacknowledged among government leaders, politicians and economists, despite the fact that it traps not only individuals and communities but also entire countries in a cycle of poor health, poor educability, poor productivity and persistent poverty. Added to this is the individual human suffering of families who lose a mother in childbirth due to iron deficiency or who bear the burden of caring for a child born retarded because of maternal iodine deficiency during pregnancy, or of whole communities that suffer weakness and ill health that prevents their crossing the threshold out of poverty.

It follows that ending micronutrient deficiency can provide the foundation for the elimination of poverty and for sustainable economic progress among poor countries by preventing illness and death and by helping populations to become healthier, more intelligent, more educated and more productive. Sufficient intake of vitamin A, essential to the human immune system, would prevent almost a quarter of child deaths in areas of high deficiency, as well as preventing nutritional blindness among children and adults. Universal salt iodization would contribute considerably to the brain development of children in areas of deficiency, adding up to 13 IQ (intelligence quotient) points to their mental capacity

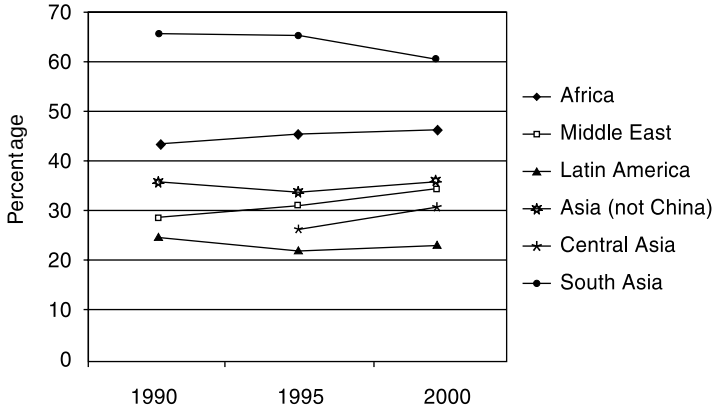


Figure 1 **Estimated prevalence of anaemia in non-pregnant women in 6 world regions over time. Source [*8*]**

and eliminating the world's greatest cause of preventable mental retardation. Ending iron deficiency would reduce absenteeism due to illness and thus improve adults' productivity. It would also improve children's concentration and memory and therefore their ability to learn.

In 1994, the World Bank estimated that interventions to end micronutrient malnutrition were among the most cost-effective investments in the health sector. The global cost of ending micronutrient deficiency was estimated by the Bank at about US$1 billion a year [*2*]. Failure to act in a country where micronutrient malnutrition exists can waste as much as 2%–3% of the gross domestic product (GDP) [*3*]. Acting to solve the problem comprehensively and sustainably would cost less than 0.3% of GDP. Clearly there are economic as well as ethical imperatives for effective action to provide large populations with micronutrients.

The first of the United Nations Millennium Development Goals, eradicating extreme poverty and hunger, is unlikely to be achieved in the absence of well-nourished, intelligent, healthy, productive populations. In fact, 5 of the Millennium Development Goals can be positively influenced by food fortification, as shown later in this paper. Fortification of staple food supplies, linked with other initiatives such as agribusiness or small business development or poverty reduction strategies, has tremendous potential to reduce poverty.

There is a cost to beginning this work, but the economic and social payoffs from micronutrient programmes, according to the World Bank, reach as high as 84 times the programme costs. Recently a group of leading economists (the Copenhagen Consensus) proclaimed that the addition of micronutrients into food was the second most effective intervention in favour of development [*4*].

Food fortification

The success of programmes of universal salt iodization in eliminating iodine deficiency disorders clearly demonstrates the effectiveness of food fortification as a vehicle for improving micronutrient status. Fortifying staple foods can be done in many countries on a national scale. It is the cheapest, most efficient and most effective way to supply large populations with essential micronutrients. Bringing the technology to fortify staple foods such as flour, salt and oil and condiments such as soy sauce to developing countries is a cost-effective solution to micronutrient deficiency, especially when undertaken in tandem with broader national strategies that improve overall nutritional status.

The cost of fortifying staple foods is not high, and food fortification does not require people to change their existing dietary habits. Because staple foods such as bread or noodles are used daily, and are part of the diets of even the poorest, fortification has the potential in a short period of time to reach millions of people around the world with micronutrients on a daily basis.

Iron fortification of flour

Iron deficiency is not easily detected, although its consequences are important. Most often, anaemia is taken as a proxy indicator for iron deficiency, especially in parts of the world where anaemia is largely caused by iron deficiency. In the Eastern Mediterranean Region (EMR), for instance, measurements in several countries suggest that only 6%–10% of all anaemia is due to

causes other than iron deficiency. The prevalence of anaemia is generally high among women of childbearing age and young children in all countries of the Region. Anaemia, however, is not synonymous with iron deficiency. In fact, iron deficiency is generally present in individuals long before haemoglobin values fall. First the body's iron stores are diminished and only then is haemoglobin production affected.

In the past, pregnant women were the main targets for anaemia control programmes. It was long believed that the main effects of iron deficiency, especially when anaemia is already present, were a risk of maternal death in childbirth and low-birth-weight infants. This, coupled with the especially high iron requirements of pregnancy, means that pregnant women were considered most at risk. There is increasing evidence, however, that iron deficiency has less obvious, developmental effects on children; they may be less intelligent, scoring up to 10 points lower on standard IQ tests, their school performance may be below normal and their future productivity may be diminished. Now that our understanding of the effects of iron deficiency has grown, programmes have become increasingly targeted towards prevention of iron deficiency, rather than treatment of anaemia. Combined approaches of supplementation with iron tablets, public health measures such as de-worming and nutrition education to improve the iron content of the diet have become popular.

Brain development takes place in the first trimester of pregnancy: a time when a woman may not yet know that she is pregnant. She will not yet have visited a health facility for prenatal care, and thus will not have received iron supplements. Yet, this is the time when iron is necessary for the development of the unborn child's brain. It is therefore imperative to ensure that a woman's iron status is optimal before she gets pregnant. The only feasible way is to ensure that her daily diet contains sufficient iron.

Unfortunately, iron is a fickle nutrient. There are 2 different types of iron in food: haem iron, found in red meat, seafood and poultry, and non-haem iron found in grains, legumes, nuts and other plant foods. About 40% of the iron in animal food is in the form of haem iron, while the rest and almost all the iron in plant foods is in the non-haem form that is less well absorbed by the body. The bioavailability of non-haem iron is influenced by factors in the diet that either enhance or inhibit absorption, as shown in Figure 2.

The bioavailability of iron in the diet varies therefore according to the type of diet, but rarely exceeds more than 5%–10% of the total iron consumed. It is very difficult therefore to get enough iron from the normal diet, even in developed countries. In the EMR, consumption of wheat flour is very high; daily intakes of 300–400 g of bread per day are reported from several countries. The wheat grain, in its un-milled form or if milled into whole-wheat flour, contains good quantities of iron. This iron, however, has a low bioavailability as it is bound to the phytates that are intrinsic to wheat. On the other hand, white flour contains much less phytate, but unfortunately does not contain high levels of iron either.

Fortifying wheat flour with iron, preferably in the form of ferrous sulfate or ferrous fumarate, which are both well absorbed, makes it possible to provide a large amount of additional iron to the diet of women, and indeed the entire population. If a woman consumes a reasonable amount of bread every day, the additional iron from fortification changes her iron status from deficient to sufficient, thus protecting the

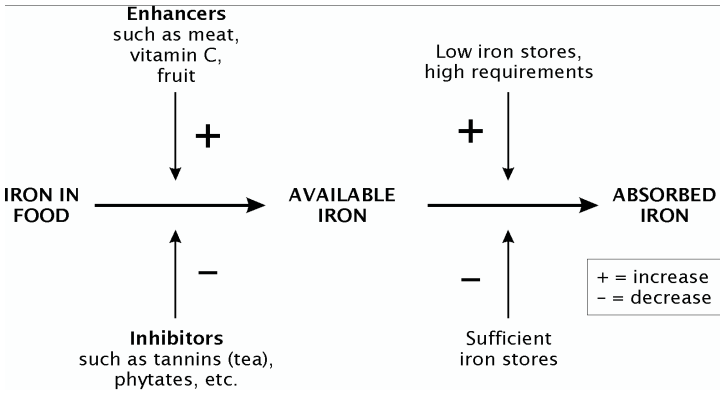


Figure 2 **Dietary factors that affect the bioavailability of non-haem iron by enhancing (+) or inhibiting (–) absorption. Source: A. Verster**

brain of any child she conceives. The United Nations Food and Agriculture Organization estimates that flour fortification can contribute from 50% to over 75% of the daily iron requirement in countries of EMR (Figure 3).

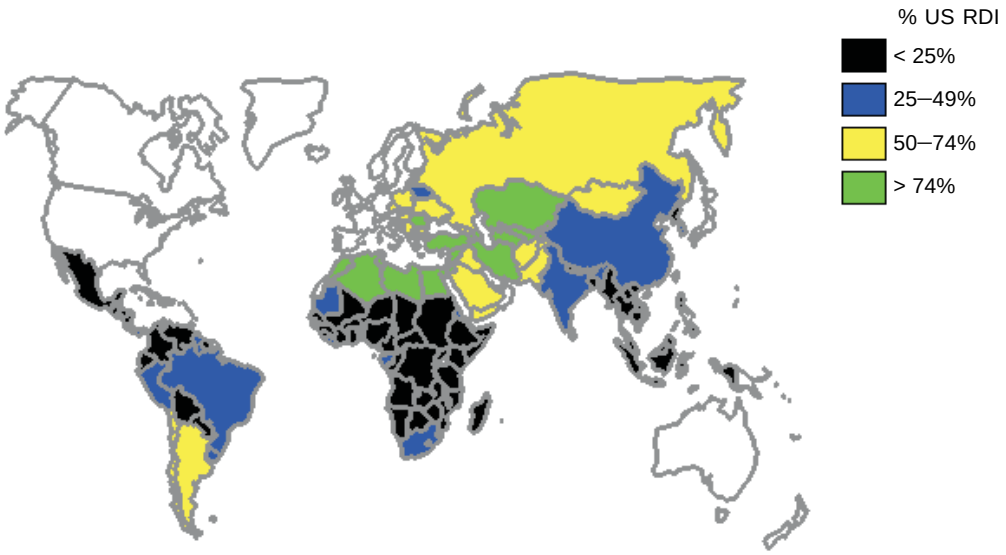


Figure 3 **Potential benefit of flour fortification to iron intake. Contribution to % iron recommended daily intake if 30 parts per million of iron were added to wheat flour. Source: J.Bagriansky and K. Sullivan (unpublished data: http://www.sph.emory.edu/wheatflour/Training/Data_Evaluation/Other/Benefitcalc.xls)**

Folic acid fortification of flour

Flour fortification is already in place in several counties of EMR (Saudi Arabia, Oman, Bahrain, Qatar, United Arab Emirates, Jordan and Morocco). In the early days of flour fortification, WHO-EMR included folic acid in its fortification premix recommendations, mainly because of the role of folic acid in anaemia. Over time, more evidence has become available of the preventive effect of folic acid on birth defects, especially neural tube defects such as spina bifida and anencephaly. Clearly, WHO-EMR was ahead of its time with the recommendation to add at least iron and folic acid to wheat flour. Recently published scientific research shows that folic acid fortification of wheat flour has led to a decline in the incidence of neural tube defects in several countries that have studied these effects, notably Chile, Costa Rica [*5*] and Canada [*6*] (Figure 4). The Canadian study, which was carried out in women aged 19–44 years and on seniors in Newfoundland, did not find any masking of vitamin B_{12} deficiency by folic acid fortification. The researchers concluded that mandatory fortification of wheat flour with folic acid should continue in Canada at the current levels.

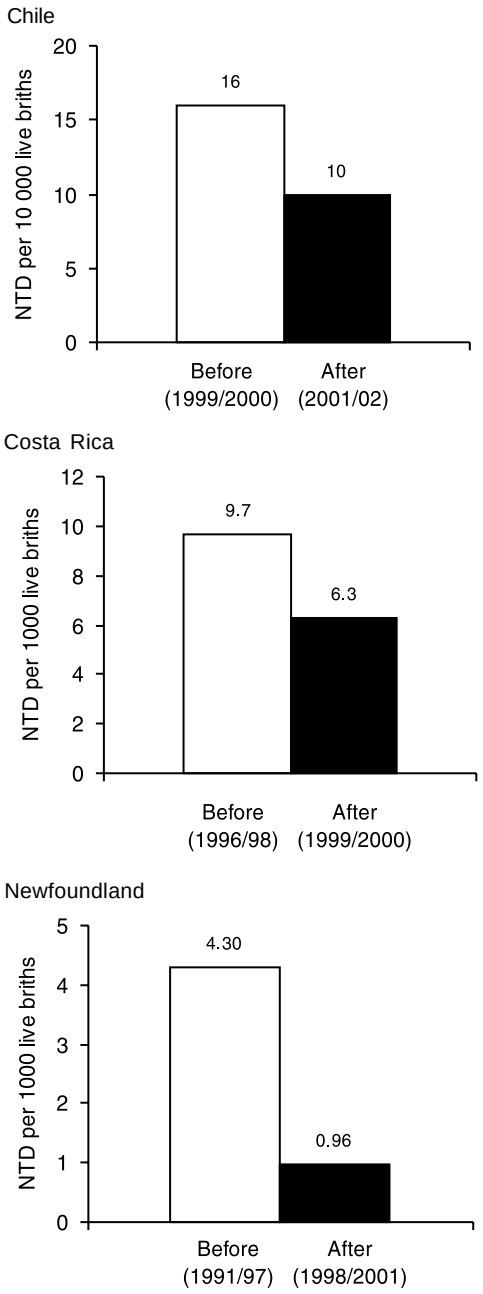


Figure 4 **Annual rates of neural tube defects (NTD) in Chile [*5*], Costa Rica [*5*] and Newfoundland [*6*] before and after fortification of flour with folic acid**

Food fortification and the Millennium Development Goals

According to the Global Alliance for Improved Nutrition, food fortification contributes to the achievement of 5 of the United Nations Millennium Development Goals [*7*].

By ensuring that a population's food includes essential vitamins and minerals, individual productivity is improved, which will contribute to poverty alleviation, thus contributing to *Goal 1 – eradicate extreme*

poverty and hunger. Fortification programmes that reach the very young can improve cognitive function and intellectual capacity, enabling children to do better in school, thus contributing to *Goal 2 – achieve universal primary education*.

Better nutrition, including the reduction of iron deficiency and anaemia among adolescent girls, is a prerequisite for improving women's physical and mental capacity and their ability to participate as equal citizens. Fortification of staple foods that are commonly consumed by young women and girls is one way to contribute to *Goal 3 – promote gender equality and empower women*.

Improving the nutritional status of infants and children through fortifying the staple foods used to prepare complementary foods, and fortifying appropriate complementary foods themselves, is essential to the achievement of *Goal 4 – reduce child mortality*.

Under-nutrition and anaemia of girls and women contribute significantly to maternal morbidity and mortality and to low birth weight. Significant improvements in the macro- and micronutrient status of girls, adolescents and women through fortification as well as other essential strategies such as micronutrient supplementation, dietary diversification and public health measures are needed to achieve *Goal 5 – improve maternal health.*

Conclusion

Fortification with iron and folic acid is the best way to provide daily doses of these essential micronutrients to women before they get pregnant and in the early months of pregnancy when brain development and neural tube developments take place. It is the most effective approach in societies where women do not plan their pregnancies. Fortification of flour with iron and folic acid is therefore not only good to have: it is an absolute necessity.

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Invited paper

Noncommunicable diseases: risk factors and regional strategies for prevention and care

O. Khatib[1]

SUMMARY Noncommunicable diseases (NCDs) are a major disease burden in the Region. Many of the risk factors are related to lifestyle and can be controlled. Physical inactivity, low fruit and vegetable intake, high fast food consumption and high cholesterol are predominant causes of cardiovascular disease and some cancers. Overweight and obesity can lead to metabolic changes and raise the risk of NCDs, including heart disease and type 2 diabetes. Three main strategies are proposed to deal with the problem: estimate need and advocate for action; develop national policies, strategies and plans for prevention and care; promote and implement community participation in prevention and care. NCDs are preventable using available knowledge; solutions are effective and highly cost-effective.

Introduction

The incidence of noncommunicable diseases (NCDs) such as cardiovascular disease, diabetes, cancer and renal, genetic and respiratory diseases is rising significantly in the Eastern Mediterranean Region. Currently, 47% of the Region's burden of disease is due to NCDs and it is expected that this will rise to 60% by the year 2020. The modifiable risk factors—smoking, unhealthy diet and physical inactivity, expressed as diabetes, obesity and high lipids—are the root causes of the global epidemic in NCD. Although the relative importance of these may vary in different populations, these conventional risk factors may explain 75% of chronic conditions [*1*].

Prevalence and burden of NCD risk factors

The World Health Organization (WHO) Eastern Mediterranean Region is exposed to NCD risk factors as part of risk-transition as a result of marked changes in the pattern of living in many countries of the Region, particularly countries of the Gulf Cooperation Council, where rapid increases in obesity are being recorded, primarily among children, adolescents and young adults. Overweight and obesity have risen 2-fold or more since 1980. Changes in food processing, production and type of food (fast food) have affected health in the majority of countries in the Region.

A review of available data from the Eastern Mediterranean Region shows that both men and women are at high risk [*2*]. Table 1 shows the frequency of distribution of NCD risk factors among adults aged 20 years and above in Member States. Figure 1 shows the overall prevalence of NCD risk factors among the adult population ≥ 20 years in the Region [*2*]. When considering the prevalence of multiple risk factors, however, it was found that, of an adult population of 300 million, 60% had at least

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Table 1 **Distribution of noncommunicable disease risk factors in the countries of the Eastern Mediterranean Region [*2*]**

Risk factor	Regional adjusted mean (%)	Range (%)
Smoking		
Males	40	9–82
Females	13	–
Hypertension	26	7–48
Diabetes	14.5	3–36
Overweight/obesity	43	11–79
Dyslipidaemia	50	4–57
Physical inactivity	79	18–97

1 risk factor and 8% had 6 risk factors. A sizeable proportion of the population is at risk since 30 million people have 4 risk factors, 36 million have 5 risk factors and 24 million have 6 risk factors. Figure 2 illustrates the burden of these risk factors as measured as a percentage of the disability adjusted life years (DALYs) among the countries of the Region that have low mortality rates (Bahrain, Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia and United Arab Emirates) compared with those with high mortality rates (Afghanistan, Djibouti, Egypt, Iraq, Morocco, Pakistan, Somalia, Sudan and Yemen). A comparison between risk factors in the Gulf Cooperation Council countries and in industrialized countries is shown in Table 2.

Many of the risk factors for heart disease, diabetes, cancer and pulmonary diseases are related to lifestyle and can be prevented. Physical inactivity, low fruit and vegetable intake, fast food consumption, high cholesterol, smoking and suboptimal control of blood pressure are the predominant causes for the endemic prevalence of coronary heart disease and ischaemic stroke.

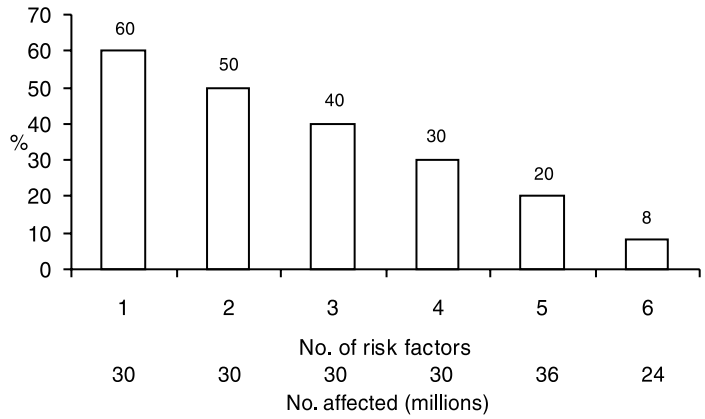


Figure 1 **Overall prevalence of risk factors for noncommunicable diseases among adult population ≥ 20 years in countries of the Eastern Mediterranean Region**

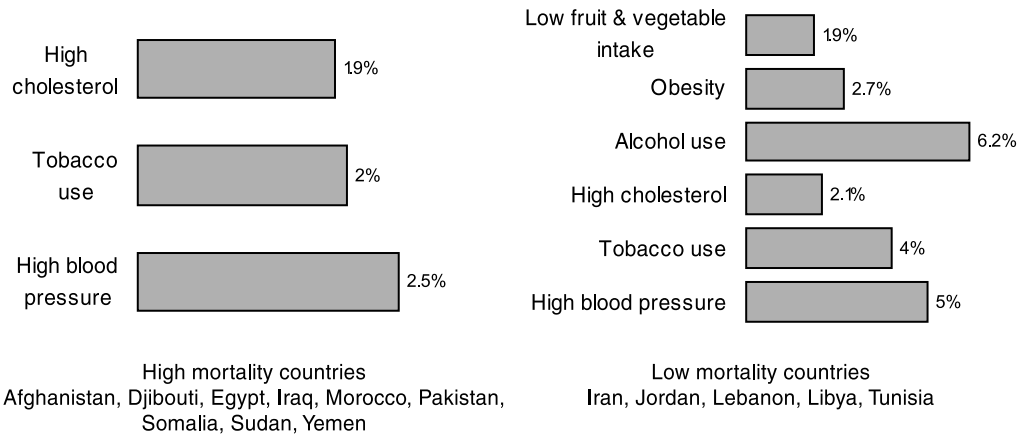


Figure 2 **Burden of risk factors (%DALYs) among high and low mortality countries of the Eastern Mediterranean Region**

Overweight and obesity

Overweight and obesity can lead to adverse metabolic changes, including increases in blood pressure, unfavourable cholesterol levels and increased insulin resistance. They raise the risk of coronary heart disease, stroke, type 2 diabetes, atherosclerosis, gall bladder disease, hypertension, kidney failure and many forms of cancer, particularly breast cancer.

World Health Organization criteria for overweight and obesity are overweight =

Table 2 **Leading risk factors among industrialized countries and Gulf Cooperation Council countries as percentage contribution to burden of all diseases [*1,3*]**

Risk factor	Contribution to burden of disease (%)	
	Industrialized countries	Gulf Cooperation Council countries
Physical inactivity	3.3	3.0
Low fruit & vegetable intake	3.9	2.5
Obesity	7.4	5.4
Alcohol use	9.2	–
High cholesterol	7.6	5.0
Tobacco use	12.2	8.0
High blood pressure	10.9	7.5

body mass index (BMI) 25–29 kg/m² (body weight/height²) and obesity = BMI ≥ 30 kg/m² [*4–6*]. Globally, the Organization estimates that 58% of diabetes mellitus, 21% ischaemic heart diseases, 4%–42% of certain cancers are attributable to BMI above 21 kg/m² [*7*].

The prevalence of overweight and obesity for males and females in a number of countries of the Region is shown in Table 3. Among males, prevalence ranges from 10.5% in Pakistan to 64.0% in Saudi Arabia, while for females it ranges from 21.7% in Morocco to 79.0% in Bahrain [*8–12*]. The regional adjusted mean for overweight and obesity is 54.2% for women compared to 31.4% among males. Obesity kills around 150 000 men and women a year in the Region.

Table 3 **Prevalence of overweight and obesity among some countries of the Eastern Mediterranean Region [*8–12*]**

Country	Overweight/ obesity (%)	
	Males	Females
Bahrain	56.4	79.0
Egypt	43.8	41.0
Islamic Republic of Iran	57.0	67.7
Jordan	46.0	43.7
Lebanon	60.0	53.0
Libyan Arab Jamahiriya	42.5	74.9
Morocco	37.2	21.7
Oman	40.5	43.5
Pakistan	10.5	34.6
Saudi Arabia	64.0	70.0
Tunisia	13.1	41.9
United Arab Emirates	25.5	39.9

Unhealthy diet: low fruit and vegetable intake

The contribution of suboptimal systolic blood pressure, high cholesterol, low fruit and vegetable intake and physical inactivity to the development of coronary heart disease and ischaemic stroke is shown in Figure 3. Globally, low fruit and vegetable intake is estimated to contribute to the development of approximately 31% of coronary heart disease and 11% of ischaemic stroke [*1*].

Low intake of fruits and vegetables among many countries of the Region has increased the prevalence of cardiovascular diseases and some cancers. At the same time, changes in lifestyle and rapid urbanization have led to less physical activity and this has contributed heavily to the increased regional prevalence of obesity and diabetes mellitus.

The prevalence of low intake of fruits and vegetables for 4 countries for which data are available (Bahrain, Pakistan, Saudi Arabia and United Arab Emirates) [*8,13*] is shown in Figure 4.

The total caloric intake among a number of Member States is shown in Figure 5 [*2*]. The mean daily intake in 2000 was 3000 kcal/capita, except in Yemen where it was 2000 kcal/capita, and it seems there was no improvement between 1994 and 2000.

The proportion of the population that has NCD but is undiagnosed varies from country to country. Throughout the Region, 30% of the population are healthy, 50% are healthy with ≥ 1 NCD risk factors, 15% have NCD (including diabetes, cardiovascular disease, cancer, asthma and chronic obstructive pulmonary disease) and 5% have acute illness [*14*].

In a study in Oman, the majority of the participants (96%) were undiagnosed for

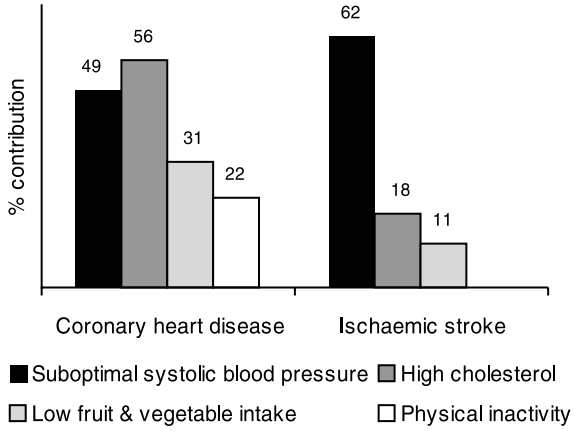


Figure 3 **Contribution of selected risk factors to coronary heart disease and ischaemic stroke worldwide**

NCD risk factors: 96% for hypercholesterolaemia, but lower for hypertension (69%) and diabetes (60%) [*15*].

Cardiovascular disease

Cardiovascular disease and stroke are rapidly growing problems, and are the major causes of illness and deaths in the Eastern Mediterranean Region, accounting for 31% of deaths. Approximately 75% of cardiovascular disease can be attributed to conventional risk factors [*16*]. Hypertension affects almost 26% of the adult population in the Region. These conditions have major adverse health, social and economic effects within and beyond the health sector. This is because of the ageing population, high rates of smoking and changing nutritional and behavioural habits, along with a sedentary lifestyle. With the changing lifestyles, there is likely to be greater exposure to risk factors such as high blood pressure, physical inactivity and diets high in saturated fat, leading to elevated serum cholesterol levels.

Regional and national data have shown that cardiovascular disease imposes the highest morbidity burden for NCDs. The total DALYs lost in the Region in 2001 was approximately 136 million, of which approx 53 million (39%) were a result of NCD (Table 4) [*1*]. Total DALYs lost among the countries of the Region that have low child/low adult mortality (Bahrain, Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia and United Arab Emirates) is approximately 23 million, of which just over 13 million (57%) were a result of NCD (Table 4). On the other hand, total DALYs lost for the countries which have high child/high adult mortality (Afghanistan, Djibouti, Egypt, Iraq, Morocco, Pakistan, Somalia, Sudan and Yemen) is approximately 113 million, of which NCD contributes 39 million (35%) (Table 4).

Interestingly, the burden of DALYs lost due to cardiovascular disease in the coun-

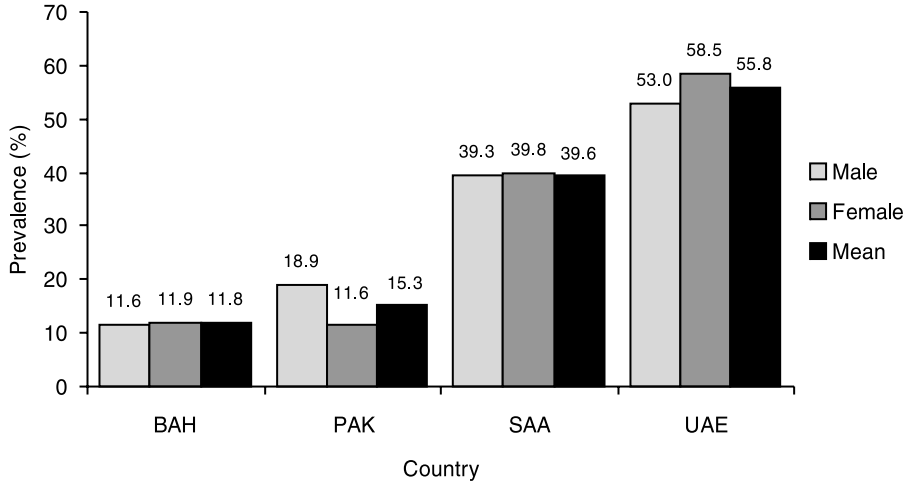


Figure 4 **Prevalence of low fruit and vegetable intake in Bahrain (BAH), Pakistan (PAK), Saudi Arabia (SAA) and the United Arab Emirates (UAE) [*8,13*]**

tries of the Region which have low child/ low adult mortality is 3 million (23% of NCD burden) and is approximately 8.8 million (23% of NCD burden) among the high

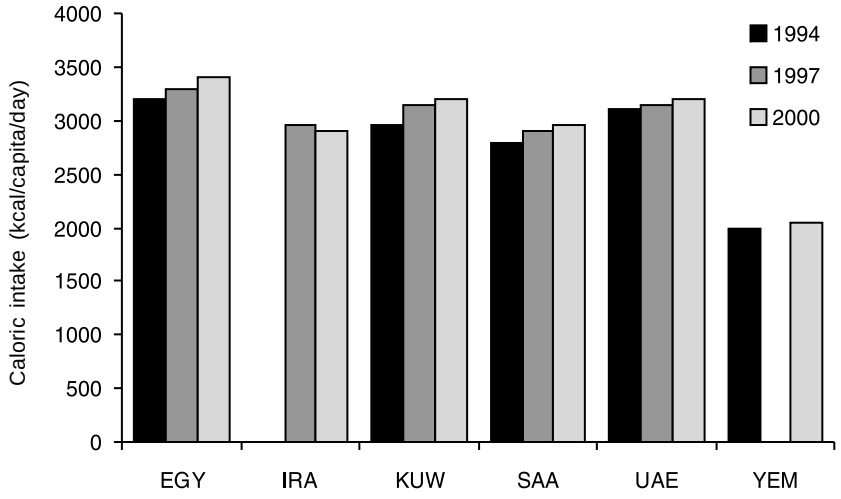


Figure 5 **Trend in total daily caloric intake (kcal/capita) among selected Member States, 1994–2000 *(Egypt, Iran, Kuwait, Saudi Arabia, United Arab Emirates, Yemen)***

child/high adult mortality countries, i.e. the burden of cardiovascular disease as part of total NCD burden is similar.

The countries of the Eastern Mediterranean Region are, therefore, suffering from a double burden of both communicable and noncommunicable diseases. Within a short time, however, NCD will dominate the scene of health problems [*14*]. Regional and national data have shown that cardiovascular disease will impose the highest morbidity burden among NCDs in both the low child/low adult mortality and high child/high adult mortality countries [*2,17–19*].

Strategic directions

In the Eastern Mediterranean Region, NCDs are the major cause of premature adult death, representing a major health challenge. These conditions can be prevented and controlled using available knowledge. Without national strategic action, however, deaths from NCDs are expected to increase by 17% from 2005 to 2015 [*2*]. There are several problems facing countries of the Region in dealing with the challenge: lack of national risk factor surveillance; lack of harmonization of monitoring and surveillance methodologies; no linking of mortality data to NCD prevention and control; lack of availability of a model of integrated care for an NCD prevention programme; and inadequate national capacity-building and lack of programme sustainability.

Three main strategic directions are advocated. These are outlined below.

Table 4 **Deaths by cause and mortality stratum in the countries of the Eastern Mediterranean Region, 2001**

Variable	Countries				Total	
	Low child low adult[a] mortality		High child high adult[b] mortality			
	No.	%	No.	%	No.	%
Population (000)	141 835		351 256		493 091	
Deaths (000)						
Total	707		3 449		4 156	
Communicable disease	126	17.8	1 700	49.2	1 826	43.9
Noncommunicable disease (total)	475	67.2	1 454	42.2	1 929	46.4
Cardiovascular disease	280	62.1	757	22.0	1 037	25.0
DALYs lost (000)						
Total	23 007		113 214		136 221	
Communicable disease	5 691	24.7	61 446	54.3	67 137	49.3
Noncommunicable disease (total)	13 282	57.8	39 329	34.7	52 611	38.6
Cardiovascular disease	2 935	22.0	8 855	22.5	11 790	22.4

[a]Bahrain, Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia and United Arab Emirates.
[b]Afghanistan, Djibouti, Egypt, Iraq, Morocco, Pakistan, Somalia, Sudan and Yemen.
DALYs = disability adjusted life years.

Estimate population need and advocate for action

There is a relatively long time between exposure to a risk factor and development of NCD. Consequently, the most effective strategy for surveillance is to focus efforts on the major NCD risk factors that predict disease. The population distribution of these risk factors is the key information required by countries in their planning of prevention and control programmes. It can also contribute to the monitoring and evaluation of these activities.

Many countries of the Region do not have a surveillance system for chronic diseases. Knowledge of NCD risk factors is important for predicting the burden of chronic disease in populations and for identifying potential interventions to reduce such burdens [*1*]. The *World Health Report 2002* identified 8 risk factors that contribute the most to mortality and morbidity, but which can be reduced through primary intervention and can be easily measured in populations [*1*]. They are tobacco use, alcohol use, physical inactivity, low fruit/vegetable intake, obesity, raised blood pressure, raised cholesterol and diabetes. In fact, the joint effects of tobacco use, raised blood pressure and raised cholesterol account for 65% of all cardiovascular disease in those above the age of 30 years.

In the STEPwise approach, WHO recommends 3 steps to implement effectively the approach to NCD surveillance (http://www.who.int/ncd_surveillance/steps/resources/en/index.html).This is based on a conceptual framework that offers a distinction between different levels of assessment of risk factors, i.e. by questionnaires, physical assessments and blood samples. This requires national authorities to develop or strengthen the national surveillance system for NCDs and risk factors. Once population need is estimated, the information must be synthesized into advocacy for policy action at the national level.

Develop national policies, strategies and plans for NCD prevention and care and capacity-building

As NCDs can be prevented and controlled using available knowledge, a comprehensive and integrated approach is required at country level, led by the government, and with the full participation of the whole community. The population-wide approach seeks to reduce the risks in the entire population. NCDs can be reduced by small reductions in the average population levels of several risk factors, such as tobacco use unhealthy diet and physical inactivity, which in turn lead to population-level reductions in risk for cholesterol, blood pressure, blood glucose and body weight. Population-wide and individual approaches are complementary strategies that provide a continuum of interventions. Countries of the Region need to set up strategies for developing a model of integrated care for NCD prevention and national capacity-building.

There are 4 approaches to prevention [*20,21*]:

- Clinical prevention: interventions involving a health care provider and a recipient of care. Clinical prevention services are provided to individuals who may accept or decline the service or the recommended health actions. A physician counselling individual patients to quit smoking is an example of a clinical prevention activity.
- Health protection: interventions that reduce health risks by changing the physical or social environment in which people live. Prohibiting smoking in pub-

lic places is an example of a health protection intervention.

- Health promotion: interventions that aim at encouraging individual behaviours believed to produce positive health effects and discouraging behaviour that produces negative health effects. Health promotion interventions frequently take the form of public information campaigns. A media-based antismoking campaign is an example of health promotion; taxation on tobacco products to reduce use is another tool.
- Public health policy: social or economic interventions that affect health but do not have health as the main policy objective.

Preventive strategies need to focus on the population as a whole, or on the people identified as being at high risk of certain diseases. Thus, it is important to integrate a comprehensive approach to NCD at the primary care level. Primary care physicians at all levels need to integrate both preventive and promotive aspects into their practices. The comprehensive approach entails providing curative, preventive and rehabilitative care and active involvement of the patients, their families and the community. Primary health care physicians must also play their part in providing education in healthy living. Health care workers are thus role models and leaders in all matters that influence health.

Promote and implement community participation in prevention and care of NCD

Integrated community-based intervention programmes for prevention and care of NCD are comprehensive packages in which different kinds of activities are combined to produce a synergistic effect. The community approach in NCD prevention has a high degree of generalization and cost–effectiveness, is able to diffuse information successfully and has the potential for influencing environmental and institutional policies that have a bearing on the health status of the population. Close collaboration between those implementing the community approach and the national health authorities is important to sustaining the programme and for influencing policy development in regard to health.

The people of the Region share a deeply-rooted health heritage. Recognizing this, in June 1989, a consultation was convened to respond to the need to formulate appropriate health messages for the people. This resulted in the Amman Declaration on Heath Promotion [*22*]. As a part of integrated community-based intervention programmes for prevention and care of NCD, this Declaration can play a major role in our Region in helping to raise community awareness and involve the people in health promotion and disease prevention.

Conclusion

The need for a comprehensive vision to address the health and economic burden of NCD in the Eastern Mediterranean Region is clear and urgent. The current burden of NCD in the Region is a reflection of exposure to the main risk factors; the future burden will be determined by conducting reliable epidemiological population studies of the major risk factors. Regional and national strategies are essential for community mobilization and for developing and implementing successful and sustainable NCD prevention and control policies and programmes.

Experience in the Region has shown that a community-based approach is feasible and that prevention of NCD and NCD

risk factors can be successful through joint collaborative efforts and coalition between health providers and the community. Population-wide interventions that seek to reduce risk factors in the entire population are needed. There is strong evidence that the policies, strategies and plans for NCD prevention and control should be comprehensive and integrated, focusing on common risk factors.

Prevention and care of NCDs represent a challenging task, nationally and regionally. Advocacy is needed to raise awareness of NCD and create a climate for resource mobilization. Two key messages for advocacy are: NCDs are the major disease burden; NCDs are preventable using available knowledge, and solutions are effective and highly cost-effective. Research is needed to explore the effectiveness of community-based programmes for NCD prevention and control. The aim is to gather solid evidence on the effectiveness of community-based programmes for NCD prevention in the Region, and for each country specifically. Community-based programmes need to be oriented appropriately with regard to regional cultures. National capacity-building is crucial to meeting national needs in tackling the NCDs and their determinants in the population.

As the regional mean prevalence for hypertension is 26.5% and diabetes prevalence is 14.5%, these 2 diseases represent a particularly important challenge to the Region, which requires early attention within the overall context of NCDs.

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Invited paper

Overweight and obesity in the Eastern Mediterranean Region: can we control it?

***A.O. Musaiger*[1]**

SUMMARY Obesity has become an epidemic problem worldwide, and in the Eastern Mediterranean Region the status of overweight has reached an alarming level. A prevalence of 3%–9% overweight and obesity has been recorded among preschool children, while that among schoolchildren was 12%–25%. A marked increase in obesity generally has been noted among adolescents, ranging from 15% to 45%. In adulthood, women showed a higher prevalence of obesity (35%–75%) than men (30%–60%). Several factors, such as change in dietary habits, socioeconomic factors, inactivity and multiparity (among women) determine obesity in this Region. There is an urgent need for national programmes to prevent and control obesity in the countries of the Region.

Introduction

The prevalence of obesity is increasing worldwide although the proportion varies from country to country and between geographical areas within a country. Changes in lifestyle, dietary habits, physical activity and the social and cultural environment are associated with the occurrence of obesity [*1*]. It is well documented that morbidity and mortality rates increase with increase in body weight. Many chronic, noncommunicable diseases are positively associated with obesity, type 2 diabetes mellitus in particular, hypertension, some forms of cancer and cardiovascular disease. These are the main causes of morbidity and mortality in most countries of the Eastern Mediterranean Region. Therefore, prevention and control of obesity can play an important role in reducing the risk for chronic diseases.

This paper highlights the current situation of obesity in the Region and the factors contributing to its prevalence.

Current status of obesity

Several studies have been carried out to determine prevalence of overweight and obesity in this Region. Most of these studies used the body mass index (BMI) as an indicator for obesity (BMI < 25.0–29.9 kg/m^2 = overweight; BMI ≥ 30.0 kg/m^2 = obese). Only very few of them used skin fold measurements. It was concluded that overweight and obesity are a cause of concern not only among adults, but also among children and adolescents [*2*].

De Onis and Blössner reviewed the prevalence of overweight among preschool children (0–5 years) in 94 countries [*3*]. The global prevalence of overweight was

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3.3%. Eastern Mediterranean countries, however, showed the highest prevalence of overweight, ranging from 3.1% to 9.0%. The prevalence of overweight continues to increase in the Region during the school age and adolescent stages. The World Health Organization reported that BMI begins to increase rapidly after a period of reduced adiposity during the preschool years [*1*]. During adolescence, children displayed an increase in body fat, often associated with irregular meals, changing food habits and inactivity. In Kuwait, for example, Al-Mousa and Parkash found that 4.7% of male and 6.7% of female preschool children (0–5 years) were obese [*4*]. The proportion increased to 8.1% and 8.8% for schoolchildren aged 6–9 years, and to 36.8% and 35.9% for those aged 10–13 years.

Excluding poorer countries in the Region (Afghanistan, Djibouti, Mauritania, Somalia, Sudan and Yemen) the prevalence of overweight and obesity among schoolchildren aged 6–10 years was 12%–25%, while among adolescents (11–18 years) it was 15%–45%, using BMI as a criterion for obesity [*5*]. Among adults (≥ 19 years) the prevalence of obesity varied widely from country to country. The proportion of overweight and obesity (BMI ≥ 25 kg/m^2) among men ranged from 30% to 60%, while among women it ranged from 35% to 75%. Some of the studies reviewed were not done on a national basis; they do, however, provide useful data on the trend for obesity [*6*]. In a review of 39 surveys from 28 developing countries to determine obesity among women, Martorell et al. reported that women in Egypt and Turkey have the highest proportion of overweight (31.7% for both), as well as the highest proportion of obesity (20.1% for Egypt and 18.6% for Turkey) [*7*].

Factors associated with obesity in the Eastern Mediterranean Region

During the past decade, there has been increasing emphasis, especially in Saudi Arabia, Bahrain, Egypt, Kuwait, Lebanon and Tunisia, on determining the factors associated with obesity [*2,8,9*]. Nevertheless, in-depth studies on this aspect are few, which means there is a grave need for establishing a well-designed, community-based study in the Region.

Change in dietary habits

Food consumption patterns and dietary habits in this Region have changed markedly during the past 4 decades. There has been an increase in per capita energy and fat intake in all countries. Data from the food balance sheet showed an increase in calories consumed during 1971–1997 in the countries of the Region, and a high percentage of these calories came from animal foods [*10*]. Over the same period, daily per capita fat intake showed notable increases, ranging from 13.6% in Sudan to 143% in Saudi Arabia [*11*]. It is probable that the high consumption of foods rich in fats and calories and the sedentary lifestyle among most communities in this Region played an important role in the rise of obesity. This is particularly true with the great shift from traditional foods to more westernized foods, which are characterized by high fat, high cholestrol, high sodium and low fibre.

Sociodemographic factors

Unlike in Europe and North America, obesity in the Eastern Mediterranean Region is more prevalent in women, urban areas and those of higher socioeconomic status. In Jordan, for example the prevalence of obe-

sity was 56% in urban areas compared with 44% in rural areas. Similar trends were found in Egypt, the Islamic Republic of Iran, Morocco, Oman, Tunisia and Turkey. Lebanon was an exception as obesity was more prevalent among rural than urban women. Interestingly, obesity was more prevalent among unemployed than employed women. In Kuwait, the rate of obesity in unemployed women was 47% compared to 34% in employed women. In Saudi Arabia, the values were 79% and 53%, and in Tunisia 24% and 15% respectively [*6*].

In general, obesity in this Region was found to be more prevalent in people who were young (30–50 years), better educated, currently married, female or unemployed, and in those who watched television more than 2 hours per day, consumed fresh fruit less than 3 times a week and owned cars [*6,8*].

Inactivity and patterns of physical activity

Changes in lifestyle and socioeconomic status in this Region have had a significant effect on physical activity. With the availability of cars, the increase in electrical home appliances and more involvement in office work, life has become more sedentary, and the pattern of practising exercise has diminished steeply in most countries. In Egypt, it was found that practising exercise is the activity least done during leisure time in a typical day. Only 2% of adults (20–70 years) were reported as practising exercise in a typical day, 8.5% practising during the weekend and 2.5% during their annual leave [*12*].

In Saudi Arabia, about 53.5% of Saudi men aged 19 years and older were totally physically inactive, and another 27.5% were irregularly active. Only 19% were active on a regular basis. Physical activity was lower among those who were married, working in the private sector, working 2 shifts, less educated or who had only 1 day off during the week. Time constraints seemed to be the major contributing factor to inactivity, while maintaining health and losing weight were the most important reasons for engaging in physical activity among Saudi men [*13*].

Pregnancy and multiparity have been widely reported as factors contributing to obesity among women. The fertility rate of the women in this Region is very high and the spacing between pregnancies is short, resulting in accumulation of fat in the body. Several studies have been carried out which indicate that obesity is high among women with multiple pregnancies and high parity. In Saudi Arabia, Al-Shammari et al. [*14*] reported that the mean BMI increased significantly with parity in Saudi women. It was 25.1 in nulliparous women, increasing to 27.1, 29.8 and 31.7 in women with parity 1–2, 3–4 and > 4 respectively.

Other factors

There are many other factors, such as home environment, body image, school environment, beliefs and attitudes, lack of health awareness and cultural conditions, which may be linked with obesity but have not been investigated as much.

The decline in exclusive breastfeeding and high dependence on bottle-feeding is another important factor. The World Health Organization reported that promotion of breastfeeding may contribute to the prevention of childhood obesity [*15*]. Studies in the Region suggest a remarkable decline in exclusive breastfeeding and an increase in the practice of mixed feeding and bottle-feeding.

Television advertising, long periods watching television and using the internet, high intake of fast foods, and increase in

food intake outside the home have also been reported to be associated with obesity among children and adolescents in some countries in the Region [*6*].

Can we prevent and control obesity?

Obesity has become one of the major health problems in the Region, and is associated with several chronic diseases. There is no strategy to prevent and control obesity in the health plans of most (if not all) the countries of the Region. Additionally, there is a great lack of quantitative and qualitative research and studies on obesity. This creates the need for affective action, either to study factors contributing to the occurrence of obesity or to establish programmes to control it. In order to achieve this, the following recommendations should be considered.

- Policy-makers should be aware of the importance and seriousness of the problem of obesity and its cost to the health care system budget.
- There is a need to include sound and reliable information on management of obesity in school and university curricula.
- There is a need for a national programme in each country to prevent and control obesity. Such a programme should be part of a national plan to prevent diet-related chronic disease. An obesity control programme should incorporate: dietary management of obesity; promotion of physical activity; health education campaigns; training courses for health workers; the drawing up of regulations and legislation to control advertising of prescription drugs and equipment that claim to reduce obesity; and consideration of the possibility of providing facilities for practising physical activity and exercise in the community.

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FAO/WHO Regional technical consultation on national food-based dietary guidelines

The World Health Organization (WHO) and Food and Agriculture Organization (FAO) are organizing the regional technical consultation on national food-based dietary guidelines, in Cairo, Egypt, from 6 to 9 December 2004. The objectives of the consultation are to: review the status of food-based dietary guidelines in Member States; assist Member States in formulating national food-based dietary guidelines; and develop the framework of a regional food-based dietary guideline. Experts from Bahrain, Egypt, Greece, India, Kuwait, Jordan, Pakistan, Qatar, Saudi Arabia, and the USA, as well as WHO concerned staff, will be attending this consultation.

Invited paper

Food safety: current situation, unaddressed issues and the emerging priorities

M. Elmi[1]

SUMMARY This paper reviews the topic of food safety with reference to the Eastern Mediterranean Region. The differing views of food safety and the current situation with regard to ensuring food safety are presented. Also discussed are some of the unaddressed issues and challenges related to food safety. The new conditions that have arisen in the modern world which have facilitated the emergence of pathogens are presented, such as changes in animal husbandry, changes in international trade and travel, lifestyle and consumer changes. The urgent need for action in order to reduce the risk of microbiological and chemical foodborne diseases is emphasized. The food chain starts from farm and ends at fork; controlling this complex process requires an integrated approach and a responsible authority to oversee it in order to protect and promote food safety.

Introduction

Food is a means to sustain and enjoy life but it is also a vehicle and a medium for transmitting hazards and causing disease and death. Foodborne diseases are a growing public health problem in both developed and developing countries today. The term "safe food" represents different ideals to different audiences. Views and descriptions of safe food held by consumers, academicians, industry and special interest groups differ and are diverse. Thus almost any single definition of food safety will be overly simplistic [*1*].

For consumers, the descriptions of safe food are generally quite practical and simple. Consumers of course come in all sorts; they differ in age, sex, culture, life experience, health, knowledge, nutritional needs, family status, purchasing power, occupation, education and access to the media. Thus their ideas of safe food will vary. For example, some may regard safe food as food that does not make a person sick. Others may describe safe food as food that is within its shelf life and has been stored or distributed at the proper temperature. Some consumers may define safe food as food that is not "contaminated".

The colloquium on food safety for the American Academy of Microbiology has described safe food as the following: Safe food, if properly handled at all steps of production, processing, distribution, from retail and food service business through consumption, is reliably unlikely to cause illness or injury [*2*]. The food industry defines food safety by its specification for raw materials and finished products. These specifications define the acceptable limits for chemical hazards such as hormones and pesticides, physical hazards such as metal fragments, and microbiological hazards such as *Salmonella* and *Listeria*. Food safety of course goes beyond food production and sale to the consumers themselves

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and their own handling and consumption of food.

The World Health Organization (WHO) and Food and Agriculture Organization (FAO) define food safety as food that is free from all hazards, whether chronic or acute, that may make food injurious to the health of the consumer [*3*].

Current situation in the Eastern Mediterranean Region

Food safety in Eastern Mediterranean Region of the World Health Organization varies considerably throughout the Region. In recent years, an increasing number of countries have moved to improve, update and strengthen their systems and infrastructure for food safety and have adopted an approach based on risk management. The United Arab Emirates and Jordan have developed modern food control systems based on risk management to monitor and control the safety of domestically produced and imported food. Oman and Tunisia have developed a national strategy for food control. Lebanon, Egypt, Pakistan, Sudan, Syrian Arab Republic and Morocco have drafted new food legislation. Egypt and Sudan harmonized food standards with Codex. Saudi Arabia, Jordan and the Islamic Republic of Iran have established a food and drug authority. Members of the Gulf Cooperation Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) have developed a common food import policy which allows for shared inspection policy and standards. The inspection systems for domestic and imported food of the United Arab Emirates make use of hand-held computers and customized software, which enhances access to information of on high-risk foods, accelerates clearing processes and improves performance of food safety. Some countries have well-functioning foodborne surveillance systems and reporting mechanisms, such as Jordan, Kuwait, Oman and Saudi Arabia. Given the strong reliance of the Region on food imports, ensuring the safety and quality of imported food is a recognized concern throughout the Region [*4*].

Many countries in the Region have embarked on unifying food safety activities from farm to fork, such as Jordan, Saudi Arabia and Bahrain. They have established or are establishing food and drug authorities which will cover food laws and regulations, food control management, foodborne disease surveillance and investigation systems, inspection services, recall and tracking systems, food monitoring laboratories, and information and education activities for the consumers themselves.

Unaddressed issues and challenges

Foodborne diseases are perceived by the majority of the people in developing countries as an unpleasant fact of daily life. Because most people regard diarrhoea as a transient inconvenience rather than a symptom of disease, the vast majority of diarrhoeal episodes do not result in a visit to a doctor [*5*].

Trends in global food production, processing, distribution and preparation present new challenges to food safety. Food grown in one country can now be transported and consumed halfway across the world. People demand a wider variety of foods than in the past, they want foods that are not in season and they often eat out of the home [*6*]. Children in schools and childcare facilities and the growing number of elderly persons in hospitals and nursing homes mean that food for many is prepared by a few and can therefore be the source of major foodborne disease outbreaks [*7*].

Greater life expectancy and increasing numbers of immunocompromised people mean a larger vulnerable population for whom unsafe food is often an even more serious threat [*8,9*].

Emerging priorities

In the last two decades, new pathogens have been recognized as being transmitted through food, these are either newly described pathogens or newly associated with foodborne transmission; they include *Salmonella enteridis*, *Campylobacter*, verocytotoxin-producing *Escherichia coli* (VTEC), *Listeria monocytogens*, Noroviruses, *Vibrio cholerae* O1, *V. parahaemolyticus*, *V. vulnificus*, *Yersinia enterocolitica*, *Cyclospora* and prions. Most of these pathogens have an animal reservoir but they do not often cause illness in the infected animal (chickens and *S. enteritidis*, cattle and *E. coli* O157:H7, oysters and *V. vulnificus* and Norwalk viruses and *Listeria monocytogenes*) [*10–12*].

New conditions facilitating the emergence of pathogens

A number of factors can explain the emergence of new foodborne pathogens as well as the re-emergence of older, well known pathogens over the last 2 decades.

New animal feeding practices
Even before the exact cause of bovine spongiform encephalopathy (BSE) was known, the actual driving force of the epidemic was identified, namely cattle feeding practices. The establishment of BSE in its new bovine host and subsequent epidemic spread has been clearly linked to the use of meat and bone meal from cattle and other ruminants in the preparation of cattle feed [*5,8*].

Changes in animal husbandry
Modern intensive animal husbandry practices, introduced to maximize production, seem to have led to the emergence and increased prevalence of *Salmonella* serovars and/or *Camplyobacter* in domestice animals, such as poultry, cattle, sheep and swine [*5,13,14*].

Increase in international trade
International trade has three main consequences: i) the rapid transfer of microorganisms from one country to another, ii) the time between processing and consumption of food is increasing, leading to increased opportunity for contamination and time/temperature abuse of the products and hence the risk of foodborne illness, and iii) people are more likely to be exposed to a higher number of different strains/types of foodborne pathogens [*5*].

Changes in the agronomic process
The use of untreated sewage for irrigation and increased use of manure rather than chemical fertilizers contributes to the increased risk associated with the consumption of fresh fruits and vegetables. Countries where an important increase in consumption of such products has occurred in recent years have experienced increases in outbreaks of *E. Coli* and *Cyclospora* infection [*15–19*].

Changes in food technology
Advances in food technology on a global scale have enabled the food industry to supply a greater variety of foods, especially ready-to-eat foods. The increased use of refrigeration to prolong the shelf-life of food has contributed to the emergence of *Listeria monocytogenes*; this bacterium is adapted to survive at freezing temperature [*5,20*].

Increase in travel

Seven hundred and sixty million international arrivals were recorded worldwide in 2004 and this number is expected to increase to 937 million by 2010 [2*1*]. Globalization of foodborne diseases results from such increased travel. Thus, a person can be exposed to a foodborne illness in one country and expose others to the infection in a location thousands of kilometres from the original source of infection. Depending on their destination, travellers are estimated to run a 20% to 50% risk of contracting foodborne diseases [*22*]. For example, 90% of salmonellosis in Sweden, 71% of typhoid fever cases in France and 61% of cholera cases in the United States of America have been attributed to international travel [*5,23*].

Changes in lifestyle and consumer demands

Fifty years ago there were far fewer restaurants, and salad bars were virtually nonexistent. Today, however, both abound and eating out is commonplace. As a result, an increasing number of outbreaks of foodborne infection are associated with foods prepared outside the home. Hitherto unrecognized microbial hazards have emerged because of changes in food consumption, such the increasing consumption of fresh fruits and vegetables in a number of countries in the Region. In addition, the recent interest of consumers in foreign cooking can be an unexpected source of foodborne disease [*24*].

Increase in susceptible populations

In many developing and industrialized countries, as a result of advances in medical care, the absolute number of elderly people is rapidly increasing as are the number of immunocompromised people. These people have a greater susceptibility to foodborne diseases [*25–30*].

Conclusion

In the absence of strong consumer protection bodies, consumer groups and informed citizens aware of food safety and their right to safe food, it remains a significant challenge for many countries in the Eastern Mediterranean Region to respond in the most appropriate way to the needs of their people for safe and healthy food.

The high costs of complying with Codex Alimentarius and other standards recognized by the World Trade Organization, such as the Sanitary and Phytosanitary Agreement and Technical Barriers to Trade, continue to create obstacles to market expansion of Member States (Table 1). Countries have sometimes been able to comply but often the available technical and financial resources have been inadequate. Unless countries allocate sufficient funds for food safety activities, they will be unable to control foodborne diseases and will have difficulty in international trade and tourism.

Today food safety is one of WHO's top 11 priorities and WHO Member States have adopted a strongly worded resolution that recognizes food safety as an essential public health function [*6*]. The regional action plan for the Eastern Mediterranean to address food safety in the 21st century was adopted in resolution EM/RC 46/R.6 at the 46th Regional Committee. The integration of research data, food control monitoring, epidemiological investigations and disease surveillance in a renewed effort to manage and lower foodborne risk is urgently needed. The development of an interdisciplinary approach with direct interaction between monitoring, surveillance and risk analysis systems could be a potential basis for improved foodborne disease prevention. Such prevention efforts naturally have to integrate the entire food production chain, from farm to fork, recognizing that the

Table 1 **Membership in the World Trade Organization and international standard setting bodies of member countries of the WHO Eastern Mediterranean Region (EMR)**

EMR country	Membership of			
	World Trade Organization[a]	Codex Alimentarius[b]	World Organization for Animal Health[c]	International Plant Protection Convention[d]
Afghanistan	Request submitted[e]	–	√	–
Bahrain	√	√	√	√
Djibouti	√	–	√	–
Egypt	√	√	√	√
Islamic Republic of Iran[e]	Request submitted[e]	√	√	√
Iraq[e]	Request submitted[e]	√	√	√
Jordan	√	√	√	√
Kuwait	√	√	√	–
Lebanon	Applied[f]	√	√	√
Libyan Arab Jamahiriya[e]	Request submitted[e]	√	√	√
Morocco	√	√	√	√
Oman	√	√	√	√
Pakistan	√	√	√	√
Qatar	√	√	√	–
Saudi Arabia	Applied[f]	√	√	√
Somalia	–	–	√	–
Sudan	Applied[f]	√	√	√
Syrian Arab Republic	Request submitted[e]	√	√	–
Tunisia	√	√	√	√
United Arab Emirates	√	√	√	√
Yemen	Applied[f]	√	√	√
Total members	**11**	**18**	**21**	**15**

[a]Source: World Trade Organization: www.wto.org (accessed 13 June 2005).
[b]Source: Codex Alimentarius: http://www.codexalimentarius.net/web/members_area.jsp?lang=EN (accessed 13 June 2005).
[c]Source: World Organization for Animal Health: http://www.oie.int/eng/OIE/PM/en_PM.htm (accessed 13 June 2005).
[d]Source: International Plant Protection Convention: https://www.ippc.int/IPP/En/default.jsp (accessed 13 June 2005).
[e]Requested accession but working parties on application have not yet met.
[f]In the process of negotiation to become members of the World Trade Association.

critical point for efficient prevention might be at the farm for some problems or at the retail level for others. Most food safety systems currently in place around the world have not been designed according to this important principle. Such lack of coherence and consistency has in some cases undermined the efficiency of food safety systems.

There are numerous pressing challenges in the area of food safety and now is the time for change. The recognition of the problems has spurred a new wave of solutions. However, these solutions will not be realized without active support from all parts of the food production and consumption chain. There is an urgent need for more systematic and aggressive steps to be taken to significantly reduce the risk of microbiological and chemical foodborne diseases. This need must not be ignored. Tackling the issues of food safety is without doubt one of the major challenges for the 21st century with regard to the protection of human health.

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Maternal anaemia and its impact on perinatal outcome in a tertiary care hospital in Pakistan

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فقر الدم في الوالدات، وتأثيره على حصائل الحمل في الفترة المحيطة بالولادة في مستشفى للرعاية الثالثية في باكستان

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الخلاصة: يمثِّل فقر الدم في الوالدات مشكلة من المشكلات الصحية الشائعة لدى الحوامل، ولاسيَّما في البلدان النامية. وقد درس الباحثون العلاقة بين فقر الدم لدى الوالدات وبين حصائل الحمل في الفترة المحيطة بالولادة، في مجموعة أتراب تتألف من 629 حاملاً في الفترة من تشرين الأول/أكتوبر 2001 إلى تشرين الأول/أكتوبر 2002. وكانت 313 من هؤلاء الحوامل مصابات بفقر الدم (الهيموغلوبين أقل من 11 غرام/لتر). أما حصائل الحمل في الفترة المحيطة بالولادة فتضمّ الولادة قبل الأوان، ونقص وزن المولود، وتأخُّر النموّ داخل الرحم، وموت الوليد في الفترة المحيطة بالولادة، وانخفاض حَرَز أبغار، وموت الجنين داخل الرحم. وقد أُجريَ التحليل الوحيد المتغيِّر، والمتعدِّد المتغيِّرات، وكان احتمال (اختطار) الولادة قبل الأوان لدى المصابات بفقر الدم، 4 أضعاف احتماله لدى غيرهن من غير المصابات بفقر الدم، كما كان احتمال (اختطار) نقص وزن المولود لدى المصابات بفقر الدم، 1.9 أضعاف احتماله لدى غيرهن من غير المصابات بفقر الدم. كذلك فإن ولدان الوالدات المصابات بفقر الدم يواجهون احتمال (اختطار) انخفاض حرز أبغار في الدقيقة الأولى بمقدار 1.8 أضعاف احتماله لدى ولدان الوالدات غير المصابات بفقر الدم، إلى جانب أن اختطار موت الجنين داخل الرحم في الوالدات المصابات بفقر الدم، يعادل 3.7 أضعاف ما هو عليه في الوالدات غير المصابات بفقر الدم.

ABSTRACT Maternal anaemia is a common problem in pregnancy, particularly in developing countries. We investigated the relationship between maternal anaemia and perinatal outcome in a cohort of 629 pregnant women from October 2001 to 2002. Of these, 313 were anaemic (haemoglobin < 11 g/L). Perinatal outcomes included preterm delivery, low birth weight, intrauterine growth retardation, perinatal death, low Apgar scores and intrauterine fetal death. Univariate and multivariate analyses were performed. The risk of preterm delivery and low birth weight among the anaemic women was 4 and 1.9 times more respectively than the non-anaemic women. The neonates of anaemic women also had 1.8 times increased risk having low Apgar scores at 1 minute and there was a 3.7 greater risk of intrauterine fetal death among the anaemic women than the non-anaemic women.

L'anémie maternelle et son impact sur l'issue périnatale dans un hôpital de soins tertiaires au Pakistan

RÉSUMÉ L'anémie maternelle est un problème courant durant la grossesse, notamment dans les pays en développement. Nous avons examiné la relation entre l'anémie maternelle et l'issue périnatale dans une cohorte de 629 femmes enceintes, d'octobre 2001 à 2002. Parmi celles-ci, 313 étaient anémiques (hémoglobine < 11 g/L). Les issues périnatales comprenaient la naissance prématurée, le faible poids de naissance, le retard de croissance intra-utérine, le décès périnatal, le faible score d'Apgar et le décès ***in utero*** du fœtus. On a procédé à une analyse univariée et multivariée. Le risque de prématurité et d'insuffisance pondérale à la naissance est respectivement 4 fois et 1,9 fois plus élevé chez les femmes anémiques que chez les femmes non anémiques. Les nouveau-nés des femmes anémiques avaient en outre un risque 1,8 fois supérieur d'avoir un faible score d'Apgar à 1 minute et il y avait un risque de décès ***in utero*** du foetus 3,7 fois plus élevé chez les femmes anémiques que chez les femmes non anémiques.

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Introduction

It has long been recognized that anaemia is a major public health problem especially among poorer segments of the population in developing countries such as India, Pakistan and Bangladesh [*1*]. Anaemia is one of the most prevalent nutritional deficiency problems afflicting pregnant women [*2*], defined by the World Health Organization as haemoglobin levels of ≤ 11 g/dL [*33*]. Maternal anaemia in pregnancy is commonly considered a risk factor for poor pregnancy outcome and can result in complications that threaten the life of both mother and fetus [*4*]. However, the extent to which maternal anaemia affects maternal and neonatal health is still uncertain. Some studies have demonstrated a strong association between low haemoglobin before delivery and adverse outcomes [*5*] while others have not found a significant association [*6*].

The prevalence of anaemia in pregnancy varies considerably because of differences in, for example, socioeconomic conditions, lifestyles and health-seeking behaviours across different cultures. Prior research in Pakistan has documented iron deficiency as the leading cause of anaemia in pregnancy [*6*]. The effects of anaemia on pregnancy outcome in Pakistan have not been evaluated systematically in randomized, prospective intervention trials that include a sufficient number of iron-deficient women, while controlling for possible confounding factors. Nonetheless, the pattern of anaemia in Pakistan and other Asian countries indicates that it is an area of public health that needs attention.

Thus the aim of this study was to investigate the relationship between maternal anaemia and perinatal outcome in Pakistan.

Methods

In this cohort study, the association of multiple effects of anaemia on perinatal outcome were studied among the pregnant women attending the Obstetrics Department of the Aga Khan University Hospital from October 2001 to October 2002.

A total number of 2975 women were delivered during the study year. From these, we included all the women who fulfilled the following inclusion criteria:

- attended the outpatient clinic before 16 weeks of gestation
- age 16 years and above
- singleton pregnancy
- had complete medical records of the pregnancy.

Women with a past history of preterm delivery, obstetric complications or medical illnesses, except anaemia, were excluded.

Exposure (anaemia) was defined as haemoglobin level of < 11 g/dL in labour and on 2 previous occasions in the current pregnancy. Women were interviewed in the local language (Urdu) on the second day of delivery and the data from the interview and medical records were recorded on a pre-designed questionnaire. During antenatal care, height and weight were recorded at each antenatal visit and haemoglobin level was measured at the first antenatal visit, at 28 to 32 weeks, at 33 to 37 weeks and in labour. Women who had haemoglobin < 11 g/dL were given oral iron; those with haemoglobin < 7 g/dL in the third trimester were given either blood transfusion or intravenous iron therapy. Information regarding gestational age at delivery, perinatal outcome (live birth, stillbirth, intrauterine death), intrauterine growth retardation (IUGR) and the type of IUGR were noted

from the medical records. Weight of the neonate and Apgar score at 1 and 5 minutes were also recorded.

One month after delivery, the same interviewer (a medical student) conducted a repeat interview with the mother and reviewed the medical records of the neonate. Health status of the neonate, and perinatal mortality and its cause were documented.

The data were analysed with *SPSS*, version 7.5. Frequencies were determined; Levene's test was applied to measure equality of variances and the *t*-test used to compare means. Univariate analysis was performed and also multivariate analysis was undertaken to control for confounding factors using multiple logistic regression for dependent variables.

Results are expressed as means, standard deviations (SD), adjusted relative risk and 95% confidence intervals (95% CI).

Results

A total of 629 women fulfilled the inclusion criteria, 313 in the anaemic group and 316 were in the non-anaemic group. The study was explained to the women and they all agreed to participate. Only 22 women were lost to follow-up after the first interview.

Table 1 shows the demographic and socioeconomic characteristics of the 2 groups. The mean age of the anaemic women was 26.85 (SD = 4.77) years as compared with 27.08 (SD = 4.65) years in the non-anaemic group. Most of the women in both groups were Muslims, urban dwellers and spoke the national language Urdu. There were no statistically significant differences between the groups in terms of educational level (most up to Grade 10; 15–16 years of age), employment status (most were housewives), family structure (most lived in extended families) and monthly income (most had < 300 000 Pakistani rupees). Thus the 2 groups were well matched.

Table 1 **Demographic and socioeconomic characteristics of the anaemic and non-anaemic women**

Variable	Anaemic (*n* = 313)		Non-anaemic (*n* = 316)	
	No.	%	No.	%
Age (years) mean (SD)	26.85 (4.77)		27.08 (4.65)	
Maternal education				
Up to grade 10 (15–16 years of age)	264	84.3	288	91.1
Above grade 10	49	15.7	28	8.9
Employment status				
Employed outside the home	265	84.7	263	83.2
Housewife	48	15.3	53	16.8
Family structure				
Extended	202	64.5	184	58.2
Nuclear	111	35.5	132	41.8
Monthly income (Pakistani rupees)[a]				
< 20 000	114	36.4	118	37.3
20 000–30 000	99	31.6	117	37.0
30 000–50 000	82	26.2	70	22.2
> 50 000	18	5.8	11	3.5

[a]*US$ 1 = 58 Pakistani rupees.*
SD = standard deviation.

Table 2 shows the univariate analysis of perinatal outcome variables in the two groups. Risk of preterm delivery (< 37 weeks) was 4 times greater among the anaemic women with a statistically significant association (95% CI: 2.5–6.3).There was a 2.2 times and 1.9 times increased risk of low birth weight (LBW) (95% CI: 1.3–3.7) and IUGR (95% CI: 1.1–3.3) respectively in the anaemic women. The risk

Table 2 **Univariate analysis of perinatal outcome among the anaemic and non-anaemic women**

Variable	Anaemic (*n* = 313)	Non-anaemic (*n* = 316)	Adjusted relative risk	95% CI
Premature birth				
Yes	79	20	4.0	2.5–6.3
No	234	296	1.0	
Low birth weight				
Yes	42	19	2.2	1.3–3.7
No	271	297	1.0	
IUGR				
Yes	41	18	1.9	1.1–3.3
No	272	298	1.0	
Perinatal mortality				
Yes	6	2	3.2	0.7–14.6
No	307	314	1.0	
Low Apgar at 1 min				
Yes	32	16	2.1	1.2–3.7
No	281	300	1.0	
Low Apgar at 5 min				
Yes	27	17	1.7	1.0–3.1
No	286	299	1.0	
Intrauterine fetal death				
Yes	5	2	2.5	0.7–13.0
No	308	314	1.0	

CI = confidence interval.
IUGR = intrauterine growth retardation.

of perinatal mortality was 3.2 times greater among the anaemic women but this was not statistically significant (95% CI: 0.7–14.6). The risk of an Apgar score ≤ 5 at 1 minute and ≤ 7 at 5 minutes in the anaemic women was 2.1 (95% CI: 1.2–3.7) and 1.7 (95% CI: 1.0–3.1) respectively greater that the non-anaemic women. The anaemic women were also at a 2.5 times increased risk of intrauterine fetal death compared with the non-anaemic group but this was not statistically significant (95% CI: 0.7–13.0).

Table 3 shows the multivariate analysis of the sample. The anaemic group was at a 4 times increased risk of having preterm delivery (95% CI: 2.5–6.3). The risk of LBW in the anaemic group was 1.9 times higher (95% CI: 1.0–3.4) than the non-anaemic group. As regards perinatal outcome, the anaemic group had a 1.8 times higher risk of giving birth to a baby with an Apgar score ≤ 5 at 1 minute (95% CI: 1.2–3.7).The risk of intrauterine death was 3.7 times greater in the anaemic women (95% CI: 0.86–14.6).

Table 3 **Multivariate analysis of perinatal outcomes among anaemic and non-anaemic groups**

Variable	Adjusted relative risk	95%CI
Premature birth		
Yes	4.0	2.5–6.3
No	1.0	
Low birth weight		
Yes	1.9	1.0–3.4
No	1.0	
Low Apgar at 1 min		
Yes	1.8	1.2–3.7
No	1.0	
Intrauterine fetal death		
Yes	3.7	0.86–14.6
No	1.0	

CI = confidence interval.

Discussion

Anaemia is a common problem in pregnant women in developing countries. The pregnancy outcomes show a variation depending upon the type of anaemia. Studies have demonstrated differences in outcomes in iron deficiency as compared to physiological anaemia of pregnancy [*7*]. In populations where the rate of anaemia is low among non-pregnant women, the primary cause of anaemia during pregnancy is likely to be plasma volume expansion, and this type of anaemia is not associated with negative birth outcomes [*8*]. Maternal haemoglobin values during pregnancy are associated with LBW and preterm birth in a U-shaped relationship with high rates of LBW at low and high concentrations of maternal haemoglobin. However, some of this association may result from using "lowest haemoglobin" rather than a haemoglobin value controlled for the stage of pregnancy.

A similar U-shaped association is likely to be found between maternal haemoglobin and perinatal mortality, but the data to establish this association are insufficient [*9*]. As it is estimated that about 7.3 million perinatal deaths occur annually in the world, mostly in developing countries [*10*], one could assume many of these deaths could be prevented by correcting maternal anaemia.

Prematurity and birth anoxia are the main causes of perinatal deaths in Pakistan. This is in great part because of poor resuscitation facilities and neonatal care in the country, putting premature babies at greater risk of perinatal death. In our study sample, although prematurity was the leading cause of perinatal death, it was lower than the perinatal mortality in other hospitals of Pakistan [*11,12*] probably due to the better resuscitation and neonatal care facilities in our hospital.

Severe anaemia(< 8 g/dL) has been reported to be associated with birth weight values that are 200–400 g lower than in women with higher (> 10 g/dL) haemoglobin values, but in that study other factors that might also have contributed to both LBW and the severity of anaemia were not excluded [*13*].

Maternal infections during pregnancy are a well-known risk factor for preterm labour and the examination of amniotic fluid or placental membranes has shown the presence of bacteria or inflammatory cytokines [*14*]. The relationship between anaemia and infections may be due to adverse effects of anaemia on immune function as a result of alterations in the proliferation of T and B lymphocytes thus reducing the killing activity of phagocytes and neutrophils, and lowering the bactericidal and natural killer cell activity [*15*]. Lymphocyte stimulation indices have also

been found to be lower in anaemic women [*16*].

Research has been conducted to understand how anaemia may predispose to preterm labour either directly or indirectly due to increased risk of infection. The direct effect is related to increased synthesis of corticotrophin-releasing hormone (CRH) as a result of tissue hypoxia [*17*]. These raised levels can induce maternal and fetal stress [*18*], and thus produce a risk factor for preterm labour, pregnancy-induced hypertension and premature rupture of the membranes. CRH also increases fetal cortisol production, which may inhibit longitudinal growth of the fetus [*19*]. An alternative mechanism could be that iron deficiency increases oxidative damage to erythrocytes in the feto–placental unit, which can stimulate the production of CRH. These abnormalities in the regulation of CRH and the production of inflammatory cytokines inhibit the activity of natural killer cells both *in vivo* and *in vitro*.

Our results show the association of maternal anaemia in pregnancy with increased risk of delivery of premature and LBW babies, intrauterine death and low Apgar score at 1 minute. Neonates of anaemic women were also found to be at increased risk of perinatal mortality. These deaths were commonly found to be due to prematurity and sepsis. Since our study was conducted in a tertiary care hospital and the majority of women in Pakistan deliver at home, it is expected that the burden of anaemia and its effect on pregnancy outcome is much greater outside the hospital setting.

Anaemia is one of the main nutritional deficiency disorders affecting a large proportion of the population, not only in developing but also in industrialized countries. In the developing countries, poverty, gender bias and lack of education about the importance of a balanced and iron-rich diet contribute to anaemia. The high prevalence of iron and other micronutrient deficiencies among women before and during pregnancy in developing countries is of concern and maternal anaemia is still a cause of considerable perinatal mortality and morbidity [*20*]. The improvement in the industrialized world is due largely to more effective diagnosis and treatment of anaemia. Although bringing about a change and introducing interventions at an early age in women remain a challenge in developing countries, efforts must be made to address the problem through strategies such as fortification and periodic supplementation and counselling of women of the risks of anaemia in pregnancy [*20*]. This may help to reduce the manifestation of iron deficiency, improve public health and thus reduce maternal and neonatal morbidity and mortality.

Additional studies on pregnant women are needed in which appropriate measures of immune function are evaluated in response to iron supplementation. Furthermore, little is known concerning the effects of maternal iron status during pregnancy on subsequent health and development of the infant and on the quality of life of the mother. These areas warrant detailed research. Finally, other nutritional deficiencies have also been proposed to have an impact on maternal and fetal outcome, e.g. niacin and zinc deficiency. These need to be studied in detail so that when further research is being done on iron deficiency anaemia, the effect of such confounders can be ameliorated.

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Iron status of babies born to iron-deficient anaemic mothers in an Iranian hospital

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وضعيَّة الحديد في الرضَّع لدى أمهات مصابات بفقر الدم بعوز الحديد في أحد المستشفيات الإيرانية

فاطمة إمام قرشي — سيد تقي حيدري

الخلاصة: للتعرف على العلاقة بين فقر الدم لدى الأمهات ووضعيَّة الحديد في ولدانهن، أجرى الباحثان دراسة شملت 97 أماً في جناح الولادة مع أطفالهن المولودين في تمام الحمل. وتم تعيين مقدار كلٍّ من الهيموغلوبين وحديد المصل والسعة الإجمالية الرابطة للحديد، وفيريتين المصل. وقد قسمت الأمهات إلى ثلاث مجموعات: أمهات مصابات بفقر الدم وعَوَز الحديد (22.7٪) وأمهات غير مصابات بفقر الدم ولكنهن مصابات بعَوَز الحديد (27.8٪) وأمَّهات غير مصابات بفقر الدم ولا بعَوَز الحديد (49.5٪). و لم يكن هناك فرق ملحوظ بين متوسط الأعمار للمجموعات الثلاثة من الأمهات، ولكن الاختلافات كانت هامة بالنسبة لعدد مرات الحمل، ومستوى الهيموغلوبين ومستوى الفيريتين في المصل في المجموعات الثلاث من الأمهات، و لم يكن هناك فروق هامة في القيمة الوسطية لحديد المصل أو السعة الإجمالية الرابطة للحديد، بين المجموعات الثلاث من الولدان. ولوحظ في الرضع من أمهات مصابات بفقر الدم، انخفاضٌ ملحوظ في فيريتين المصل (115.3 نانو غرام/ميلي لتر) وذلك بالمقارنة بالمجموعة غير المصابة بفقر الدم ولا بعوز الحديد (204.8 نانوغرام/ميلي لتر) [مَنْسَب الاحتمال P = 0.014] و لم تتم مقارنتهم بالمجموعة التي تعاني من عوز حديد المصل دون الإصابة بفقر الدم. وقد استنتج الباحثان أن عَوَز الحديد لدى الأمهات قد يؤثِّر على وضع الحديد في أطفالهن ويؤهبهم للإصابة بعَوَز الحديد.

ABSTRACT We investigated the relation between maternal anaemia and neonatal iron status in 97 mothers and their babies. Haemoglobin (Hb), serum iron, total iron binding capacity and serum ferritin were determined. Mothers were divided into 3 groups: iron-deficient anaemic (22.7%), non-anaemic iron-deficient (27.8%) and non-anaemic non-iron-deficient (49.5%). There was no significant difference in the mean ages of the 3 groups but there were significant differences in relation to parity, Hb and serum ferritin levels. There was no significant difference in the mean value of serum iron or total iron binding capacity among the neonates of the 3 groups. Babies of iron-deficient anaemic mothers had significantly lower levels of serum ferritin (115.3 ng/mL) than non-anaemic, non-iron-deficient mothers (204.8 ng/mL) but not compared with the non-anaemic iron-deficient group. Maternal iron deficiency may affect iron status in their babies and predispose them to iron deficiency.

Le bilan en fer des enfants nés de mères anémiques ayant une carence martiale dans un hôpital iranien

RÉSUMÉ Afin d'examiner la relation entre l'anémie maternelle et le bilan en fer des nouveau-nés, nous avons effectué une étude de 97 mères et des bébés. L'hémoglobine, le fer sérique, la capacité totale de fixation du fer et la ferritine sérique ont été mesurés. Les mères ont été réparties en trois groupes : mères anémiques ayant une carence martiale (22,7 %), mères non anémiques ayant une carence martiale (27,8 %) et mères non anémiques n'ayant pas de carence martiale (49,5 %). Il n'y avait pas de différence significative dans l'âge moyen des trois groupes de mères mais il y en avait pour la parité, le taux d'hémoglobine et celui de ferritine sérique. Il n'y avait pas de différence significative dans la valeur moyenne du fer sérique ou la capacité totale de fixation du fer chez les nouveau-nés des trois groupes. Les bébés des mères anémiques ayant une carence martiale avaient un taux de ferritine sérique significativement plus faible (115,3 ng/mL) par rapport aux bébés des mères non anémiques n'ayant pas de carence martiale (204,8 ng/mL) mais non par rapport à ceux des mères non anémiques ayant une carence martiale. La carence martiale chez la mère peut affecter le bilan en fer de son bébé et prédisposer l'enfant à la carence martiale.

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Introduction

Iron-deficiency anaemia is the most common type of anaemia among pregnant women, especially in developing countries [*1–4*]. The risk of iron deficiency is particularly high in women with high parity and short intervals between pregnancies [*5*].

Iron transfer from mother to fetus occurs against the concentration gradient. Maternal iron is the only source of fetal iron; it is logical, therefore, that maternal iron status will affect the iron status of the neonate.

Several studies have been done to investigate the relationship between maternal and neonatal iron status. Based on the results, no significant relationship exists [*6*]. On the other hand, severe maternal iron deficiency has been shown to adversely affect neonatal iron status, and subsequently growth and development [*7*].

Iron-deficiency anaemia is a common problem in the Islamic Republic of Iran. Health care centres recommend regular iron supplementation during pregnancy, but this advice is often ignored. Because there are doubts regarding the relationship between maternal and neonatal iron status and the lack of data regarding maternal iron status in Jahrom, this study was carried out to evaluate overall prevalence of iron deficiency in pregnant women without medical problems, regardless of their iron supplementation and nutrition status, and to evaluate the effects on neonatal iron status.

Methods

We carried out a cross-sectional study between April and September 2003 in Mottahary Hospital (a referral hospital serving all pregnant women referred from clinics, health care centres and medical practices) of Jahrom School of Medical Sciences in Jahrom, in the southern part of the Islamic Republic of Iran. Ninety-seven pregnant women aged 17–38 years were included in the study. None of the women refused to participate. All the participants had been admitted to the labour ward after 37 weeks gestation. Exclusion criteria were having a chronic medical condition, bleeding during pregnancy, premature labour pain, high-risk pregnancy (e.g. history of repeated abortion, history of trauma and severe infection during pregnancy, severe hyperemesis, pre-eclampsia) and previous history of haemoglobinopathy.

Blood samples were obtained from mothers before delivery and cord blood was taken immediately after clamping and before delivery of the placenta. EDTA tubes were used for blood samples for haemoglobin and red blood cell indexes. For total iron binding capacity and serum iron measurement, tubes were washed with acid chloride and distilled water. Then serum was separated by centrifugation. Serum iron was measured using a spectrophotometer (Spectronic 20D, Milton Roy, Ostend, Belgium) according to the method of Hork and Sanderm [*8*]. We measured total iron binding capacity by the iron exchange resin method (Stat-Fax 2100, Awareness Technology, Palm City, Florida) and serum ferritin by an enzyme-linked immunosorbent assay. Serum ferritin was standardized according to the international standards included with the kit.

Age, parity, residence, iron supplementation and duration of prenatal care were recorded for each mother. Weight, length and head circumference of neonates were also recorded. We did not record information about the mother's weight gain during pregnancy.

The mothers were divided into 3 groups based on the pre-delivery haemoglobin (< 11 g/dL) and serum ferritin (< 12

ng/mL) levels: iron-deficient anaemic mothers, non-anaemic iron-deficient mothers, and non-anaemic non-iron-deficient mothers (normal group). Neonatal anaemia was defined based on cord haemoglobin level < 14 g/dL [*9*].

Statistical analysis was carried out using *SSPS,* version 11.5. The mean and standard deviation were calculated for each group. Duncan's and Scheffe's tests were applied and $P < 0.05$ was considered significant.

Results

Of the 97 mothers in the study, 51.5% were from urban areas and 48.5 % from rural areas. Age range was 17–38 years (mean 25.1 years). More than 92% had received routine iron supplementation from the antenatal clinic during their pregnancy. Parity ranged from 1 to 8 (mean 2.0). Table 1 gives overall data on the mothers and neonates in the study group. All pregnancies were singleton pregnancies.

On the basis of the serum ferritin and haemoglobin levels, 48 (49.5%) mothers were classified as non-anaemic non-iron-deficient, 27 (27.8%) were non-anaemic iron-deficient and 22 (22.7%) iron-deficient anaemic.

There was no significant difference between the mean ages of the 3 groups of mothers but there were significant differences in relation to parity, haemoglobin and serum ferritin levels (Table 2). Babies of iron-deficient anaemic mothers were heavier ($P = 0.006$) and had greater head circumference than the 2 other groups ($P = 0.009$). In addition, babies of iron-deficient anaemic mothers had significantly lower levels of serum ferritin, 115.3 ng/mL, compared to the non-anaemic non-iron-deficient group, 204.8 ng/mL ($P = 0.014$), but comparing babies of iron-deficient anaemic mothers with babies of non-anaemic iron-deficient mothers, the difference was not significant. Similarly, there was no significant difference comparing babies of non-anaemic iron-deficient mothers and babies of non-anaemic non-iron-deficient mothers. There was no significant difference in haemoglobin level

Table 1 **Characteristic of mothers and neonates**

Variable	Mean (SD)	Range
***Mother*s**		
Age (years)	25.1 (5.0)	17–38
Parity	2.0 (1.3)	1–8
Prenatal care (months)	4.8 (2.0)	0–8
Hb (g/dL)	13.9 (1.3)	10.1–17.2
Serum iron (µg/dL)	115.8 (53.5)	23–286
Serum ferritin (ng/mL)	30.1 (32.8)	1–330
Total iron binding capacity (µg/dL)	487.7 (121.0)	213–780
Neonates		
Head circumference (cm)	34.73 (1.3)	31–38
Weight (g)	3289 (444)	2400–4800
Height (cm)	50.04 (2.5)	44–56

SD = standard deviation.

Table 2 **Characteristics of 97 neonates and mothers in 3 groups according to maternal iron deficiency and anaemia status**

Characteristic	Maternal group			*P*-value
	IDA (*n* = 22)	NAID (*n* = 27)	NC (*n* = 48)	
Neonates				
Mean weight (g)	3517[a]	3211[a]	3254[a]	0.069
Mean height (cm)	50.1	50.2	50.1	0.009
Mean head circumference (cm)	35.6[a]	34.6[a]	34.5	0.009
Mean Hb (g/dL)	15.2	14.8	15.4	0.35
Mean serum ferritin (ng/mL)	115.3[a]	151.5	204.8[a]	0.014
Mothers				
Mean age (years)	26.0	25.4	24.9	0.73
Mean parity	2.6[a]	2.2[a]	1.7[a]	0.032
Mean Hb (g/dL)	10.2[a]	13.2[a]	13.8	< 0.01
Mean serum iron (µg/dL)	103.7	104.2	122.9	0.27
Mean serum ferritin (ng/mL)	7.8[a]	10.4	46.6[a]	0.04

IDA = iron-deficient anaemic.
NAID = non-anaemic iron-deficient.
NC = non-iron-deficient non-anaemic.
Hb = haemoglobin.
[a]***Indicates groups that differed significantly.***

between the 3 groups of neonates ($P = 0.35$).

We did not find any correlation between serum iron, total iron binding capacity or haemoglobin of mothers and haemoglobin of the neonates.

Discussion

About half the pregnant women in our study were iron deficient and 22.7% had iron-deficiency anaemia. This prevalence is high, and is at variance with reports from India and Turkey [*10–13*]. In a study in Istanbul and Izmit the prevalence of iron deficiency in pregnant women was 52.3% [*10*]. In 2 separate studies in South Africa and Israel, prevalence of anaemia in pregnant women was 3.0% and 21.6% respectively [*11*]. Shukla et al. studied 246 pregnant and non-pregnant women in 7 villages in India and showed prevalence of anaemia to be between 25% and 68% [*12*]. Molina et al. studied 88 pregnant women of lower and middle economic status and found significantly lower ferritin and Hb levels in the poorer group [*13*].

Multiparity was a factor in iron deficiency in mothers but we found no relationship with age. It has been observed that younger mothers, especially teenage mothers, are prone to iron-deficiency anaemia [*14*], but in our study mean age was similar in the 3 groups of mothers.

For evaluation of the effect of maternal iron deficiency on neonates, we considered neonatal weight, height and head circumference as growth indexes.

Scholl et al. showed that mothers with iron-deficiency anaemia had a 3 times greater risk of giving birth to infants with low birth weight [*15*]. In contrast, in a

study by Preziosi et al., no significant difference was found between birth weight and maternal iron status; there was, however, a significant difference for mean birth length [*16*]. The effect of iron deficiency in mothers on fetal growth has been reported to be especially striking in teenage mothers [*14*].

Micronutrient consumption during pregnancy has an appreciable effect on neonatal growth and development; mothers who received iron supplements have been reported to have heavier babies [*17*]. Our study showed a significant relationship between neonatal head circumference and maternal iron status; however, the relationship was borderline significant for neonatal weight. The babies of iron-deficient anaemic mothers had greater head circumference (35.6 cm versus 34.5 cm; $P = 0.006$) and were heavier (3517 g versus 3254 g; $P = 0.069$) than babies of non-anaemic non-iron-deficient mothers. Cogswell et al. showed that for mothers with severe iron deficiency, using iron supplements improved fetal growth, but maternal iron storage indexes may not change [*17*]. The majority of the mothers in our study had received iron supplementation, so iron-deficient anaemic mothers were actually even more severely deficient because they were taking iron supplements. This iron may have had an effect on their fetus and improved growth while having less effect on the maternal iron indexes. Another explanation for this observation could be that the greater amount of iron needed by larger fetuses resulted in a greater level of iron deficiency in their mothers.

Many studies, with differing results, have been done on the relationship between maternal and neonatal iron status [*18–23*]. Rios et al. did not report any significant difference in serum ferritin level in infants of iron-depleted and non-depleted mothers [*24*]. Kelly, MacDonald and McDougall observed a significantly lower ferritin level in cord serum when mothers were iron deficient [*25*]. We found a significant correlation between maternal and neonatal iron status. Babies of iron-deficient anaemic mothers had lower iron storage: ferritin was 115.3 ng/mL compared to 204.8 ng/mL in babies of non-anaemic, non-iron-deficient mothers ($P = 0.014$).

Because of the poor outcome of pregnancy in iron-deficient anaemic mothers and the resultant high cost burden on health care services [*26–28*], and taking into consideration the high prevalence of iron deficiency in pregnant women in our area, more emphasis is needed on the benefits of regular iron supplementation during pregnancy and improving supervision of the consumption of the supplements.

In 1993, the Institute of Medicine, Food and Nutrition recommended that maternal iron prescription must be based on iron status evaluation, including serum iron, total iron binding capacity, serum ferritin and haemoglobin, and supplements would only be prescribed to iron-deficient pregnant women [*29*]. This approach is expensive and not available in many health care centres. The best way to reduce iron deficiency in pregnant women in our country would be regular iron supplementation during pregnancy and between pregnancies in high parity women. We did, however, find that even though, according to the data on the questionnaires and clinical data from antenatal care files, 92% of the mothers we studied were being given iron supplements, 23% were anaemic and 29% were iron deficient. It needs to be established whether mothers prescribed iron supplements are actually taking them, and if not, why not.

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Is stored expressed breast milk an alternative for working Egyptian mothers?

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هل يعد لبن الثدي المَحْلوب والمخزون بديلاً لدى الأمهات المصريات العاملات؟

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الخلاصة: يُعد حَلْبُ (عصر) لبن الثدي وتخزينه أحد طرق المداومة على الرضاعة من الثدي، عندما تضطر الأمهات للافتراق عن ولدانهن، شريطة المحافظة على القيمة التغذوية. وقد جُمعت ثلاثة نماذج من لبن الثدي المعصور من 61 من الأمهات اللواتي يتمتعن بصحة جيدة في القاهرة، مصر، للتعرُّف على إجمالي كميات البروتينات والدهون واللاكتوز والزنك فيها، إلى جانب تركيز كل من الفيتامينات A وC وE. وقد أجري التحليل لأحد النماذج فور الحصول عليه وقبل تخزينه، ولنموذج آخر بعد ساعة من تخزينه لمدة 24 ساعة في الثلاجة بدرجة حرارة 4 سيلزيوس ثم بعد تخزينه لمدة أسبوع في مجمدة منزلية بدرجة حرارة تتراوح بين –4 و–8 سيلزيوس. وقد اتضح أن تخزين اللبن في الثلاجة وفي المجمدة يؤدي إلى تناقص واضح في مستويات الفيتامينات A وC وE، فيما بقيت قِيَم بقية المغذيات ضمن القِيَم المرجعية الدولية للبن الثدي الناضج.

ABSTRACT Expression and storage of breast milk is way to maintain breastfeeding when mother and infant are separated, if the nutritional value can be conserved. Three expressed breast milk samples were collected from 61 healthy lactating mothers in Cairo, Egypt, for determination of total protein, fat, lactose and zinc content, as well as vitamins C, A and E concentrations. One sample was analysed immediately without storage, 1 after storage for 24 hours in a refrigerator (4 °C) and 1 after storage for 1 week in a home freezer (–4 °C to –8 °C). Refrigeration and freezing of breast milk caused a statistically significant decline in levels of vitamins C, A and E. Nevertheless, the values of all nutrients were still within the international reference ranges for mature breast milk.

Le lait maternel extrait et conservé constitue-t-il une alternative pour la mère égyptienne qui travaille ?

RÉSUMÉ L'extraction et la conservation du lait maternel constituent une manière de poursuivre l'allaitement au sein lorsque la mère et l'enfant sont séparés, si la valeur nutritive peut être préservée. Trois échantillons de lait maternel extrait ont été recueillis chez 61 mères allaitantes en bonne santé au Caire (Égypte) pour déterminer la teneur en protéines totales, en graisses, en lactose et en zinc ainsi que les concentrations en vitamines A, C et E. Un échantillon a été analysé immédiatement sans conservation, un autre a été analysé après conservation pendant 24 heures au réfrigérateur (4 °C) et un troisième après conservation pendant une semaine dans un congélateur familial (- 4 °C à - 8 °C). La réfrigération et la congélation du lait maternel ont entraîné une réduction statistiquement significative de la concentration en vitamine A, C et E. Toutefois, les valeurs de tous les nutriments étaient toujours comprises dans la fourchette de référence internationale pour le lait maternel mûr.

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Introduction

Researchers, especially in recent years, have documented diverse and compelling advantages to infants, mothers, families and society from breastfeeding. They established that human milk is uniquely superior for infant feeding and is species specific, in addition to its unique immunological, growth and developmental benefits. They also suggested that benefits attributable to breastfeeding may persist past infancy [*1*].

When it is not possible to breastfeed an infant in the postnatal period, expressed breast milk, fresh or frozen, may provide both nutritional and immunological benefits, if its nutritional value can be conserved. In such a way, it can be fed to babies separated from the mother for 8 hours or more due to hospitalization or maternal employment [*2,3*].

The aim of this study in Egypt was to investigate the effect of storage of breast milk on some of its chemical constituents: total protein, total fat, lactose, zinc and vitamins C, A and E concentrations.

Methods

This study was carried out in Abu El-Reesh hospital outpatient clinics and Qasr El-Aini neonatal intensive care unit follow-up clinic at Cairo University. Sample collection took place from February to April 2003 at an average maximum outside temperature range of 25–30 °C.

Sample

This study was carried out on 61 healthy lactating mothers who had delivered by vaginal delivery or caesarean section. Their ages ranged between 17 and 40 years, their parity between 1 and 9 and their babies' ages between 2 weeks and 1 year. All mothers were of low or intermediate socioeconomic groups. Exclusion criteria included the presence of any significant maternal disease, malnutrition or the use of any medication during lactation. Informed consent was taken from all mothers participating in the study.

Sample collection and transportation

Each mother was instructed to wash her hands carefully with soap and water before collecting the milk sample and to express some of her breast milk manually or by bicycle horn pump into 3 labelled sterile hard plastic containers (10 mL in each). The 3 containers were tightly closed immediately after expression. The samples were transported in an ice chest to the laboratory within 20–25 minutes.

One sample was analysed immediately as the baseline control. The second sample was stored in the first shelf of the refrigerator at 4–6 °C for 24 hours before analysis, and the third sample was stored in the freezer at –4 to –8 °C for 1 week before analysis.

Biochemical methods of milk analysis

Milk lactose level was determined using phenol reagent and sulfuric acid [*4,5*]. Determination of lipids was performed by acid hydrolysis, while proteins were determined as nitrogen content of the milk sample, then multiplied by a specific factor to obtain the protein content [*4,5*].

Determination of zinc (trace element) in milk was done by the atomic absorption spectrophotometer technique [*4,5*]. Determination of fat-soluble vitamins A and E was performed by high performance liquid chromatographic separation [*4,5*].

Data analysis

SPSS, version 9.0, was used to perform the statistical analysis. The values of breast milk nutrients at baseline were compared with reference values [*6*] using Student *t*-test. Paired *t*-test was used to compare between the means of baseline milk composition and after 24 hours of milk storage in the first shelf of the refrigerator, and between the means of baseline milk composition and after 1 week of freezing. *P* values ≤ 0.05 were regarded as statistically significant.

Results

Table 1 shows the baseline values of breast milk nutrients compared with the range of international reference values. The mean values of macronutrients, vitamins and zinc studied in the women's breast milk samples, as well as the minimum and maximum values for the group, were within the international reference range.

Table 2 shows the effect of storage of breast milk samples for 24 hours in the refrigerator (4–6 °C), where vitamins C and A showed a statistically significant decrease ($P < 0.05$). Table 2 also shows the effect of storage for 1 week in the freezer (–4 to –8 °C), where vitamins C, A and E showed a statistically significant decrease ($P < 0.05$). Small reductions in the fat, protein and lactose content of breast milk were measured after refrigeration for 24 hours as well as after freezing for 1 week but these were not statistically significant. All values after storage were still within the international reference ranges [*6*].

Discussion

In this study, baseline measurements showed that the mean fat, protein and lactose content and the mean vitamin C, A and E and zinc concentrations in expressed breast milk, as well as the overall ranges, were within the international reference

Table 1 **Baseline nutrient values for expressed breast milk of 61 mothers compared with the international reference range of milk nutrient values**

Nutrients	Baseline		Reference range [*6*]
	Mean (SD)	Range	
Macronutrients (g/L)			
Fat	35.98 (3.97)	30–49	13.4–82.9
Protein	10.55 (0.63)	9.6–12	7.3–20
Lactose	57.59 (7.29)	46–75	49–95
Vitamins (mg/L)			
Vitamin C	47.30 (9.64)	32–72	0–112
Vitamin A	0.27 (0.00)	0.2–0.46	0.15–2.26
Vitamin E	1.39 (0.10)	1.23–1.53	1.0–4.8
Trace elements (mg/L)			
Zinc	1.145 (0.145)	0.8–1.4	0.17–3.02

SD = standard deviation.

Table 2 **Mean nutrient values for expressed breast milk at baseline and after 24 hours storage in a refrigerator (4–6 °C) and after 1 week storage in a freezer (–4 to 8 °C)**

Nutrients	Baseline	Refrigerator storage (24 hours)		Freezer storage (1 week)	
	Mean (SD)	Mean (SD)	% decrease	Mean (SD)	% decrease
Macronutrients (g/L)					
Fat	35.98 (3.97)	35.84 (3.97)	0.4	35.55 (4.04)	1.2
Protein	10.55 (0.63)	10.12 (0.82)	4.1	9.4 (0.80)	10.9
Lactose	57.59 (7.29)	57.55 (7.28)	0.1	57.30 (7.43)	0.5
Vitamins (mg/L)					
Vitamin C	47.30 (9.64)	30.24 (13.74)	36.1*	20.39 (10.99)	56.9*
Vitamin A	0.27 (0.00)	0.20 (0.00)	25.9*	0.14 (0.00)	48.1*
Vitamin E	1.39 (0.10)	1.30 (0.11)	6.5	0.99 (0.00)	28.8*
Trace elements (mg/L)					
Zinc	1.145 (0.145)	1.143 (0.143)	0.2	1.134 (0.150)	0.96

P < 0.05.
SD = standard deviation.

ranges for nutrient concentrations of mature breast milk [*6*]. The wide variation in the composition of mature breast milk (observed in the wide ranges of the international reference values as well as in our results) can be attributed to several reasons. Factors which are known to influence the concentrations of different mature breast milk constituents in predictable ways include stage of lactation, breastfeeding routine, parity, maternal age, maternal diet and other maternal characteristics, as well as regional differences and in some situations, seasons of the year [*7*].

In our work, mature breast milk was taken from nursing mothers, whose infant's age ranged from 15 days up to 360 days. Other studies showed that mature breast milk composition also changes during the course of lactation, although not as markedly as in the early weeks. Many important ingredients of breast milk, such as lactose, zinc, sodium and lysozyme, show a gradual decrease in concentration of about 10%–30% during the first year of lactation [*8*]. Moreover, mature breast milk may vary during the day and from the beginning to the end of a feeding session. This is most pronounced for fat and fat-soluble components, such as vitamin A, E and zinc [*9*]. Moreover, Wagner documented that breast milk at the start of feeding (fore milk) has a lower fat content, and as the infant continues to breastfeed over the next several minutes, the fat content increases (hind milk), which is thought to facilitate satiety in the infant [*10*]. He also reported that diurnal variations in breast milk exist, which reflect maternal diet and daily hormonal fluctuations. These variations can be seen in most of the constituents in breast milk, mainly fat and proteins.

The parity of the lactating mothers in our work varied from 1 to 9, and their ages varied from 17 to 43 years. Maternal parity and maternal age could be others explanations for the wide variations in mature breast milk composition, as shown by

many studies [*8,11*]. It was noticed that African young primiparous mothers have higher concentration of several breast milk constituents, especially fat, protein and immunoproteins, whereas older mothers of very high parity (9 or more) tend to produce milk with reduced quality [*11*].

Even if all these various influences were taken into consideration, breast milk volume and composition would still vary considerably from one mother to another in the same population. Generally, between-mother differences in milk volume and composition are maintained throughout lactation and are usually not related to each other [*8,11*].

Our study revealed a small, statistically non-significant decline in the fat content of breast milk after refrigeration at 4–6 °C for 24 hours as well as after freezing at –4 to –8 °C for 1 week. This decline was by 0.4% and 1.19% respectively. Our results tend to agree with Pardou et al. [*12*], who observed a non-significant decrease in total lipid content after refrigeration at 4–6 °C as well as after freezing at –20 °C for 8 days, which could be due to lipolysis occurring during storage. They reported that this decrease did not exceed 2.0%–6.7% from the initial values of fat in breast milk samples, which was not very important from the nutritional point of view.

Similarly, Silprasert et al. reported that the fat content of human milk (the creamatocrit) tended to remain stable when the milk was refrigerated at 4 °C for up to 14 days [*13*]. Moreover, our results match with those of Friend et al., who initiated a study to evaluate the effects of freezer storage at –25°C on lipid components of mature human milk [*14*]. They reported that quick freezing and frozen storage tended to increase lipase activity, although these increases were not significant. Similarly, the lipid content, fatty acid levels and the relative percentage of each fatty acid were not significantly different in the frozen milk samples as compared with their levels before storage.

Our study revealed a statistically non-significant decrease in protein content of breast milk, after refrigeration for 24 hours as well as after freezing for 1 week. This decline was by 4.1% and 10.9% respectively. Our results tend to disagree with Garza et al., who found that there was a significant effect of storage temperature (4 °C) on the protein nitrogen concentration, especially when the duration of storage was prolonged for 48 hours [*15*]. The difference in the results could be attributed to their longer duration of storage.

Moreover, this study revealed a very small, non-significant decline in lactose content of breast milk after refrigeration for 24 hours or after 1 week of freezing (decreased by 0.07% and 0.5% respectively). Our results match with those of Pardou et al., which showed that there was no significant decline over time (up to 8 days) in lactose content of refrigerated milk samples at 0–4 °C or after freezing at –20 °C [*12*]. They explained that this could be related to the absence of lactose-fermenting bacteria in the carefully collected breast milk samples.

In our study, there was a statistically significant decline in the studied vitamins (C and A) in breast milk after refrigeration for 24 hours and in vitamins C, A and E after freezing for 1 week. This decline was 36% and 56.9% respectively for vitamin C, 25.9% and 48.1% for vitamin A and 28.8% for vitamin E (after freezing). Our results regarding vitamin C are in agreement with Garza et al. [*15*]. In their study, human milk samples were stored at 4 °C and were analysed after 4, 24 and 48 hours storage. The researchers discovered a significant effect of storage duration and temperature

on vitamin C concentrations. They reported that refrigeration at 4 °C resulted in a significant decline in vitamin C content in milk and that this decline was exaggerated with prolonged duration. However, they revealed that milk refrigeration at 4 °C for 24 hours maintained vitamin C levels at 60% of values observed before refrigeration. Moreover, our results also agree with Buss et al., who found that after 24 hours refrigeration at 4–6 °C, mean vitamin C concentration decreased to 65% of the pre-storage values [*16*]. However, the range of vitamin C losses varied widely, from 6%–76%. They reported that initially 91% of total vitamin C was in the ascorbic acid form. After storage the proportion of ascorbic acid decreased, but this also varied widely for different milk samples. Buss et al. have also studied the effect of storage of expressed breast milk for 1 week, 1 month and 2 months in a freezer (–16 °C) on total vitamin C concentration [*16*]. They found that after 1 week of freezing, total vitamin C concentration decreased to 92% of the initial concentration (the range of losses was 83%–100%), whereas after 1 month of freezing total vitamin C concentration decreased to 63% (range 0%–97%) and 2 months of freezing decreased it to 38% of initial concentration (range 0%–83%). The authors verified that the mechanism of vitamin C loss after storage is partly due to lactoperoxidase activity. They explained that the decline in vitamin C levels could be due to oxidation of ascorbic acid during storage. Therefore, based on the wide and unpredictable variations in vitamin C losses in stored breast milk samples, it was recommended that the storage duration should be as short as possible and if long-term stored milk was to be given, vitamin C supplementation should be considered [*16*].

As for the other vitamins measured, our results tend to disagree with Garza et al. who reported that there was no significant change in vitamin A concentration of breast milk after 4 and 24 hours of refrigeration at 4 °C [*15*]. Our results match better with those of Moffat et al., who reported a non-significant effect of storage of pooled human milk on vitamin E concentrations (mainly α- and γ-tocopherols) when pooled milk samples were stored for 24 hours at 4 °C [*17*].

Our study revealed a non-significant change in zinc content in expressed breast milk after refrigeration for 24 hours or after freezing for 1 week. Similarly Garza et al. determined the effect of storage of breast milk on its zinc content [*15*]. Milk samples were stored in a refrigerator at 4 °C or stored after pasteurization and freezing for 4 hours and 24 hours, with no significant change in zinc content. However, they noticed that pasteurization followed by freezing of human milk caused a significant shift in the relative distribution of zinc in fat, whey and casein fractions, with a decrease in the whey fraction of zinc and an increase in its fat fraction. They concluded that this redistribution and alteration in zinc-binding pattern during pasteurization and freezing storage of human milk might reduce its bioavailability to the infant [*15*].

To conclude, our study has shown that storage of expressed breast milk caused a decline in vitamins A and C concentrations after 24 hours in a refrigerator (4 °C) and a decline in vitamins A, E and C after 1 week in a freezer (–4 to –8 °C). However, the mean values as well as the range of values after storage were still within the international reference ranges. Total protein, fat and lactose content as well as the zinc content of expressed breast milk were not affected by storage. Therefore, it can be concluded that it could be nutritionally safe to supply expressed human milk that has

been stored for 24 hours in refrigerator and up to 1 week in freezer. Further studies are needed to understand the effect of different temperatures and durations of storage on different constituents of expressed breast milk.

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Nutritional assessment of lactating women in Shiraz in relation to recommended dietary allowances

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التقييم التغذوي للأمهات المرضعات في شيراز وعلاقته بالمخصصات الغذائية الموصى بها

سيد محمد تقي آية اللهي

الخلاصة: أعدت جداول حول تواتُر تناوُل الأغذية والدَّخْل من المغذِّيات في عينة عشوائية تضم 266 من الأمهات المرضعات من مناطق مختلفة من مدينة شيراز، جمهورية إيران الإسلامية. وأجريت مقابلات لهؤلاء المرضعات في المنازل عام 1998، تم خلالها حساب الدَّخْل من المغذيات باستخدام استبيان حول تناوُل الطعام، وتذكُّر ما تم تناوله منه خلال الساعات الأربعة والعشرين المنصرمة. وقد اتضح أن المستهلك من الطعام يومياً بشكل وسطي حصَّتان من مشتقَّات الألبان، وأربع حصص من الخبز أو الرز، وحصتان من الخضروات وحصتان من الفواكه، أما المستهلك من الطعام أسبوعياً فقد كان خمس حصص من اللحم وثلاث حصص من الخضروات. فيما بلغ الوسطي التقديري من دَخْل الطاقة يومياً 2250 كيلو كالوري. وكان دَخْل البروتين والفيتامين C أعلى بشكل واضح من المخصصات الغذائية الموصى بها في الولايات المتحدة الأمريكية، في حين كان دَخْل الحديد والكالسيوم أخفض بشكل واضح من تلك المخصصات. ولم يكن دَخْل البروتين كافياً في 9٪ من النساء، ولا الكالسيوم كافياً في 35.7٪ منهن، ولم يكن دَخْل الحديد كافياً في 18.8٪ منهن ولم يكن دَخْل الفيتامين C كافياً في 15.0٪ منهن.

ABSTRACT Tables of food frequency and nutrient intake were created for a random sample of 266 lactating women from different areas of Shiraz city, Islamic Republic of Iran. Women were interviewed at home in 1998 and nutrient intake was calculated from a food frequency questionnaire and 24-hour dietary recall. On average, daily consumption was 2 servings of dairy foods, 4 of bread/rice, 2 of vegetables and 3 of fruits; weekly consumption was 5 servings of meat and 3 of legumes. Estimated average daily energy intake was 2250 kcal. Protein and vitamin C intake were significantly higher than United States recommended dietary allowances (RDA), while iron and calcium intake were significantly lower. Protein intake was insufficient among 9.0% of women, calcium in 35.7%, iron in 18.8% and vitamin C in 15.0%.

L'évaluation nutritionnelle des femmes allaitantes à Chiraz par rapport aux apports alimentaires recommandés

RÉSUMÉ Des tableaux concernant la fréquence de consommation alimentaire et les apports en nutriments ont été établis pour un échantillon aléatoire de 266 femmes allaitantes issues de différents quartiers de la ville de Chiraz (République islamique d'Iran). Ces femmes ont été interrogées à domicile en 1998 et l'apport en nutriments a été calculé à partir d'un questionnaire de fréquence de consommation et du rappel des 24 heures. En moyenne, la consommation quotidienne comprenait deux portions de produits laitiers, quatre portions de pain/riz, deux portions de légumes et trois de fruits ; la consommation hebdomadaire était de cinq portions de viande et de trois portions de légumes. L'apport énergétique quotidien moyen estimé s'élevait à 2250 kcal. L'apport en vitamine C et en protéines était significativement plus élevé que les apports alimentaires recommandés aux États-Unis d'Amérique tandis que l'apport en calcium et en fer était significativement inférieur. L'apport était insuffisant chez 9,0 % des femmes pour les protéines, chez 35,7 % des femmes pour le calcium, chez 18,8 % des femmes pour le fer et chez 15,0 % des femmes pour la vitamine C.

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Introduction

Current guidelines published by national advisory bodies for nutrient intakes during lactation differ around the world, even between neighbouring countries with essentially similar populations [*1*], reflecting the inadequacy of knowledge about nutrient requirements in human reproduction. Lactation places nutritional demands on the mother for milk production [*2–4*]. An examination of studies on nutritional assessment indicates the importance of recording food habits and nutrient intakes in pregnant and lactating women and their effects on mothers and children. Nutritional status relates to and varies with socioeconomic, cultural and demographic factors [*5–10*]. However, nutrient intakes are generally compared with the United States (US) National Academy of Sciences recommended dietary allowance (RDA) [*11*].

Knowledge about the nutritional status of lactating women in the Islamic Republic of Iran is minimal and inadequate. Only one clinic-based study [*12*] has been carried out in 1978 on a group of 88 urban pregnant women of different socioeconomic status in Tehran, the capital of the country, comparing their nutrient intakes with US RDAs. The energy intake of women of middle socioeconomic status was within the safety margin of RDA (2200 kcal) but for women of low socioeconomic status (1880 kcal) it was significantly lower than RDA. Vitamin C intake was adequate in both groups but calcium intake was below RDA in both groups, especially the disadvantaged women.

At present, there is no data on dietary intakes available for lactating mothers in the Islamic Republic of Iran. Therefore, this study aimed to provide a baseline food frequency table and assess the intakes of essential nutrients of a representative random sample of healthy lactating mothers in Shiraz, one of the five principal cities in the country and the most developed city in the south.

Methods

A 2% random sample of 266 lactating mothers was selected in 1998. Subjects were selected from different geographical areas of Shiraz city, using a probability proportional to size sampling method.

The women were visited at home and given a face-to-face interview by a trained member of the research team. A structured food frequency questionnaire and a 24-hour dietary recall questionnaire were used to record the types, amounts and frequencies of foods consumed.

The food frequency intake for different types of food was defined by the author as:

$$\sum_{i=1}^{k} k_i n_i \,/ \sum_{i=1}^{k} n_i$$

where k_i was the midpoint of number of servings in category k, and n_i the number of lactating women who had k_i servings of food daily or weekly, whichever applied.

This index presents the average food consumption of mothers for whom calorie intake was calculated properly. Applying this procedure, food frequency tables were drawn up for various kinds of foods on a daily or weekly basis, as appropriate.

The weights of foods consumed were calculated from the recall data. In the case of complex dishes, quantities of ingredients were calculated from standard recipes. From this data, the daily intake of 4 essential nutrients (protein, iron, calcium and vitamin C) was estimated. These values were compared with the US RDAs [*3*] using *SAS* software, version 8.02, and *t*-tests and sign tests where appropriate.

Results

Table 1 presents the food frequency intake of food items on a daily basis. Lactating women consumed on average 1.9 servings of dairy products, 3.2 servings of bread or rice, 1.8 servings of vegetables and 1.7 servings of fruits daily. Food frequency intake for foods consumed weekly are shown in Table 2. The women on average had 4.9 servings of meat, 3.0 servings of eggs and 2.8 servings of legumes or cereals on a weekly basis.

Table 3 presents the daily nutrient intake of the lactating mothers and the relevant summary statistics. Daily mean (SD) intakes were estimated as 78 (14) g protein, 13 (4) mg iron, 1054 (282) mg calcium and 156 (57) mg vitamin C respectively. Protein and vitamin C intakes were on average significantly higher than the RDA (120% and 164% of RDA respectively). However, iron and calcium consumption were significantly lower than the RDA (87% and 88% of RDA respectively).

The distribution of daily nutrient intake of lactating mothers by categories of sufficiency in relation the RDA is shown in Table 4. Nutrient intakes were insufficient

Table 1 **Daily food frequency intake of 266 lactating women in Shiraz**

Food (serving)	Daily servings						Average no. of servings/ woman
	< 1		1–2		3–4		
	No. of women	%	No. of women	%	No. of women	%	
Milk (240 mL)	148	55.6	117	44.0	1	0.4	0.9
Yoghurt (100 g)	121	45.5	145	54.5	0	0.0	1.0
Bread (100 g)	1	0.4	229	86.1	36	13.5	1.8
Rice (100 g)	27	10.2	235	88.3	4	1.5	1.4
Vegetables (100 g)	40	15.0	154	57.9	72	27.1	1.8
Citrus fruits (× 1)	41	15.4	192	72.2	33	12.4	1.6
Non-citrus fruits (× 1)	112	42.1	151	56.8	3	1.1	1.1

Table 2 **Weekly food frequency intake of 266 lactating women in Shiraz**

Food (serving)	Weekly servings								Average no. of servings/ woman
	< 2		2–3		4–6		> 6		
	No. of women	%	No. of women	%	No. of women	%	No. of women	%	
Meat (90 g)	8	3.0	73	27.4	107	40.2	78	29.3	4.9
Legumes (120 g cooked)	57	21.4	186	69.9	18	6.8	5	1.9	2.8
Eggs (× 1)	43	16.2	161	60.5	49	18.4	13	4.9	3.0
Cheese (30 g)	49	18.4	135	50.8	61	22.9	21	7.9	3.1

Table 3 **Summary statistics of daily nutrient intake in 266 Shiraz lactating women and their significance as compared with the recommended dietary allowance (RDA)**

Nutrient	RDA[a]	Daily intake of nutrient			*P*-value
		Mean (SD)	95% CI	% RDA	
Protein (g)	65	78 (14)	77– 80	120	< 0.001
Iron (mg)	15	13 (4)	12–13	87	< 0.001
Calcium (mg)	1200	1054 (282)	1020–1088	88	< 0.001
Vitamin C (mg)	95	156 (57)	149–163	164	< 0.001

Source: [13]

among 9.0% of lactating mothers for protein, 35.7% for calcium, 18.8% for iron and 15.0% for vitamin C, compared with the RDA reference data.

The mean calorie intake of this group of lactating mothers was estimated to be 2250 kcal per day (range 1500 to 2900 kcal).

Discussion

Food frequency tables for lactating women of Shiraz are presented in this paper for the first time to form a baseline for further studies. The women consumed on average 2 servings of dairy products, 3 servings of bread or rice, 2 servings of vegetables and 3 servings of fruits daily. The subjects had 5 servings of meat and 3 servings of legumes or cereals weekly. The calorie intake of lactating mothers was estimated to be 2250 kcal per day, which is lower than the RDA (2700 kcal, i.e. 83% of RDA) but in the range of some other studies [*5,10*].

This study assessed 4 of the most important nutrients for lactating mothers that play a role in milk production (protein, iron, calcium and vitamin C) [*14–16*]. A comparison of our results with a study in 1978 shows that, compared with the middle-class women of Tehran, lactating mothers in Shiraz consumed more calcium and vitamin C, less iron and similar amounts of protein and calories (ratio of 0.95 protein, 1.34 calcium, 1.95 vitamin C, 0.71 iron and 0.90 calories) [*12*]. Changing food habits and lifestyle over the 25-year period could be a reason, especially for the high vitamin C consumption among the lactating moth-

Table 4 **Distribution of daily nutrient intake in relation to recommended dietary allowance (RDA) in 266 lactating women in Shiraz**

Nutrient	RDA category	No. of women	%
Protein **(*g*)**			
< 60	Insufficient	24	9.0
60–64	Satisfactory	20	7.5
65+	Sufficient	222	83.5
Calcium **(*mg*)**			
< 1000	Insufficient	95	35.7
1000–1199	Satisfactory	76	28.6
1200+	Sufficient	95	35.7
Iron **(*mg*)**			
< 10	Insufficient	50	18.8
10–14	Satisfactory	149	56.0
15+	Sufficient	67	25.2
Vitamin C **(*mg*)**			
< 90	Insufficient	40	15.0
90–119	Satisfactory	24	9.0
120+	Sufficient	202	75.9

ers of Shiraz who are in the habit of eating their food with citrus fruit juices and vinegar.

At 1054 mg/day, the mean calcium intake of our lactating women is within the safety margin of values from Northern Europe and North America. Intakes of 200–500 mg calcium/day are typical in African and Asian societies where the consumption of animal milks is low [*17*], while the average consumption of calcium in Northern Europe, North America and Australia is in excess of 1000 mg/day [*18*]. The protein intake of our subjects was within the range of other studies [*5–9*].

The US RDAs are designed to meet the needs of the majority of the population and include a safety margin of 30% of average requirements [*10*]. Direct analysis of dietary components indicated that on average lactating mothers were consuming more than sufficient amounts of protein, with a mean of 120% of the RDA. The iron and calcium intakes of this study, although only 87% and 88% of the RDA respectively, were also within this safety margin. However, mothers were consuming vitamin C beyond the safety margin of 30% with a mean of 164% of RDA. This is because women in Shiraz traditionally consume citrus fruits with their dishes, as the city is located in a region of citrus fruit production.

The food frequency questionnaire method designed for this study has proved to be flexible and feasible in that it can be used for short-term or long-term dietary recall, and for estimating partial or complete diets, and was administered by an expert interviewer, taking cultural as well as traditional and environmental aspects of nutrition into account. However, to make a more comprehensive study, we suggest using samples from different provinces of the Islamic Republic of Iran in a population-based study using food record methods, which are a more accurate method of assessing dietary intake [*19–21*]. The tables provided here may serve as a baseline until further studies are carried out.

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An intervention programme for improving the nutritional status of children aged 2–5 years in Alexandria

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برنامج تدخُّلي لتحسين الحالة التغذوية للأطفال البالغين من العمر 2–5 أعوام بالإسكندرية

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الخلاصة: قمنا بتقييم مداخلة منتقاة لتحسين الحالة التغذوية للأطفال البالغين من العمر 2–5 أعوام بمراكز الرعاية النهارية. وباستخدام التصميم الطولاني التدخلي الاستباقي للاختبار القَبْلِيِّ والاختبار البَعْدِيِّ، تـمَّت متابعة 974 طفلاً من 3 مراكز لمدة عام. وجُمعت بيانات القياسات البشرية وبيانات الملفات اليومية المسجَّلة خلال 3 أيام، وكان هذا الجمع انطلاقاً من خط قاعدي، وتم حساب الدخل من القوت ومقارنته بالمخصَّص اليومي المُوصَى به. وقد نُفذ هذا البرنامج التدخلي من خلال إنشاء مطابخ في هذه المراكز الثلاثة، وتقديم وجبتين يومياً مع تقديم التثقيف التغذوي للوالدين وتدريب المشرفين. وكشفت بيانات الخط القاعدي عن انخفاض مدخول معظم المُغذيات وخصوصاً الكالسيوم والسعرات والفيتامين والحديد. وكَشَفَ الاختبار التالي للمُداخلة عن تحسن المعرفة التغذوية عند الأمهات، كما انخفضت نسبة الأطفال المصابين بفقر الدم من 47.3٪ إلى 14.2٪، وكذلك لُوحِظ انخفاض نسبة الأطفال المصابين بنقص الوزن، وتـمَّتْ متابعة الأطفال المصابين بالتقزُّم والهزال أيضاً أثناء هذا البرنامج. وقد بلغت تكلفة البرنامج لكل طفل في العام 20.5 دولار.

ABSTRACT We assessed the effect of a selected intervention on the nutritional status of 2–5-year-old children in day care centres. Using a longitudinal prospective pretest/post-test intervention design, 974 children from 3 day care centres in Alexandria were followed for 1 year. Anthropometric measurements and 3-day 24-hour recall data were gathered at base line and dietary intake was calculated and compared with recommended daily allowances. An intervention programme was implemented through the establishment of kitchens in the 3 centres, provision of 2 meals/day, nutrition education for parents and training of supervisors. Baseline data revealed deficient intake of most nutrients especially calcium, calories, vitamin C and iron. Post-intervention test revealed improvement in mothers' nutrition knowledge and the percentage of anaemic children decreased from 47.3% to 14.2%. A decrease in the percentage of underweight, stunted and wasted was also observed. The cost of the programme per child per year was US$ 20.5.

Programme d'intervention pour améliorer l'état nutritionnel des enfants âgés de 2 à 5 ans à Alexandrie

RÉSUMÉ Nous avons évalué l'effet d'une intervention sélectionnée sur l'état nutritionnel des enfants âgés de 2 à 5 ans dans des garderies. En utilisant un modèle d'intervention prospectif longitudinal pré-test/post-test, 974 enfants de trois garderies à Alexandrie ont été suivis pendant un an. Des mesures anthropométriques ont été prises et des données du rappel des 24 heures sur trois jours ont été recueillies au début de l'intervention ; l'apport alimentaire a été calculé et comparé avec les apports journaliers recommandés. Un programme d'intervention a été exécuté avec la mise en place de cuisines dans les trois garderies, la fourniture de deux repas par jour, l'éducation nutritionnelle pour les parents et la formation du personnel d'encadrement. Les données initiales ont révélé un apport insuffisant pour les plupart des nutriments, notamment le calcium, les calories, les vitamines et le fer. Le test post-intervention a montré une amélioration des connaissances des mères en matière de nutrition, et le pourcentage d'enfants anémiques a chuté de 47,3 % à 14,2 %. Une diminution de la proportion d'enfants présentant une insuffisance pondérale, ayant un retard de croissance et émaciés a également été observée. Le coût du programme par enfant et par année s'élevait à USD 20,5.

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Introduction

In Egypt, the health status of the population has improved rapidly due to improvements in health services and in the economic achievement thus improving the quality of life both in urban and rural areas [*1*]. However, it has been reported that about 50% of preschool children in urban areas of Alexandria were anaemic, 5% were stunted, 2.4% were wasted and 15% were obese [*2,3*]. Studies in rural and squatter areas reported up to 20% stunting, 11% wasting and 4% obese [*4,5*].

The changing eating habits due to introduction of fast foods and snacks and the affluent lifestyle have provided a wide variety of foods for children and mothers. Moreover, nowadays it is more difficult to remain aware of the nutritional values of food because of prepackaging, vending machines and fast-food restaurants. Increasingly frequently you find, "formulated", non-nutritious food replacing wholesome foods in the diet, especially children's foods and snacks. Parents also wrongfully teach their children by using rewards to encourage them to eat. Remarks such as "eat your meat and after that you can have your chocolate" encourage children to want to eat more sweet and sugary foods. Furthermore, the increasing habit of the eating out aggravates the problem of unhealthy eating and unbalanced diets [*6*].

Health-care professionals believe that lifelong eating habits and risk factors for chronic disease begin in early childhood [*6*]. Nutrition interventions targeted at children include diet therapy, counselling or use of specialized nutrition supplements, and nutrition monitoring and evaluation [*6–8*]. *The dietary guidelines*, which recommend food choices to promote health and decrease the risk of chronic disease for people 2 years of age and older, include 8 items that apply to children as well as adults [*9*]. Several recent large-scale studies have noted declines in fat intake among preschool and primary-school children and adolescents, but currently reported fat intake—33% to 35% of total daily calories—still exceeds, by 3 to 4 percentage points, the recommended dietary allowances (RDAs) [*10,11*]. The average diet of children and adolescents includes too much fat, saturated fat, and sodium and too few servings of fruits, vegetables and calcium [*11,12*]. National surveys indicate that overweight among children is a growing problem and that children from lower income families are at greater risk of obesity, increased serum lipid levels and food intakes that fail to meet the RDAs than are children of higher socioeconomic status [*10,12*].

The principal objectives of the present study were: to assess the feasibility of providing nutrition intervention to 2–5-year-old children in day care centre settings; to help mothers develop important concepts, attitudes and behaviour toward food and to be able to make wise choices about their children's food; and to evaluate the effect of a selected intervention on the nutritional status of children.

Methods

A longitudinal prospective pretest/post-test intervention design was used where the study population was composed of all children aged 2–5 years, from 3 day care centres run by Al Moasat Organization located in 3 areas of Alexandria (Anfushy, Smouha and Boulkly) representing different socioeconomic levels.

Sampling

All children enrolled in the 3 day care centres and aged 2–5 years at the time of the study (October 2000 to September 2001)

were included in the study (974 children). All mothers were invited to participate and their consent was obtained. Of these, 935 mothers submitted a complete questionnaire with 24-hour recall over 3 days. Stool samples were taken for all children. After 1 year, 563 children (60.2%) remained for final nutritional assessment. The 40% not included were because the child had gone to school, or was absent because of mother's vacation, or the child's data were incomplete and he/she was therefore excluded from the final analysis. A subsample of children was systematically selected in proportion to the number of children in each centre for blood and stool sampling; special consent was obtained from the parents. The estimated minimum required subsample using *Epi-Info* was 280 children. These were chosen in a systematic manner from the 3 day care centres. Of these, 214 (76.4%) consented to blood sampling and had a negative stool analysis. Any children with positive stool sample were referred to a physician and were excluded from the analysis but not from the intervention. After 1 year 66 children were lost to follow up (30.8% attrition) leaving 148 children (69.2%) for final blood sampling. No significant difference was found between respondents and non-respondents in sociodemographic characteristics whether in blood sample or for anthropometry.

Data collection

Mothers were interviewed by trained supervisors in the nursery about sociodemographic characteristics of mother and child. After the interview they were asked to record at home the 24-hour recall of all food and drinks intake of their children over 3 days including a week-end. Food quantities were expressed by the mothers in common household measures (spoons, cups, etc.) and converted to weights in grams. The recall responses were transformed to the average nutrient intake per day using food composition tables of the Egyptian Nutrition Institute using EXCEL [*13*]. Then these nutrients were compared to the RDAs for age and sex [*13*].

Nutritional assessment

Two parameters were used to evaluate the nutritional status of the children; anthropometric measurements (weight and height) and biochemical analysis (haemoglobin concentration, blood lead and cadmium). For measurement of height, the child stood erect, without shoes with weight equally distributed on both feet and heels together and touching the vertical board and looking straight ahead. Height was recorded to the nearest 0.1 cm. Body weight was measured on a levelled platform scale with movable weights. The child, in minimum clothing and without shoes, stood with weight evenly distributed on both feet. Weight was recorded to the nearest 100 g. Measurements of weight and height were evaluated by comparison with tables derived from a reference population [*14*]. The same instruments were used before and after the intervention and reliability was checked repeatedly; those taking the measurements were trained and remained the same. Stool analysis was performed to exclude parasitic infection.

Because of its low cost, easy and rapid application, the test most commonly used to screen for anemia is haemoglobin level. This measure reflects the amount of functional iron in the body. The concentration of haemoglobin in circulating red blood cells is the most direct and sensitive measure (colorimetric method) [*15*]. The WHO criterion for iron deficiency anaemia (haemoglobin level < 11 g/dL) was used to diagnose anaemic children [*16*]. All laboratory investigations were carried out by one

of the staff members of the Faculty of Medicine, University of Alexandria.

Intervention programme

The intervention programme included the following activities.

- Updating of the 3 kitchens, dining rooms and stocks where all old utensils were exchanged by new stainless steel ones. Also, kitchens were equipped with the needed electric machines. The floor was covered by tiles and ceramic, sewage disposal (bathrooms) was renovated and windows were covered by nets.
- Training of supervisors (the nursery care givers) by university staff members on the nutritional requirements of children and handling of children's food. The training was implemented through 60 theoretical and 40 practical teaching hours over 25 days for 100 supervisors and 15 graduate assistants.
- Health education of parents consisting of 12 sessions including lectures given by university staff about healthy child feeding practices and feeding schedules of children.
- Nutritional programme which included 2 meals per day (breakfast and lunch) and a fruit snack in between. Meals were selected carefully to be rich in proteins, iron and vitamins and free of additives. The programme was devised by 2 of the authors together with university consultants. Purchases and preparation of food was done in teams and all members were trained.

The cost of the intervention amounted to US$ 20.5 per child per year. This was calculated from the total cost of the programme for the year which amounted to LE 206 160. With 1500 children enrolled, the cost per child was LE 137.44. At the time of the study the rate of exchange was US$ 1 = LE 6.8.

Programme evaluation

The programme was evaluated by comparing the nutritional status of the children before and after the intervention, mother's nutritional awareness by a pre- and post-test and programme costs. Mother's knowledge was assessed by a 20-item Likert scale questionnaire where the answers are scored as 2 for agree, 1 for undecided and zero for disagree. Percentage scores were calculated.

Data analysis

Data were analysed using *Epi-Info* 2000, Microsoft Excel XP and *SPSS*, version 10.0. A *P*-value of 0.05 was used for statistical significance and all tests were two-sided. The arithmetic mean, standard deviation and percentage were used as summary statistics. The shape of the distribution of quantitative variables was explored using the Kolmogorov–Smirnov one-sample test. Comparison among proportions was performed using Cramer's V and paired comparison before and after the programme was performed using McNemar test where the binomial distribution with exact *P*-values was applied. Univariate analyses of data on nutritional indicator Z-score and haemoglobin level were performed using the paired *t*-test for normally distributed data and the Wilcoxon signed rank test for skewed data. General linear model repeated measures ANOVA was used to examine simultaneously the within subject (intervention) effect as well as the between subjects effect of sociodemographic factors on the response to the intervention programme. For multiple comparison among means Tukey HSD test was used [*17,18*].

Results

The present study included 935 children at baseline assessment; 314 each from Anfushy and Smouha day care centres and 307 from Boulkly nursery (Table 1). About 65% of the children were between 2 and 4 years and the remaining 35% were 4–<6 years. Children were fairly equally distributed by sex (48.4% boys and 51.6% girls). More than 50% of mothers were university educated, 38.1% had had vocational education and only 9.7% were illiterate or could just read and write. As expected, mothers were mostly working (67.7%). The birth order of child was first or second for 47.4% of the study children and 52.6% were the third or higher birth order. The 3 day care centres showed significant difference in all sociodemographic characteristics. Smouha and Boulkly had higher percentages of university educated mothers than Anfushy and also higher proportions of lower birth orders.

Table 2 shows the percentage of children consuming a daily average of nutrients ≥100% the RDAs. The most deficient nutrient was calcium (only 22.1% consumed ≥100% the RDAs), followed by calories (26.4%) and vitamin C (39.1%). The least deficient nutrient was proteins (98% consumed ≥100% the RDAs) followed by vitamin B_2 (71.0%) and vitamin A (60.3%). Comparison of the 3 day care centres revealed significant difference between them in the percentage of children consuming ≥100% the RDAs of vitamin B_1, vitamin B_2 and niacin with lower percentages in Anfushy than Smouha and Boulkly.

The mean (and standard deviation) score of mother's knowledge, was 78.5% (SD 10.8%) before the intervention which

Table 1 **Baseline characteristics of the study sample**

Characteristic	Anfushy (*n* = 314)		Smouha (*n* = 314)		Boulkly (*n* = 307)		Total (*n* = 935)		Cramer's V
	No.	%	No.	%	No.	%	No.	%	
Age (months)									0.34***
24–	133	42.4	255	81.2	217	70.7	605	64.7	
48–	181	57.6	59	18.8	90	29.3	330	35.3	
Sex									0.10**
Male	136	43.3	174	55.4	143	46.6	453	48.4	
Female	178	56.7	140	44.6	164	53.4	482	51.6	
Mother's education									0.35***
Less than secondary	79	25.2	6	1.9	6	2.0	91	9.7	
Vocational	160	51.0	77	24.5	119	38.8	356	38.1	
University	75	23.9	231	73.6	182	59.3	488	52.2	
Mother's work									0.35***
Working	143	45.5	261	83.1	229	74.6	633	67.7	
Non-working	171	54.5	53	16.9	78	25.4	302	32.3	
Birth order									0.13**
<3rd	133	42.4	137	43.6	173	56.4	443	47.4	
3rd+	181	57.6	177	56.4	134	43.6	492	52.6	

P < *0.01*;*P < *0.001*.

Table 2 **Nutrients intake at baseline assessment in relation to recommended daily allowances (RDAs)**

Nutrient	Percentage consuming ≥ 100% RDAs				Cramer's V
	Anfushy (*n* = 314)	Smouha (*n* = 314)	Boulkly (*n* = 307)	Total (*n* = 935)	
Calories	25.2	30.9	23.1	26.4	0.08
Protein	98.7	98.4	96.7	98.0	0.06
Calcium	18.2	23.2	25.1	22.1	0.07
Iron	43.6	39.2	35.2	39.4	0.07
Vitamin A	59.6	63.7	57.7	60.3	0.05
Vitamin B_1	37.9	48.1	45.3	43.7	0.09*
Vitamin B_2	64.0	74.2	74.9	71.0	0.11**
Vitamin C	40.1	37.3	40.1	39.1	0.03
Niacin	32.2	54.1	48.2	44.8	0.19***

*P < 0.05; **P < 0.01; ***P < 0.001.

increased significantly 1 year after the intervention to 91.8% (SD 6.0%). This improve- ment was greatest in Anfushy [from 81.5% (SD 7.5%) to 92.0% (SD 3.4%)] while in Smouha it increased from 84.2% (SD 5.6%) to 91.0% (SD 3.0%) and in Boulkly it increased from 76.5% (SD 5.5%) to 85.0% (SD 2.6%).

Table 3 shows the categories of the nutritional status Z-scores (< –2, +2 and +2 SD) before and after the intervention by nursery and sex. The percentage of underweight boys before the intervention was 4.6% which decreased 1 year after the programme to 1.5%. The comparative percentages among girls were 4.6% and 0.3%. As regards the percentage of stunted boys and girls they were 5% and 4.6% before the intervention compared to 3.5% and 2.3% after the intervention respectively. Wasting was present among 1.9% of boys and 2.3% of girls before the intervention compared with 0.0% and 0.3% respectively after the intervention. These findings were consistent for the 3 day care centres. Among the whole sample and for both sexes there was a significant improvement in the nutritional status after the intervention in all indices with a few exceptions in the height-for-age Z (HAZ) score among boys in Smouha and Boulkly. Also no significant difference was found in weight-for-height Z (WHZ) scores among boys and HAZ scores among girls in Smouha. As regards overweight, 4.6% of boys and 6.9% of girls were overweight before the intervention; this rose to 8.5% and 11.5% respectively after the intervention..

Table 4 illustrates the simultaneous analysis of the within subject intervention effect and the between subjects effect of sociodemographic factors on the mean nutrition indices Z scores. There was a highly significant within subject effect which reflects the success of the programme in improving the nutrition status of a child regardless of which group he/she belonged to. However a significant interaction effect was noticed between intervention on the one hand and each of sex, nursery, moth-

Table 3 **Proportion (%) of children in each anthropometric category before and 1 year after intervention, by nursery and sex**

Z score	Anfushy		Smouha		Boulkly		Total	
	Before	After	Before	After	Before	After	Before	After
				Boys				
No. examined	104		70		85		259	
Weight-for-age								
<–2	4.8	1.9	4.3	0.0	3.5	2.4	4.2	1.5
± 2	87.5	82.7	94.3	97.1	91.8	92.9	90.7	90.0
>+2	7.7	15.4	1.4	2.9	4.7	4.7	5.0	8.5
Height-for-age								
<–2	5.8	1.0	4.3[a]	4.3[a]	4.7[c]	5.9[c]	5.0	3.5
± 2	87.5	91.3	94.3	92.9	91.8	90.6	90.7	91.5
>+2	6.7	7.7	1.4	2.9	3.5	3.5	4.2	5.0
Weight-for-height								
<–2	3.8	0.0	0.0[b]	0.0[b]	1.2	0.0	1.9	0.0
± 2	89.4	87.5	100.0	95.7	92.9	92.9	93.4	91.5
>+2	6.7	12.5	0.0	4.3	5.9	7.1	4.6	8.5
				Girls				
No. examined	138		60		106		304	
Weight-for-age								
<–2	5.8	0.7	3.3	0.0	3.8	0.0	4.6	0.3
± 2	87.7	87.7	90.0	86.7	95.3	91.5	90.8	88.8
>+2	6.5	11.6	6.7	13.3	0.9	8.5	4.6	10.9
Height-for-age								
<–2	5.1	2.2	8.3[d]	5.0[d]	1.9	0.9	4.6	2.3
± 2	89.1	89.1	83.3	90.0	96.2	97.2	90.5	92.1
>+2	5.8	8.7	8.3	5.0	1.9	1.9	4.9	5.6
Weight-for-height								
<–2	1.4	0.0	3.3	1.7	2.8	0.0	2.3	0.3
± 2	90.6	87.0	86.7	86.7	93.4	90.6	90.8	88.2
>+2	8.0	13.0	10.0	11.7	3.8	9.4	6.9	11.5

Categories with common superscripts had mean Z-scores that were not significantly different (before vs after paired* t*-test).

er's work and mother's education. This indicates that these factors modified the response to the intervention programme. As regards sex, the interaction was significant only with HAZ scores where the improvement was more pronounced among girls (–0.05 to 0.20) than boys (–0.05 to 0.01). The effect of nursery was observed with the 3 nutrition indices; the increase was more pronounced in Anfushy nursery than both Smouha and Boulkly. Mother's work interacted with the intervention for HAZ scores with more improvement among children of non-working mothers (from –0.07 to 0.22) than working mothers (–0.03 to 0.06). With mother's education

Table 4 **Nutrition indices Z-score before and after intervention by sociodemographic characteristics**

Characteristic	Nutrition indices Z-score [Mean (SD)] (*n* = 563)					
	Weight-for-height		Height-for-age		Weight-for-age	
	Before	After	Before	After	Before	After
Sex						
Male (***n*** = 259)	0.07 (1.19)	0.61 (1.05)	–0.05 (1.23)	0.01 (1.12).	–0.05 (1.23)	0.44 (1.22)
Female (***n*** = 304)	0.13 (1.20)	0.69 (1.13)	–0.05 (1.22)	0.20 (1.08)	–0.05 (1.12)	0.55 (1.12)
F for intervention	163.52***		18.50***		232.97***	
F for intervention × sex	0.05		7.27**		2.24	
F for sex	0.62		1.13		0.28	
Age (months)						
24– (***n*** = 338)	0.05 (1.12)	0.57 (1.02)	0.02 (1.26)	0.16 (1.11)	–0.08 (1.11)	0.43 (1.12)
48+ (***n*** = 225)	0.17 (1.30)	0.77 (1.20)	–0.16 (1.15)	0.04 (1.09)	–0.01 (1.26)	0.60 (1.23)
F for intervention	163.75***		21.12***		236.77***	
F for intervention × age	1.00		0.83		1.86	
F for age	3.40		2.54		1.69	
Nursery						
Anfushy (***n*** = 242)	0.09 (1.27)	0.78 (1.13)	0.01 (1.37)	0.38 (1.12) [ab]	–0.01 (1.26)	0.79 (1.22) [cd]
Smouha (***n*** = 130)	0.10 (1.12)	0.53 (1.09)	–0.10 (1.23)	–0.18 (1.10) [a]	–0.07 (1.15)	0.20 (1.06) [c]
Boulkly (***n*** = 191)	0.11 (1.14)	0.57 (1.04)	–0.09 (1.00)	–0.02 (1.00) [b]	–0.09 (1.07)	0.34 (1.10) [d]
F for intervention	142.36***		10.54**		195.47***	
F for intervention × nursery	3.85*		14.24**		20.19***	
F for nursery	0.74		5.15**		5.21**	

Table 4 **Nutrition indices Z-score before and after intervention by sociodemographic characteristics *(concluded)***

Characteristic	Nutrition indices Z-score [Mean (SD)] (*n* = 563)					
	Weight-for-height		Height-for-age		Weight-for-age	
	Before	After	Before	After	Before	After
Mother's work						
Working (***n*** = 192)	0.06 (1.10)	0.64 (1.05)	–0.03 (1.13)	0.06 (1.12)	–0.07 (1.10)	0.44 (1.11)
Not working (***n*** = 371)	0.17 (1.35)	0.66 (1.18)	–0.07 (1.39)	0.22 (1.07)	0.01 (1.32)	0.60 (1.28)
F for intervention	141.07***		26.42***		222.47***	
F for intervention × mother's work	0.97		7.07**		0.90	
F for mother's work	0.49		0.40		1.44	
Mother's education						
Less than secondary (***n*** = 70)	0.08 (1.07)	0.60 (1.18)	–0.31 (1.19)	0.14 (1.09)	–0.12 (1.23)	0.53 (1.22)
Vocational (***n*** = 229)	0.05 (1.27)	0.71 (1.11)	0.01 (1.28)	0.21 (1.07)	0.06 (1.18)	0.61 (1.21)
University (***n*** = 264)	0.15 (1.16)	0.62 (1.06)	–0.03 (1.18)	0.02 (1.13)	–0.03 (1.15)	0.39 (1.11)
F for intervention	116.61***		31.43***		191.87***	
F for intervention × mother's education	2.03		6.64**		6.04**	
F for mother's education	0.05		1.15		0.54	
Birth order						
<3rd (***n*** = 261)	0.17 (1.30)	0.72 (1.15)	0.09 (1.37)	0.23 (1.13)	0.07 (1.26)	0.62 (1.25)
3rd+ (***n*** = 302)	0.04 (1.09)	0.60 (1.04)	–0.16 (1.06)	0.01 (1.07)	0.15 (1.08)	0.39 (1.09)
F for intervention	163.76***		19.92***		236.06***	
F for intervention × birth order	0.05		0.14		0.01	
F for birth order	2.20		6.65*		6.45*	

P < 0.05; ** P < 0.01; *** P < 0.001.

Groups with common superscripts were significantly different in response to intervention (Tukey HSD test).

SD = standard deviation

the interaction effect was significant with both HAZ and weight-for-age Z (WAZ) scores. Children of university educated mothers showed minimal increase in HAZ score (–0.03 to 0.02) and WAZ score (–0.03 to 0.39) compared to children of illiterate mothers (–0.31 to 0.14 and –0.12 to 0.53 respectively). The comparative figures for those of vocationally educated mothers were 0.01 to 0.21 and 0.06 to 0.61 respectively.

Another significant between-group effect was observed by nursery and by birth order (in HAZ and WAZ scores). Anfushy nursery had higher Z-scores for children than both Smouha and Boulkly whether at baseline or 1 year after intervention and lower ranked children in birth order (below third) had higher Z scores than the higher ranked children (third or higher) both at baseline and at final assessment.

The impact of the nutrition programme on the blood haemoglobin level is shown in Figure 1. There was a shift in the distribution of children from the low haemoglobin levels (the peak of the curve below 10 g/dL) to a peak curve after intervention at 11 g/dL or higher.

In Table 5 the overall prevalence of anaemia among children examined was 47.3% which decreased significantly after intervention to 14.2%. Boys and girls were similar at baseline in the prevalence of anaemia (47.8% and 46.8% respectively) and the drop was significant and to the same extent in both groups (15.9% and 12.7% respectively). For all the other socioeconomic characteristics (age, nursery, mother's work, mother's education and birth order) the prevalence of anaemia decreased significantly after the intervention ($P < 0.05$).

Table 6 presents the mean haemoglobin levels before and after intervention by sociodemographic factor. The within subject intervention effect was significant for all groups ($P < 0.001$) and no significant interaction effect was found for any variable.

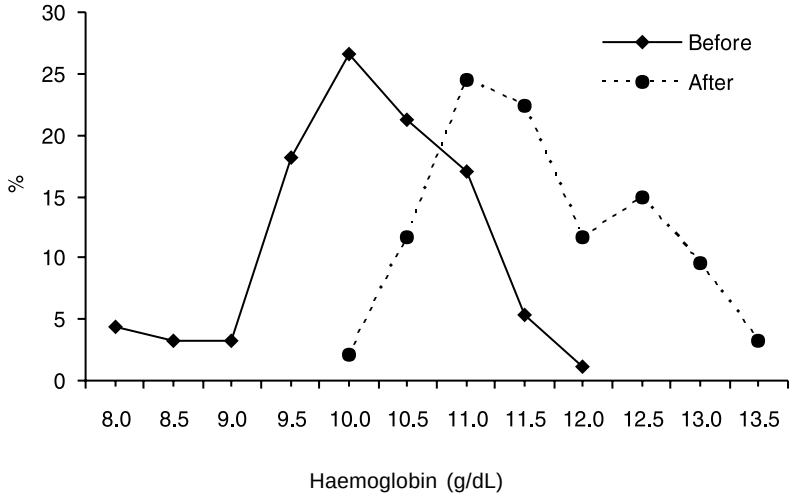


Figure 1 **Haemoglobin level before and 1 year after the intervention**

The only between-subjects effect was encountered with nursery where children of Anfushy nursery had a significantly higher haemoglobin level both at baseline and at final assessment than those of Smouha nursery.

In Figure 2, the mean lead and cadmium before and 1 year after the programme are presented. Both blood lead and cadmium were low at baseline assessment (1.55 µg/L and 0.24 µg/dL respectively) and decreased significantly after intervention to 0.80 µg/dL and 0.09 µg/L respectively.

Discussion

Good nutrition is essential for proper growth during childhood. To grow up healthy, with vitality and energy, children need adequate nutrition. Many nutrition intervention programmes have been tried to improve the nutritional status of children [*6,7,19*]. However, no single intervention or mix of interventions should ever be prescribed in isolation from a participatory process of problem assessment, causal and capacity analysis and programme design.

Table 5 **Percentage anaemic before and after intervention by sociodemographic characteristics**

Characteristic	Percentage anaemic		McNemar exact *P*[a]
	Before	After	
Overall (***n*** = 148)	47.3	14.2	0.000
Sex			
Male (***n*** = 69)	47.8	15.9	0.000
Female (***n*** = 79)	46.8	12.7	0.000
Age (months)			
24– (***n*** = 89)	39.0	13.6	0.000
48+ (***n*** = 59)	52.8	14.6	0.000
Nursery			
Anfushy (***n*** = 92)	65.0	35.0	0.031
Smouha (***n*** = 20)	55.6	11.1	0.000
Boulkly (***n*** = 36)	40.2	10.9	0.000
Mother's work			
Working (***n*** = 75)	46.6	17.8	0.000
Not working (***n*** = 73)	48.0	10.7	0.000
Mother's education			
Less than secondary (***n*** = 25)	40.0	12.0	0.039
Vocational (***n*** = 67)	49.3	13.4	0.000
University (***n*** = 56)	48.2	16.1	0.000
Birth order			
<3rd (***n*** = 81)	48.1	17.3	0.000
3rd+ (***n*** = 67)	46.3	10.4	0.000

[a]***Binomial distribution used.***

Table 6 **Haemoglobin level before and after intervention by sociodemographic characteristics**

Characteristic	Haemoglobin (g/dL)				*F* for intervention	*F* for intervention × factor	*F* for between group effect
	Before		After				
	Mean	SD	Mean	SD			
Sex					97.73***	0.53	0.78
Male (***n*** = 69)	10.96	0.88	11.52	0.78			
Female (***n*** = 79)	11.03	0.86	11.67	0.86			
Age (months)					95.09***	0.01	1.55
24– (***n*** = 89)	11.09	0.90	11.70	0.82			
48+ (***n*** = 59)	10.93	0.84	11.53	0.82			
Nursery					69.59***	0.04	3.07*
Anfushy (***n*** = 92)	11.10	0.91	11.70	0.77			
Smouha (***n*** = 20)	10.63	1.08	11.28	0.97			
Boulkly (***n*** = 36)	10.94	0.52	11.54	0.84			
Mother's work					98.79***	0.01	0.38
Working (***n*** = 75)	11.03	0.76	11.64	0.83			
Not working (***n*** = 73)	10.95	0.97	11.56	0.81			
Mother's education					91.91***	0.73	0.69
Less than secondary (***n*** = 25)	10.82	1.11	11.59	0.80			
Vocational (***n*** = 67)	11.09	0.79	11.66	0.86			
University (***n*** = 56)	10.96	0.84	11.53	0.79			
Birth order					98.75***	0.15	0.01
<3rd (***n*** = 81)	11.00	0.80	11.58	0.86			
3rd+ (***n*** = 67)	10.99	0.95	11.62	0.78			

***P < 0.05; ****P < 0.001.*

There was a significant difference in response to intervention between Smouha and Anfushy (Tukey HSD test).

SD = standard deviation.

Participatory problem-solving approaches will reveal the main causes of undernutrition and the type and amount of resources available to combat it [*20*].

The present study is a demonstration of a participatory process of problem-solving including problem assessment, causal and capacity analysis and programme design. The baseline problem assessment analysis revealed that, with the exception of protein, vitamins A and B_2, all nutrients were deficient compared with the RDAs, about 50% of children were anaemic, and underweight, stunting and wasting among boys and girls were about 4.2%, 5.0% and 1.9% respectively. Furthermore, were mean blood lead and cadmium were 1.55 mg/dL and 0.24 mg/dL respectively. An analysis of dietary intake of preschool Indian children belonging to poor income groups indicated a similar deficiency of nutrients [*8*]

Risk-factor analysis revealed consistent deficiency in nutrients by sex, age, mother's work, and mother's education. This consistency of results indicates that the problem is universal and all study groups needed intervention.

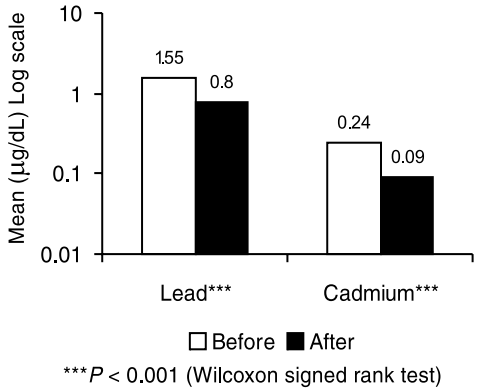


Figure 2 **Mean lead and cadmium before and after intervention**

Similar programmes implemented in other countries have shown success over the same period of time [*22*], a relatively longer period of time [*22*] or did not achieve improvement [*23*]. The post-test situation of the current programme revealed considerable improvement in the nutritional status of children whether in anthropometric measurements or in haemoglobin level. One year after the programme, the proportion with a haemoglobin level of 12+ g/dL increased from 10.9% to 44.5% among boys and from 15.5% to 44.5% among girls and the improvement was consistent for all study groups (Tables 4–6). A similar project in the Islamic Republic of Iran, which did not include intervention feeding, reported a drop in wasting from 6.5% to 1.8% [*24*]. The comparable figures in the present study were 1.9% to zero among boys and 2.3% to 0.3% among girls.

The significant interaction between the area and degree of improvement after the programme in the 3 anthropometric indicators reflects the higher level of cooperation among mothers of the lower income locality (Anfushy) relative to the higher income localities (Smouha and Boulkly). Lower income mothers were pleased to offer food supplements to their children. The same can explain the interaction of HAZ and WAZ indices with mothers' work and education which were correlated by area.

Mahaffey reported that the burden of iron deficiency anaemia is amplified for children who have lead toxicity, since at the same blood lead levels the adverse effects are increased if iron deficiency is present [*25*]. Cadmium is another toxic metal with a long history of detrimental effects. It accumulates in humans throughout their lives because of its very long half-life [*26*]. Cadmium has an adverse effect on brain metabolism [*27*]. Also, it has been demonstrated to aggravate anaemia by suppressing erythropoietin gene expression in anaemic patients [*28*]. So the design of the present intervention considered the elimination or decline of blood lead and cadmium currently and in the future through increasing mother's awareness of the factors causing lead and cadmium toxicity and presentation of healthy food which helps the elimination of blood lead. Evaluation of the programme revealed that both blood lead and cadmium were lower after the programme.

Some researchers have documented a significant relationship between nutrition knowledge and nutrition behaviour [*29,30*]. Comparison of the mean knowledge score of mothers before and after the intervention indicated the beneficial effect of the educational sessions. This concurs with the results of a community-based study in Delhi including a nutrition education of 4 months where mothers showed significantly higher nutrition knowledge and the dietary iron intake of children was significantly higher than their control group counterparts [*30*]

Past experience has suggested that around US$ 5 to 15 per participant per year seems to be associated with effective programmes, at least for those that do not include provision of additional food which approximately doubles the cost [*20*]. In many cases, well conceived programmes may be ineffective simply because their coverage is too low to have a broad impact on the problem, or because they do not reach those most in need. In other cases, the principles may be correct but the level of resources committed may be unrealistically low so nothing much can really be achieved [*19*].

Analysis of the cost of the present programme per subject indicated US$ 20.5 per child per year was within the range of effective nutrition intervention programmes; this includes provision of additional food.

A finding in the present study that was not intended but expected is the shift of the nutrition status toward overweight. Mothers would not accept a loss in the body weight of their children even if they were overweight at the start of a study even though it aimed at improving the nutritional status of children. However, it is expected that the knowledge mothers acquired on healthy food will eliminate the possibility of obesity in the study group in the long run.

This programme has been sustainable by increasing the nursery fees by LE 5 per month which, added to the original feeding fund of LE 3500 per month, allows for this programme to continue.

Conclusions

Nutrition intervention can be provided to preschool children in day care centres. Short interventions appear to be practical strategies for improving the nutritional status of children.

Acknowledgement

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Note from the Editor

We would like to inform our readers that the next Special Issue of the EMHJ (Volume 11, 2005) will be on Maternal and Child Health to reflect the theme for World Health Day 2005.

Multidisciplinary intervention for reducing malnutrition among children in the Islamic Republic of Iran

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مُداخلة متعددة المجالات لتقليص سوء التغذية لدى الأطفال بجمهورية إيران الإسلامية

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الخلاصـة: أُجريت مُداخلة متعدِّدة المجـالات لتقلـيص سـوء التغذيـة بـالبروتين والطاقـة لـدى الأطفـال القـاطنين في المناطق الريفية في ثلاث مقاطعات بجمهورية إيران الإسلامية. وبناءً على التحليل البدئي للوضع، تم تنفيذ عـدد مـن المداخلات من خلال المنظمات الأهلية المحلية اللاحكومية. وقد شملت هذه المداخلات كـلاً مـن: التغذيـة، والإلمـام بالقراءة والكتابة، والتثقيف الصحي للأمهات، وتعزيز برنـامج رصـد النمـو، وتـدعيم التعاونيـات الريفيـة، والـنُظُم المدرَّة للدخل. وقد تم تقييم سوء التغذية قبل وبعد المداخلة (1996–1999)، باستخدام القياسات البـشرية لعيِّنـات عشوائية من الأطفال الذين تـتراوح أعمـارهم بـين 6 أشـهر و35 شـهراً، في منـاطق المداخلـة ومنـاطق المجموعـات الشاهدة. ومن الجدير بالذكر أنه بعد مضي ثلاث سنوات من المداخلة، تقلَّصَ سوء التغذية تقلُّـصاً كـبيراً في جميـع المناطق التي كانت موضعاً للمداخلة، كما انخفـض معـدل انتـشار انخفـاض الـوزن والتقـزم. وقـد أظهـرت المنـاطق الشاهدة أنماطاً مختلطة من الزيادة الطفيفة والانخفاض في مؤشرات سوء التغذية.

ABSTRACT A multidisciplinary intervention to reduce protein–energy malnutrition among children in rural areas was piloted in 3 provinces of the Islamic Republic of Iran. Based on an initial situation analysis, a range of interventions were implemented through local nongovernmental organizations, including nutrition, health and literacy education for mothers, improved growth monitoring and fostering rural cooperatives and income generation schemes. Malnutrition before and after the intervention (in 1996 and 1999) was assessed using anthropometric measurements of random samples of children aged 6–35 months in control and intervention areas. Three years into the intervention, all indicators of malnutrition had consistently decreased in all intervention areas and the prevalence of underweight and stunting was significantly lower. Control areas showed a mixed pattern of small increases and decreases in malnutrition indicators.

Intervention multidisciplinaire pour réduire la malnutrition chez l'enfant en République islamique d'Iran

RÉSUMÉ Une intervention multidisciplinaire pour réduire la malnutrition protéino-énergétique chez l'enfant en zone rurale a été menée dans trois provinces de la République islamique d'Iran. Sur la base d'une analyse de la situation initiale, diverses interventions, comprenant l'éducation nutritionnelle et sanitaire des mères et leur alphabétisation, le renforcement du programme de surveillance de la croissance, la promotion des coopératives rurales et de projets générateurs de revenus, ont été mises en oeuvre par le biais d'organisations non gouvernementales. La malnutrition avant et après l'intervention (en 1996 et en 1999) a été évaluée en utilisant les mesures anthropométriques réalisées sur des échantillons aléatoires d'enfants âgés de 6 à 35 mois dans les zones témoins et dans les zones d'intervention. Trois ans après le début de l'intervention, tous les indicateurs de la malnutrition avaient diminué systématiquement dans toutes les zones d'intervention et la prévalence du déficit pondéral et du retard de croissance était significativement plus faible. Les zones témoins montraient un tableau diversifié avec de petites augmentations et diminutions des indicateurs de la malnutrition.

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Introduction

Considerable efforts have been made throughout the world to promote the health of communities. Although these efforts have decreased mortality rates, especially among infants, protein–energy malnutrition is still the most important nutritional problem in many developing countries [1], including the Islamic Republic of Iran. The last national survey in the country in November 1998 showed that in rural areas 12.8% of under 5-year-olds suffered from mild to severe nutritional stunting, 13.7% of them were underweight and 4.8% of them suffered from wasting [2]. The prevalence of underweight among children under 6 months is similar to a well-nourished community (3%), but the prevalence of underweight increases after this age, peaking at 13.8% in 2-year-olds (aged 24–35 months). In order to prevent the problem of underweight, therefore, interventions should be focused on children under 2 years old before they display the symptoms of underweight.

Some of the factors known to affect the development of malnutrition include poor nutritional knowledge of mothers, illiteracy, inappropriate child feeding, low household income, food shortages and poor sanitation practices that involve children in a vicious cycle of infection and malnutrition [*3*].

Experiences of other countries such as Indonesia and India show that multidisciplinary interventions in the community using non-governmental organizations (NGOs) with expertise in food and nutrition development can reduce protein–energy malnutrition [*4*]. In the present study, a pilot intervention for decreasing malnutrition among children, with the emphasis on intersectoral cooperation and obtaining the participation of the community, especially mothers, was carried out in rural areas of 3 provinces of the Islamic Republic of Iran. The main target of the intervention was to reduce the malnutrition of children aged less than 3 years old to one-third of its initial figure. This paper outlines the stages of the programme: the preliminary data gathering to plan the intervention, the implementation of the intervention and the collection and analysis of pre- and post-intervention anthropometric measurements of children.

Methods

Intervention areas

This study was performed from 1996 to 1999 in rural areas of 3 different districts of 3 provinces: Ilam (Ilam province), Bardsir (Kerman province) and Borazjan (Bushehr province). These areas were selected on the basis of a number of criteria: the high prevalence of malnutrition among children under 5 years old based on routine data from the primary health care system; a good primary care infrastructure, efficient management and sufficient health personnel; and the appropriate capacity of relevant sectors in the area, including agriculture and education. In each district of each province, all the villages were covered by the intervention: 139 in Ilam, 122 in Borazjan and 176 in Bardsir.

To select control areas for comparison with the intervention areas, another district was selected from each province with a similar socioeconomic situation and a similar prevalence of malnutrition, and data was collected from all the villages in the district.

Sample

To demonstrate a reduction in malnutrition of children aged less than 3 years old to one-third of its initial figure, the required sample size was estimated to be about 700

children in each area ($\alpha = 0.05$, $\beta = 0.01$). Considering the ratio of children aged less than 3 years to the total population, about 2000 households were needed to obtain the required number of children. With the success of the national family planning programme in recent years, it was possible to reduce the number of children in the samples. In this way, 659 children aged 6–35 months from Ilam, 532 children from Borazjan, and 512 children from Bardsir were selected by systematic random sampling (Table 1).

Situation analysis

In the first phase, a situation analysis was made of the incidence of malnutrition and factors affecting the problem among children of the study areas. The situation analysis aimed to collect and analyse basic socioeconomic and health information from households and agricultural information about the areas using questionnaires. Data were collected about: knowledge, attitudes and practices of mothers about child feeding, growth monitoring, family planning, sanitation, safe drinking water, food production and socioeconomic conditions. Food consumption patterns of the household and child were studied with a food frequency questionnaire, and by weighing samples of consumed foods.

Anthropometric measures

The first phase included taking baseline anthropometric measures of children in the intervention and control areas to determine the prevalence of malnutrition. The weight of the children was measured using pan weight scales and height using a height meter. The precision of the scales was checked with control weights. The percentage prevalence of underweight (weight-for-age), nutritional stunting (height-for-age) and wasting (weight-for-height) in the control and intervention areas were calculated. The reference for anthropometric measures was the World Health Organization/National Center for Health Statistics (WHO/NCHS) standards [5] and the cut-offs were –2 standard deviations from the mean.

Table 1 **Number of children participating in the study pre- and post-intervention in the control and intervention areas**

Area	No. of children measured	
	Pre-intervention	Post-intervention
Ilam		
Control area	524	339
Intervention area	654	335
Bardsir		
Control area	521	331
Intervention area	510	381
Borazjan		
Control area	586	359
Intervention area	531	433

Intervention

Based on the findings of the situation analysis, a range of appropriate nutritional and social intervention strategies were designed to combat malnutrition in the areas. The intervention measures included:

- educating mothers about: breastfeeding, complementary feeding, child feeding in diarrhoea and other diseases, balancing and diversifying diet and food groups, preparing safe drinking water, creating a healthy home environment and family planning,
- reinforcing the growth monitoring programme and sensitizing mothers to children's growth cards,
- strengthening literacy programmes for women,
- increasing access to foods through establishment of rural cooperative stores,
- promoting home gardening,
- granting loans for family self-sufficiency programmes such as carpet weaving, confectionary, tailoring, embroidery and poultry breeding,
- establishing programmes for improved employment and income generation.

Different sectors, agricultural, educational and social, participated in this intervention programme, including a literacy movement organization, social welfare organizations and rural cooperatives.

Safe drinking water. Households that obtained their water from wells and rivers were supplied with concentrated chlorine solution by the *behvarz* for chlorination of water at home.

Sanitary toilets. To expand the number of sanitary toilets the district health centre supplied plumbers to villagers who needed them. Building the toilet structures and septic tanks were done by the villagers themselves.

Waste disposal. All refuse was collected in containers with lids. Removal was done by volunteers from the villages. The *behvarz* was responsible for educating people and involving them in this activity.

*Health education for a healthy environment***.** Education about the environment was done by the *behvarz* with support from peripheral workers from all sectors such as agricultural extension workers, teachers and schoolchildren.

Promotion of breastfeeding. Counselling was done by the *behvarz* in the health house at the time of prenatal and postnatal check-ups, at consultations and during home visits. Breastfeeding was also promoted via the mass media and with the help of others such as teachers and schoolchildren.

Growth monitoring and promotion. The *behvarz* were actively involved in the counselling of mothers on the nutritional requirements for children based on the outcome of weighing and charting. The mothers also were taught to interpret their children's growth curves.

Complementary feeding. All health houses were equipped with gas cookers and other necessary items for conducting nutrition classes and the *behvarz* transported the equipment to satellite villages. The *behvarz* held demonstrations about correct methods of food preparation for mothers with children in the age groups requiring complementary food as well as for other women of the village.

Home gardening. In order to encourage people to consume more vegetables, agriculture extension workers were involved in the distribution of seeds to health houses and schools. Practical training about nutrition and planting vegetables at home were conducted for women and girls through the rural women's unit of the Bureau of Pro-

motion of Rural Women and by the agriculture extension workers.

Promoting consumption of dairy products and fruits. The *behvarz* and peripheral workers from all sectors (welfare organizations, education, and agriculture) were actively involved in nutrition education and awareness about the importance of a balanced and varied diet. Special booklets on nutrition for rural women were designed by nutrition experts and simplified by the literacy movement officers.

Animal husbandry. The department of animal husbandry in the Ministry of Agriculture was involved in encouraging villagers to start rearing livestock and poultry in order to improve the availability of dairy products, meats and eggs and to contribute towards income generation.

Coordination of the intervention

The organizations involved in the intervention were run at the local government, provincial and district level but the activities had to be coordinated at the national level. The literacy movement is a department in the Ministry of Education that is responsible for educating rural illiterate adult women and men. Social welfare is a governmental organization which covers poor people in rural areas (health insurance, food aid, etc.). The rural cooperatives organization is under the Ministry of Agriculture and is responsible for distributions of food items and managing rural markets. The specification of this education intervention was that all relevant government sectors were actively involved in educating the people in the villages. Training workshops were conducted for them through provincial health centres.

Evaluation

In the evaluation carried out 3 years after the start of the intervention, anthropometric data collected in the first phase were again gathered through measuring the weight and height of children aged 6–35 months who were selected by a sampling method similar to the first phase. The weight and height of randomly selected children in the control districts were also measured.

Analysis

The data were analysed using Epi-Info, version 6.0. Differences in the prevalence of underweight, stunting and wasting were assessed in the intervention and control areas comparing the values before (1996) and after (1999) implementation of the intervention.

Results

Intervention areas

Figure 1 shows the percentage prevalence of underweight, stunting and wasting in the 3 intervention areas before and after implementation of the intervention. All indicators of malnutrition decreased in all areas after the intervention (except for wasting in Ilam).

A small non-significant decrease in percentage prevalence of underweight (weight-for-age) was seen in Ilam (12% to 10%) , whereas in Borazjan and Bardsir the prevalence of underweight was halved after the intervention (23% to 11% in Borazjan and 28% to 14% in Bardsir) ($P < 0.0001$).

Figure 1 also shows that nutritional stunting (height-for-age) greatly decreased in all areas (25% to 12% in Ilam, 41% to 13% in Borazjan and 31% to 19% in Bardsir) ($P < 0.0001$).

The percentage prevalence of wasting (weight-for-height) decreased in Borazjan (9% to 4%) ($P < 0.0001$) (Figure 1). In

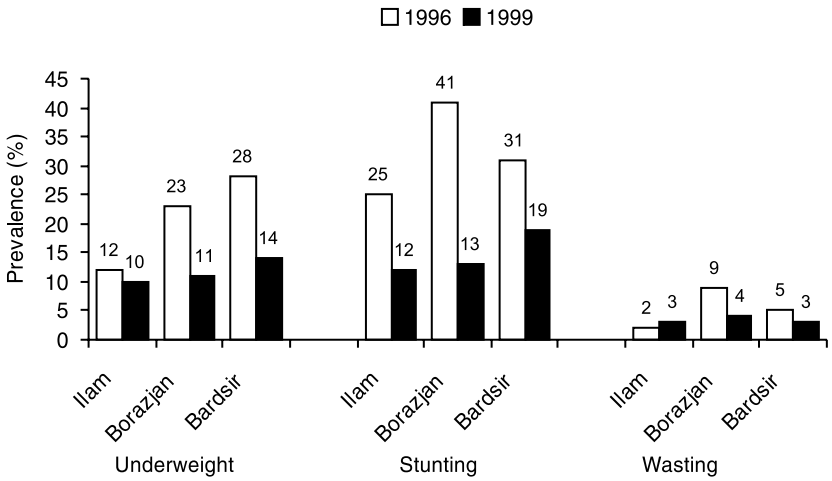


Figure 1 **Comparison of prevalence percentage of malnutrition indicators in intervention areas of Ilam, Borazjan and Bardsir in 1996 and 1999 (before and after the intervention)**

Bardsir, a small decrease in wasting was seen (5% to 3%), but this was not statistically significant. The prevalence of wasting increased slightly in Ilam (2% to 3%), but not significantly so.

Control areas

Figure 2 shows the percentage prevalence of malnutrition in control areas of the 3 provinces in the same years as the intervention period (1996 and 1999). In 1996, levels of malnutrition were generally lower in control areas than in intervention areas. While some decreases in underweight, stunting and wasting were recorded in 1999, these were much smaller than in intervention areas.

Underweight decreased in control areas of Borazjan (13% to 8%) ($P > 0.05$) and Bardsir (24% to 16%) ($P < 0.0001$), but the prevalence of underweight increased in Ilam over the 3 years (9% to 12%).

Similarly, stunting increased in Ilam (13% to 17%), and small decreases were seen in Borazjan (16% to 15%) ($P > 0.05$) and Bardsir (37% to 30%) ($P < 0.03$).

The prevalence of wasting changed little over the 3 years in all areas (from 2% to 4% in Ilam, from 5% to 4% in Borazjan and 3% to 3% in Bardsir).

Discussion

Our intervention for reducing children's malnutrition was based on the triple-A approach (Assessment–Analysis–Action) proposed by UNICEF in 1989 [6]. The initial assessment and analysis of the situation determined the key factors affecting the prevalence of malnutrition, while the evaluation phase determined the effectiveness of interventions. Other studies, in different countries such as Thailand, India and the Philippines, present considerable evidence about the usefulness of such interventions. In Thailand, the Family Nutrition Improvement programme used multicultural initiatives, including growth monitoring of children under 5 years old, practical nutrition education, promotion of home gardening, iron and vitamin A supplementation and

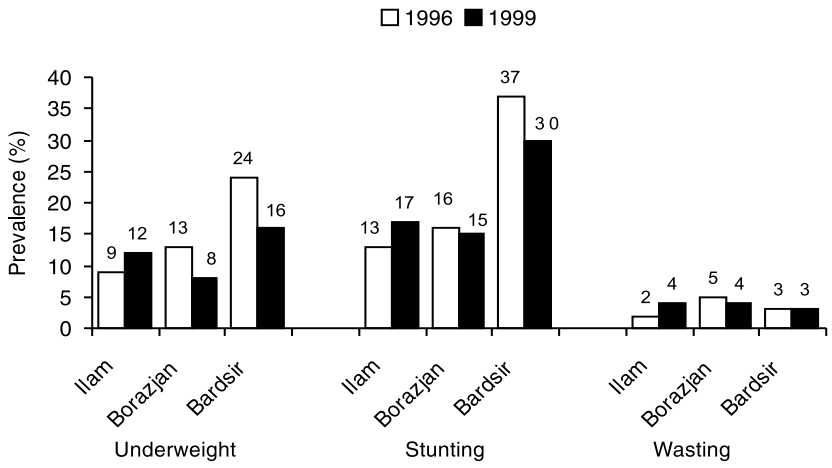


Figure 2 **Comparison of prevalence percentage of malnutrition indicators in control areas of Ilam, Borazjan and Bardsir in 1996 and 1999**

treatment of diarrhoea with oral dehydration solutions [7]. These were performed with the participation of the community and trained volunteers. Evaluation of this programme showed that it led to positive changes in knowledge and practice of households regarding children's growth. For this project, the government of Thailand assigned all of its resources and facilities to the selected interventions.

In the Integrated Child Development Services project in 1975, India carried out an integrated initiative for children under 5 years and for pregnant and lactating women, through food grants, food supplements and immunization and nutrition education by health and social workers. Evaluation of the programme showed a decrease of severe malnutrition in centres covered by the scheme. One of the essential factors in the success of that programme was the training of workers and continuous supervision at the local level, which led to promotion of their skills [*6*].

In the Philippines, the Philippines Nutrition Programmes has since 1974 carried out thorough growth monitoring of children less than 5 years old using rural volunteers. The volunteers were involved in weighing children, nutrition education, family planning services, immunization and other health services. This programme was supported by government and succeeded in its aims, despite the political instabilities in the country [*7*].

Similar to our study, South Africa performed the Integrated Nutrition Programme in its primary health care system, as a pilot in 4 provinces in 1997. The main activities of that programme, which was achieved by intersectoral participation, were training of teachers, farmers and other volunteers interested in food self-sufficiency, promotion of the health of women and children, promotion of exclusive breastfeeding of children under 6 months and continuing breast feeding for 2 years and establishing "nutrition rehabilitation centres". After evaluation of the programme at the end of 1998, it was extended nationwide [*8*].

In the present study, strengthening the existing growth monitoring programme and sensitization of mothers to children's growth cards were considered key strategies for promoting the growth of children. In the Family Nutrition Improvement Programme in Indonesia, growth monitoring of children proved to be effective as an educational means for timely recognition and control of children's growth disorders [*9*].

One of the specifications of our study was the reliance on nutrition education, without resorting to food grants. Although food grants programmes for children in Senegal, Morocco, Sri Lanka, Tanzania and India have had good effects, programmes based on nutrition education alone have also been successful. As an example, a community-based intervention through nutrition education performed in the Dominican Republic showed that the prevalence of moderate and severe malnutrition in children aged 2–3 years decreased to one-third of its initial figure 3 years after the intervention [*10*]. The beneficial effects of nutrition education on the nutrition status of low-income pregnant Mexican women is another example of a successful intervention [*11*].

This 3-year intervention for decreasing malnutrition in rural areas of the Islamic Republic of Iran with the cooperation of different community and NGO sectors resulted in a significant decrease in all malnutrition measures among under-3-year-olds. The success of our programme, as in interventions in other countries, may be attributed to the intersectoral cooperation and participation of all development sectors to tackle the multidimensional causes of malnutrition.

Acknowledgements

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Global Strategy for Infant and Young Children Feeding

WHO and UNICEF jointly developed this global strategy to focus world attention on the impact that feeding practices have on the nutritional status, growth and development, health, and thus the very survival of infants and young children. The strategy is the result of a comprehensive two-year participatory process. It is based on the evidence of nutrition's significance in the early months and years of life, and of the crucial role that appropriate feeding practices play in achieving optimal health outcomes. The strategy is intended as a guide for action; it identifies interventions with a proven positive impact, it emphasizes providing mothers and families the support they need to carry out their crucial roles, and it explicitly defines the obligations and responsibilities in this regard of governments, international organizations and other concerned parties. This document is available on line at: http://www.who.int/child-adolescent-health/New_ Publications/NUTRITION/gs_iycf.pdf

Survey of dietary habits of in-school adolescents in Damascus, Syrian Arab Republic

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دراسة مسحية للعادات الغذائية لدى المراهقين في مدارس دمشق – سورية

هيام بشور

الخلاصة: كانت الغاية من هذه الدراسة وصف العادات الغذائية لدى المراهقين السوريِّين في المدارس الثانوية في دمشق والمناطق المحيطة بها. وهي دراسة وصفية مستعرضة أُجْرِيَتْ عام 2001 وشملت 3507 تلاميذ، أخذوا على شكل عينة عشوائية مُتَطبقة عنقودية ذات مرحلتين. وقد سُئِل التلاميذ أن يَصِفوا النموذج الاستهلاكي لأصناف الطعام خلال الأسبوع المنصرم، فقال أكثر من 50٪ منهم إنهم لم يتناولوا الخضراوات الطازجة، فيما قال أكثر من 35٪ منهم إنهم لم يتناولوا اللحوم، وقال أكثر من 35٪ منهم إنهم تناولوا الجبن والحليب مرة واحدة في اليوم على الأقل، في حين قال 11.8٪ فقط منهم إنهم تناولوا الفواكه 3 مرات في اليوم أو أكثر. وقد تمَّ تحليل المحدِّدات المحتملة لنموذج الاستهلاك الغذائي، كما وُصفت الممارسات المتَّبعة في إنقاص الوزن، والعادات الأخرى في تناول الطعام.

ABSTRACT This study aimed to describe dietary habits of Syrian adolescents attending secondary schools in Damascus and the surrounding areas. A descriptive, cross-sectional study was carried out on 3507 students in 2001. A stratified, 2-stage random cluster sample was used to sample the students. The consumption pattern of food items during the previous week was described. More than 50% of the students said that they had not consumed green vegetables and more than 35% had not consumed meat. More than 35% said that they consumed cheese and milk at least once a day. Only 11.8% consumed fruit 3 times or more daily. Potential determinants of the pattern of food consumption were analysed. Weight control practices and other eating habits were also described.

Enquête sur les habitudes alimentaires d'adolescents scolarisés à Damas (République arabe syrienne)

RÉSUMÉ Cette étude avait pour objectif de décrire les habitudes alimentaires d'adolescents syriens fréquentant des écoles secondaires à Damas et dans ses environs. Une étude transversale descriptive a été réalisée auprès de 3507 élèves en 2001. Un échantillonnage aléatoire en grappes stratifié à deux degrés a été utilisé pour répartir les élèves. Les caractéristiques de la consommation des aliments durant la semaine précédente ont été décrites. Plus de 50 % des élèves déclaraient n'avoir pas consommé de légumes verts et plus de 35 % n'avaient pas consommé de viande. Plus de 35 % déclaraient avoir consommé du fromage et des laitages au moins une fois par jour. Seuls 11,8 % des élèves consommaient des fruits trois fois par jour ou plus. Les déterminants potentiels de la consommation alimentaire ont été analysés. Les pratiques de contrôle du poids et les autres habitudes alimentaires ont également été décrites.

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Introduction

The quantity, strength, and consistency of evidence that relates dietary factors to chronic diseases, and the substantial impact of these conditions on health are reason enough to promote policies to increase the adoption of healthy diets [*1,2*].

The health of young people and adults is critically linked to the health-related behaviours they choose to adopt. Unhealthy dietary behaviour is one of those risky behaviours. Evidence from studies of the eating habits of young people raises concern about the implications on their future health [*3*].

The Syrian Arab Republic is a country witnessing great developments. It is also facing a clear epidemiological transition; chronic diseases are emerging as the main causes of death (Syrian Ministry of Health, unpublished report, 2000). The population of the country is rather young: the age group 10–19 years constitutes more than 25% of the total [*4*]. The net enrolment at secondary school is 40% for males and 45% for females [*5*].

Adolescents may not think of the long-term consequences of their health practices, rather, they consider only short-term consequences and assume they can alter their habits later for better health [*3*]. An analysis of dietary habits among adolescents would be useful in depicting prevalent habits, and also for designing relevant effective nutrition education recommendations. As far as is known, there are no previous studies in the Syrian Arab Republic that describe eating habits among adolescents, although other risky behaviours have been studied, e.g. smoking [*6*].

This study aimed to describe dietary habits of Syrian adolescents attending secondary schools in Damascus city and the surrounding areas.

Methods

The study was conducted in Damascus and surrounding areas. Damascus, the capital of the Syrian Arab Republic, has a population of > 1.5 million [*4*]. It constitutes one of the 14 provinces in the country and is surrounded by another province called Rural Damascus, with a population of < 2 million [*4*]. The total number of secondary schools (grades 7–12) in the 2 provinces approaches 400, the vast majority of them government schools.

This was a descriptive, cross-sectional study. A stratified, 2-stage, random, cluster sample was used to sample the students. In the first stage, schools were randomly selected from a sampling frame that included all schools (grades 7–12) in Damascus city and Rural Damascus (only 30 km around Damascus city). That frame was stratified by education level (2 strata), sex (2 strata) and place of residence (2 strata). Three schools from each stratum were randomly selected, i.e. 24 schools in total. Classes from each level of education in the selected schools were randomly chosen. Students in the 9th and 12th grades were not as well represented as other grades owing to the fact that some class teachers refused to allow any interruption in their classes since the students were registered for important exams in June of the same year. In the schools where this occurred (5/24 schools), we replaced that class with the class from the grade below. All students attending the selected classes were included. The sample size was estimated at 3380 taking into account: desirable confidence limit of 95%; an estimated prevalence of an unhealthy eating habit of 40%; the acceptable error; and the design effect of 1.5. Initial sample size was 3514 in-school adolescents; 5 students refused to participate and

2 questionnaires were returned blank. The total number of questionnaires analysed was 3507.

The questionnaire was developed and adapted from the questionnaire used for the behavioural risk factor surveillance system [*7*]. This modified questionnaire was piloted on 25 secondary students to check for ease of understanding and completion. The questionnaire consisted of 54 questions. Data collected included background information; food consumption and frequency of the main food items consumed in the past week; weight perception and weight control measures practised; reported weight and height if known by the student; habits of consuming products such as salt, coffee, tea, soft drinks and packaged food (e.g. biscuits, potato chips); and also snacking habits. A question on the perceived best authority to provide health education on nutrition was also included.

Students filled in the questionnaires during regular class times, and questionnaires were also collected in class. The principal investigator visited all the selected schools between February and May 2001. Approval of the school principals was obtained before the start of the study, and written, informed consent was taken from all the students through the tool of data collection itself.

Questionnaires were checked and coded, and analysis of data was carried out using *SPSS*. Missing values were allowed for in the analysis. Descriptive statistics was carried out where frequencies were calculated for all questions. Comparisons between sexes and place of residence were also done. The chi-squared test to compare proportions and *t*-test to compare means were calculated. The level of significance was 0.05.

Results

A total of 3509 students in 24 secondary schools in Damascus and surrounding areas received the questionnaire (5 adolescents had refused to participate). Participation rate was extremely high, only 2 questionnaires were returned blank leaving a total of 3507 questionnaires. Table 1 summarizes the characteristics of the participants: 73.2% resided in urban areas, 41.7% were female, and age range was 13–18 years. More than 36% earned money through work; this proportion varied significantly between males and females (59.7% and 20.9% respectively).

Figure 1 shows the frequency of food consumption in the week preceding the day of the school visit. More than 50% did not consume green vegetables, about 35% did not consume red meat and 40% did not consume red meat at all during that week. More than 35% said that they consumed cheese and milk once a day. Only 11.8% consumed fruits 3 times or more daily in the previous week. The average number of meals consumed per day as reported by students was 2.58 (standard deviation [SD] 0.78). Those who reported the intake of only 1 meal per day constituted 7.7% of the study subjects.

The frequency of food consumption was analysed according to age group, sex, place of residence, perceived economic status of the family, and whether the student earned money through work. Table 2 shows the results for 2 food items only, fruits and green vegetables. These were selected because of their special importance. An analysis of other items is not shown here for space reasons. For this analysis, the frequency of food consumption was recoded into 2 groups: inadequate con-

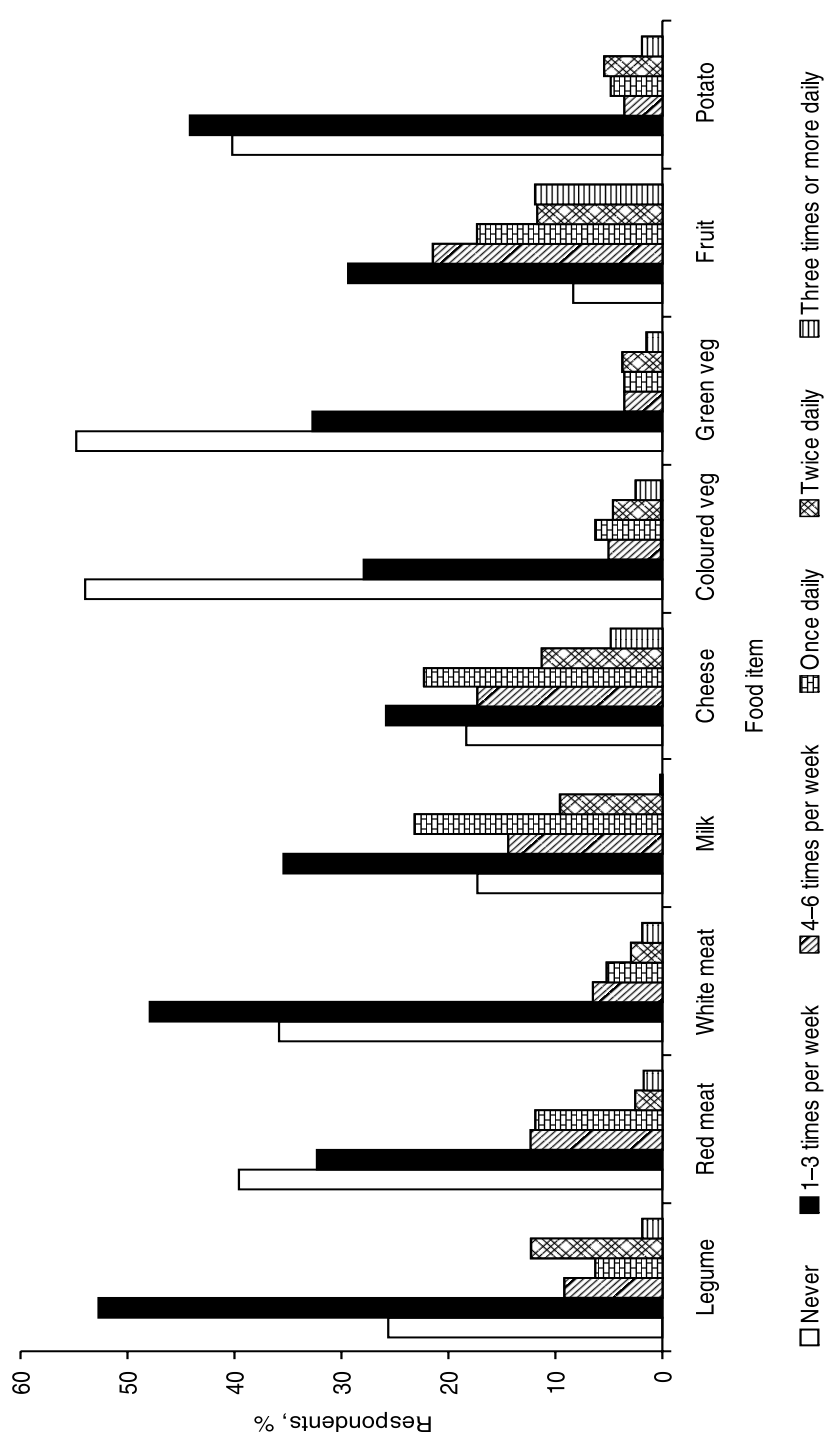


Figure 1 **Frequency (%) of food consumption among in-school adolescents**

Table 1 **Characteristics of the study subjects (*N* = 3507)**

Characteristic	No.	%
Residence		
Damascus	2568	73.2
Surroundings	939	26.8
Age (years)		
13	730	20.8
14	576	16.4
15	696	19.8
16	695	19.8
17	654	18.6
18	145	4.1
Sex		
Male	1461	41.7
Female	2046	58.3
School grade		
7th	652	18.6
8th	652	18.6
9th	350	10.0
10th	863	24.6
11th	627	17.9
12th	363	10.4
Perceived economic status of family		
Low	152	4.3
Moderate	1984	56.6
Good	1229	35.0
Earning money through work		
Yes	1240	35.4
No	2116	60.3

Missing data for some questions means that some values for total number of respondents are different.

sumption (< 1 time daily during the past week), and adequate consumption (consumed ≥ 1 time daily during past week). As can be seen from Table 2, the consumption of fruit differed significantly with perceived economic status and earning money, while the consumption of green vegetables differed significantly with age, sex, place of residence, perceived economic status and earning money. All these variables were included in a multivariate logistic regression analysis, where the dependent variable was the adequacy of fruit/vegetable consumption. The only predictor for the inadequacy of fruit consumption was economic status as perceived by the student (OR = 0.7 for the highest economic status, 95% CI: 0.47–0.99). Low vegetable consumption was, however, related to sex (OR = 0.65 for males, 95% CI: 0.56–0.76) and age (OR = 0.79 for the younger age group, 95% CI: 0.69–0.91) and place of residence (OR = 1.61 for urban residence, 95% CI: 1.36–1.89).

Table 3 demonstrates how the students perceived their weight when they were asked to describe it. It also shows their plans to control their weight and whether they actually did that in the previous month. The mean body mass index (BMI) of 19 males who reported their weight and height and who described themselves as being slightly overweight was 24.6 kg/m^2 (SD = 4.4), and the mean BMI of 223 females in the same group was 22.6 kg/m^2 (SD = 2.5). According to the World Health Organization, BMI 25.0–29.0 kg/m^2 is defined as overweight and BMI ≥ 30 kg/m^2 is obese [*8*]. Of 882 students who actually controlled their weight in the previous month, 806 described their method. Changes in diet and/or doing exercises were reported by 705 students. Only 101 students said that physical activity and exercise were the only method of weight control they embarked on. Significant differences between males and females regarding weight management practices were noticed (Table 3). When the results were analysed by place of residence, no differences were found. Of the 1882 (54%) students who stated their weight and height on the questionnaires,

Table 2 **Differences in frequency of food consumption of selected items by demographic and socioeconomic characteristics**[a]

Characteristic	Fruit consumption				Green vegetable consumption			
	Adequate[b]		Inadequate		Adequate		Inadequate	
	No.	%	No.	%	No.	%	No.	%
Age (years)								
13–15	826/1984	41.6	1158/1984	58.4	843/1954*	43.1	1111/1954	56.9
16–18	599/1494	40.1	898/1494	60.1	707/1481	47.7	774/1481	52.3
Sex								
Male	569/1448	39.3	879/1448	60.7	736/1426*	51.6	690/1426	48.4
Female	856/2033	42.1	1177/2033	57.9	814/2009	40.5	1195/2009	59.5
Place of residence								
Damascus	1078/2552*	42.2	1474/2552	57.8	1218/2510*	48.5	1292/2510	51.5
Surroundings	347/929	37.4	582/929	62.6	332/925	35.9	593/925	64.1
Perceived economic status of family								
Low	47/152*	30.9	105/152	69.1	72/148*	48.6	76/148	51.4
Moderate	840/1970	42.6	1130/1970	57.4	909/1949	46.6	1040/1949	53.4
Good	479/1217	39.4	738/1217	60.6	502/1199	41.9	697/1199	58.1
Earning money through work								
Yes	481/1226	9.2	745/1226	60.8	589/1224*	48.1	635/1224	51.9
No	886/2106	42.1	1220/2106	57.9	896/2073	43.2	1177/2073	56.8

[a]***Numbers of respondents are different due to missing answers for some items.***
[b]***Adequate = eating item ≥ 1 time daily, inadequate = eating item < 1 time daily.***
****Statistically significant at** P **< 0.05; results from chi-squared test.***

only 7% had a BMI > 25 and only 1% had a BMI > 30.

Students were asked about their own perceptions of their eating habits (Table 4). A large proportion considered that they consumed lots of tea and soft drinks. Also, more than a third of students admitted using too much salt on food. More than 50% said that they ate too much packaged food such as biscuits and chocolates. Some had consumed as much as 6 pieces per day. Snacking and eating outside the house were extremely prevalent among study subjects. When asked about the foods they usually ate for snacks, it varied from western type meals (pizza, for example) to traditional types such as legume-containing food (*falafel*), and meat-containing food (*shawerma, shish tawouk*). Snacks were taken inside restaurants or from take-away shops. Snacking did not differ significantly by age group or perceived economic status of the family.

When asked about sources of nutrition education, 33.1% of students indicated the family only as the best source of information; 6.4% indicated the school only and 5.1% indicated the media only. A total of 19.5% of adolescents indicated > 1 source.

Table 3 **Weight perception and management as reported by students**

Variable	Males		Females		Total		*P* value[a]
	No.	%	No.	%	No.	%	
Weight perception							
Very thin	8	0.6	10	0.5	18	0.5	< 0.001
Thin	280	19.6	323	16.1	603	17.6	
Appropriate	930	65.2	1269	63.3	2199	64.1	
Slightly overweight	207	14.5	401	20.0	608)	17.7	
Overweight	2	0.1	3	0.1	5	0.1	
Total	1427	100	2006	100	3433	100	
Plan to control weight							
Lose weight	279	19.8	817	41.1	1096	32.3	< 0.001
Gain weight	403	28.6	292	14.7	695	20.5	
No change planned	494	35.1	671	33.7	1165	34.3	
Not interested	231	16.4	209	10.5	440	13.0	
Total	1407	100	1989	100	3396	100	
Weight control during past month							
Yes	316	22.0	566	28.0	882	25.5	< 0.001
No	1118	78.0	1453	72.0	2571	74.5	
Total	1434	100	2019	100	3453	100	

[a]P-***values were derived using chi-squared test.***

Table 4 **Self reported dietary habits of in-school adolescents**

Dietary habit	Males		Females		Damascus city		Rural Damascus	
	No.	%	No.	%	No.	%	No.	%
Drinking a lot of tea	990/1455**	68.0	1018/2041	49.9	1475/2562	57.6	533/934	57.1
Drinking a lot of coffee	157/1449**	10.8	293/2035	14.4	337/2552	13.2	113/932	12.1
Drinking a lot of maté tea	328/1446**	22.7	285/2032	14.0	462/2546	18.1	151/932	16.2
Drinking a lot of soft drinks (not canned)	702/1447**	48.5	801/2033	39.4	1026/2551**	40.2	477/929	51.3
Eating a lot of packaged food	669/1422**	47.0	1185/2015	58.8	1332/2514	53.0	522/923	56.6
Using too much salt on food	532/1439	37.0	791/2029	58.5	943/2540*	37.1	380/928	40.9
Using too much pepper on food	352/1426	24.7	497/2019	24.6	596/2525*	23.6	253/920	27.5
Eating frequently outside the house	932/1382**	67.4	1074/1972	54.5	1479/2459	60.1	527/895	58.9

Missing data for some questions means that some values for total number of respondents are different.
****Significant at** P **< 0.05.***
*****Significant at** P **< 0.01. Results from chi-squared test.***

Discussion

This study identified a number of eating habits practised by in-school adolescents in Damascus city and the surrounding areas that are potentially harmful and unhealthy [*2*]. Food consumption and other dietary behaviours are influenced by many factors. These include culture, agriculture, socio-economic factors and lifestyle. Our results are comparable with those of studies from neighbouring countries (A.M. Sibai, N. Kanaan, unpublished report, 1998) and western countries [*9*].

The study revealed that food consumption could be determined by economic factors such as fruit consumption as this is rather an expensive item on the market. Green vegetables, being a cheap item on the market, were consumed more by participants who reported low economic status of their families compared to more expensive items like fruit (Table 2).

Self-reported weight and height indicated that obesity and overweight were not prevalent among the study subjects. Nevertheless, Syrian adolescents did engage in weight control behaviours. Some of those who practised weight control measures, mainly females in this study, may be at risk of inadequate nutritional intake. Adolescents in particular can come under considerable pressure from the world at large to conform to current trends in fashion, body image, behaviour or foods. Recent developments in western dietary practices have tended to leave adolescents vulnerable to low intake of energy and of certain nutrients [*10*]. Studies of adolescents have noted the importance of psychosocial variables such as body image and self-perception in shaping dietary practices [*11*]. Nonetheless, our study revealed that nearly half the participants (46%) were not aware of their weight and height; this is another interesting finding that deserves note.

Snacking and light meal consumption was very common among study subjects. The food pattern was characterized by irregularity of meal consumption. Although snacks can be a source of needed nutrients, it is important that they do not substitute for regular meals. Snacking is an established eating pattern among adolescents worldwide. Snacking was more common in Nordic countries compared to southern European countries [*12,13*].

This study, like many others, has many limitations. First of all, using the food frequency questionnaire may be problematic. In spite of their inherent limitations, food frequency questionnaires have been used increasingly in research. Considerable research has been devoted to improving the validity and reproducibility of these questionnaires [*14*]. Secondly, our study has focused on in-school adolescents. Although secondary education is not universal in the country, a large proportion of adolescents attend schools. Additionally, our sample may have under-represented the rural areas. We embarked, for feasibility reasons, on sampling from schools close to Damascus city, within around 30 km of the city centre (the study was not intended to cover a national representative sample). In the cases where 9th and 12th grades were replaces by the grade below, we have no reason to think that this biased the results. Thirdly, self-administered questionnaires have some inherent problems and are subject to self-perceived measurements and reporting errors. But since our sample size was large, this should not affect the validity of the results very much, and the results compared well with similar studies. Further research is, however, needed to measure the nutritional status of Syrian adolescents objectively.

As far as is known, this study provided, for the first time in the country, data on the

dietary habits of Syrian adolescents. It highlighted, despite some limitations, the urgent need to intervene and to promote healthy eating behaviour among those youngsters. Schools can help young people improve their eating habits by implementing effective policies and educational programmes that reach families and the community at large [*15*]. Interventions at school have a great potential to work positively. A study from the United Kingdom suggested how difficult it is to achieve sustained dietary changes in the eating habits of secondary school children [*16*]. However, our study revealed that families might have an important role to play since a high proportion of students felt their families would be a good source for nutrition education.

In conclusion, this study provided some baseline data for future research and for the use of policy makers. It also clearly supports the need for effective dietary education for adolescents, and even for children.

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Regional training workshop to develop nutrition surveillance capabilities of Member States to improve the monitoring and evaluation capacities in nutrition programmes

The World Health Organization organized a training workshop in Alexandria, Egypt, from 7 to 15 March 2004 to develop the nutrition surveillance capabilities of Member States to improve the monitoring and evaluation capacities in nutrition programmes. The objectives of the workshop were: to prepare Member States to establish national nutrition surveillance systems with a focus on micronutrient deficiencies control and prevention which will enable Member States to monitor the iron and folate nutrition of their populations; and to develop a framework of national plans of action. Participants from Bahrain, Islamic Republic of Iran, Jordan, Kuwait, Morocco, Oman as well as representatives from the Centers for Disease Control and Prevention, Atlanta and UNICEF attended the workshop.

Urinary iodine and other iodine deficiency indicators in a sample of school-age children in Egypt

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تركيز اليود في البول والمؤشرات الأخرى على عوز اليود في عينة من الأطفال في سن المدرسة في مصر

فاطمة أحمد الموجي، شيرين عبد الغفار، نهلة فايق، منال محمَّد

الخلاصة: لا تتوافر في مصر معطيات كافية حول إفراغ اليود في البول لدى الأطفال، وحول المؤشرات الأخرى على عوز اليود. لذلك قمنا بقياس تركيز اليود في البول وقياس مستوى الهرمون المنبه للدرقية، والثيروغلوبولين وثلاثي يود الثيرونين ورباعي يود الثيرونين في المصل، لدى 99 من الأطفال المصريين في سن المدرسة. وقد كُشف الدُّراق (ضخامة الغدة الدرقية) لدى 25 طفلاً، وكان التركيز الوسطي لليود في البول 70 مكروغرام في اللتر. وقد وجدنا عَوَزاً طفيفاً في اليود (50 — 99 مكروغرام في اللتر) لدى 60.6٪ من الأطفال وعَوَزاً متوسطاً أو وخيماً في اليود (أقل من 50 مكروغرام في اللتر) لدى 31.3٪ منهم. وقد أبدى الأطفال المصابون بالعَوَز الوخيم تواتراً مرتفعاً للدُّراق، مع ارتفاع في القيم الوسطية لثلاثي يود الثيرونين والهرمون المنبه للدرقية والثيروغلوبولين. ولما كانت معدلات إفراغ اليود في البول تختلف من فرد لآخر، فإن هذه المؤشرات الأخرى قد تساعد في تحري عَوَز اليود بين الأفراد، ولاسيَّما في حالات العَوَز المتوسط أو الوخيم.

ABSTRACT Sufficient data relating urinary iodine excretion in children to other iodine deficiency indicators are lacking in Egypt. We assayed urinary iodine concentration and serum levels of thyroid stimulating hormone (TSH), thyroglobulin, free triiodothyronine (T_3) and free tetraiodothyronine in 99 school-aged Egyptian children. Goitre was found in 25 children. Median urinary iodine concentration was 70 µg/L. We found mild iodine deficiency (50–99 µg/L) in 60.6 % of the children and moderate to severe deficiency (< 50 µg/L) in 31.3%. The latter showed a high frequency of goitre and elevated mean serum free T_3, TSH and thyroglobulin levels. Individual urinary iodine excretion rates vary, therefore these other indicators could help in screening for iodine deficiency at an individual level, especially in moderate to severe deficiency.

L'iode urinaire et les autres indicateurs d'une carence en iode dans un échantillon d'enfants d'âge scolaire en Égypte

RÉSUMÉ On manque de données suffisantes concernant l'excrétion d'iode urinaire chez l'enfant par rapport aux autres indicateurs d'une carence en iode en Égypte. Nous avons mesuré la concentration d'iode urinaire et le taux sérique d'hormone thyréotrope (TSH), de thyroglobuline et de triiodothyronine libre (T_3) et de tétraiodothyronine libre chez 99 enfants égyptiens d'âge scolaire. Un goitre a été observé chez 25 enfants. La concentration moyenne d'iode urinaire était de 70 µg/L. Nous avons trouvé une légère carence en iode (50-99 µg/L) chez 60,6 % des enfants et une carence modérée à sévère (< 50 µg/L) chez 31,3 % des enfants. Ces derniers ont montré une forte fréquence du goitre et des concentrations sériques moyennes de T_3 libre, de TSH et de thyroglobuline élevées. Le taux d'excrétion d'iode urinaire individuel varie ; ces autres indicateurs pourraient donc aider à dépister la carence en iode au niveau individuel, notamment dans les cas de carence modérée à sévère.

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Introduction

Worldwide, iodine deficiency is the commonest cause of preventable mental retardation as well as goitrous hypothyroidism (endemic goitre), especially in developing countries. An insufficient supply of the essential micronutrient iodine, an integral part of thyroid hormones, results in impaired thyroxine production, producing a spectrum of iodine deficiency disorders including endemic goitre, cretinism, hypothyroidism, short stature and neuromuscular and neurosensorial deficit [*1,2*].

Most iodine absorbed in the body eventually appears in the urine, so urinary iodine concentration is a good marker for very recent dietary iodine intake [*1*]. Iodine concentrations can, however, vary considerably from day to day and over a single day in one individual [*3*]. Thus, a single urinary iodine measurement is not representative of individual nutritional iodine status. Urinary iodine concentrations are useful, however, when used in cross-sectional, epidemiological surveys in population samples of appropriate size [*4*].

Therefore, the assessment of other indicators of iodine deficiency disorder such as the presence of goitre, serum thyroid profile or serum thyroglobulin might be helpful at an individual level if used in conjunction with urinary iodine concentration to discover iodine deficiency, especially in moderate to severe cases, and would also help for follow-up after iodine supplementation to ensure its success and to prevent consequent morbidity [*5*].

It has been confirmed that urinary iodine excretion assesses iodine nutrition only at the time of measurement, whereas, thyroid size reflects iodine nutrition over months or years [*1*]. Serum thyroglobulin has been reported to change inversely with iodine intake in all age groups [*6*]. On the other hand, the pattern of circulating thyroid hormones in clinically euthyroid children in areas of severe iodine deficiency has been characterized by low serum tetraiodothyronine (T_4), elevated thyroid stimulating hormone (TSH) and normal or supernormal triiodothyronine (T_3) [*7*].

In Egypt, endemic goitre and low urinary iodine concentration have been reported in several regions [*8–11*]. Most studies in Egypt, however, did not relate urinary iodine concentration with other laboratory indicators for iodine deficiency disorders.

The objective of this study was to relate the urinary iodine excretion in a sample of school-age children (5–13 years) to other indicators of iodine deficiency disorder such as thyroid profile, serum thyroglobulin and the presence of goitre. Children are at high risk of the consequences of iodine deficiency and hypothyroidism (growth and physical and mental development can be affected) and are the focus of school-based national surveys.

Methods

We interviewed 300 children as potential participants in this study. The inclusion criterion was age group (5–13 years) while the exclusion criteria were the presence of any systemic chronic or autoimmune disease. Informed consent was taken from all participants or their parents before entering the study. We excluded 74 of these children: 25 were outside the age range, 40 had chronic systemic disease and 9 had autoimmune disease. A total of 127 refused to participate, 55 because of fear of giving blood samples and 72 owing to lack of time.

In all, 99 school-age children 5–13 years old, 58 males and 41 females, were consecutively enrolled. These children were apparently healthy siblings and rela-

tives of patients attending the clinic of Cairo University children's hospital. People attending this hospital come from many regions of Egypt; most of them are of low or intermediate socioeconomic status.

History taking (which included questions on iodine supplementation and symptoms of hypothyroidism) and clinical examination were carried out, including neck examination by inspection and palpation for goitre according to World Health Organization (WHO) classification [*1*]. Blood samples (5 mL venous blood) were taken from each child. Sera were separated and divided into 2 aliquots for assay of thyroid hormones. One was used for serum free T_3 and free T_4 by solid phase radioimmunoassay [*12*], and serum TSH by solid-phase immunoradiometric assay (Allegro highly sensitive TSH kit, Nichols Institute Diagnostics, San Juan Capistrano, California). The second aliquot was used for assay of serum thyroglobulin by chemiluminescent immunoassay using the automated Immulite analyser [*13*]. All commercial kits were supplied by DPC (Diagnostic Products Corporation, Los Angeles).

A morning spot urine sample was obtained from each child in a clean cup and stored at –20 °C until assayed for urinary iodine. Urine was digested with ammonium persulfate to get rid of interfering substances, then iodide was measured by its catalytic action on the reduction of ceric ammonium sulfate (yellow) to the cerous form (colourless), coupled to the oxidation of arsenite to arsenate (Sandell–Kolthoff reaction) [*14*]. All chemicals were supplied by Sigma (Saint-Quentin, France).

We used *SSPS,* version 9 for data processing. Quantitative data were presented as mean and standard deviation for normally distributed variables and mean and percentiles for skewed distributions. For comparison of means, the Student *t*-test or Mann–Whitney test was used. For qualitative data chi-squared was used for comparison. Correlation between variables was done and Spearman's rank correlation coefficient calculated. All tests were 2-tailed and considered statistically significant at $P < 0.05$.

The WHO cut-off points for urinary iodine levels were used to define iodine deficiency as well as to classify the severity of the deficiency: optimal urinary iodine concentration > 99 µg/L; mild deficiency 50–99 µg/L; moderate deficiency 20–49 µg/L; and severe deficiency < 20 µg/L [*1*].

Results

There were 99 children in the study group, 59 male and 41 female. Mean age was 9.1 years (standard deviation 2.8), range 5–13 years.

Classification according to urinary iodine concentration followed the WHO cut-off points for iodine deficiency levels is shown in Table 1. Urinary iodine concentration was not normally distributed; the median level was calculated as 70.0 µg/L with the 25th and 75th percentiles being 33.0 µg/L and 85.0 µg/L (Table 1). No significant difference between males and females was seen in the different grades of iodine deficiency ($P = 0.06$).

By clinical examination, goitre was found in 25 of the children we studied. Urinary iodine concentration was decreased in all goitrous children (Table 2). Goitre was present in 64.5% of children who had moderate or severe iodine deficiency (mostly grade 2 goitre) compared to only 8.3% of children with mild deficiency (mostly grade 1 goitre). The difference was statistically significant ($P < 0.01$). Goitre was not

Table 1 **Classification of children (*N* = 99) according to urinary iodine level using the 2001 World Health Organization recommended cut-off values [*1*]**

Classification (urinary iodine)	Median, 70 µg/L	Interquartile range, 33–85 µg/L
	No.	%
Optimal (> 99 µg/L)	8	8.1
Mild deficiency (50–99 µg/L)	60	60.6
Moderate deficiency (20–49 µg/L)	27	27.3
Severe deficiency (< 20 µg/L)	4	4.0

present in the children who did not have iodine deficiency.

Elevated serum thyroglobulin (> 40 ng/mL) was found in 6 children (6.1%); all had moderate or severe iodine deficiency. They constituted 19.4% of the children who had moderate or severe iodine deficiency. Similarly, increased serum TSH (> 6.5 µIU/ml) occurred in 13 (41.9%) of the 31 children who had moderate or severe iodine deficiency. Cases with optimal urinary iodine concentration had no elevation of serum TSH or serum thyroglobulin (Table 2).

Mean serum free T_3, serum TSH and serum thyroglobulin were significantly elevated in the children with moderate or severe iodine deficiency compared to those with optimal urinary iodine concentration or mild iodine deficiency ($P < 0.001$ for both). However, free T_4 levels were not significantly different between groups ($P = 0.9$) (Table 3). Moreover, a negative correlation was observed between urinary iodine level and serum TSH ($r_s = -0.34$; $P < 0.001$).

Discussion

Our results showed a high prevalence of iodine deficiency in the children we studied; only 8.1% had optimal urinary iodine concentration according to the WHO cut-off points for urinary iodine levels [*1*]. One

Table 2 **Number of children with disturbance of thyroid function according to iodine deficiency category**

Variable	Iodine deficiency level of children					
	None[a] (*n* = 8)		Mild[b] (*n* = 60)		Moderate & severe[c] (*n* = 31)	
	No.	%	No.	%	No.	%
Goitre	0	–	5	8.3**	20	64.5**
Increased serum TSH (> 6.5 µIU/mL)	0	–	0	–	13	41.9
Increased serum thyroglobulin (> 40 ng/mL)	0	–	0	–	6	19.4

[a] > 99 µg/L.
[b] 50–99 µg/L.
[c] < 50 µg/L.
****P < 0.01***
TSH = thyroid stimulating hormone.

Table 3 **Comparison of mean age, thyroglobulin and thyroid hormone levels in children grouped according to their urinary iodine level (*N* = 99)**

Variable	Optimal and mild deficiency[a] (*n* = 68) Mean (SD)	Moderate and severe deficiency[b] (*n* = 31) Mean (SD)	*P*-value
Age (years)	9.0 (2.8)	9.4 (2.8)	0.6
Free T_3 (pg/mL)	3.29 (0.58)	4.76 (0.67)	< 0.001
Free T_4 (ng/dL)	1.53 (0.24)	1.52 (0.36)	0.9
TSH (μIU/mL)	2.35 (0.99)	7.09 (6.52)	< 0.001
Thyroglobulin (ng/mL)	14.23 (8.38)	23.31 (19.72)	< 0.001

[a] ≥ 50 μg/L iodine.
[b] < 50 μg/L iodine.
TSH = thyroid stimulating hormone.
T_3 = triiodothyronine.
T_4 = tetraiodothyronine.
SD = standard deviation.

quarter of the children had clinical goitre. These results could signify that iodization of salt may not be adequate or they may be affected by consumption of goitrogens.

Previous studies reporting endemic goitre in Egypt are consistent with the results of this study. In Cairo, a prevalence of 13.5% has been reported in primary school children, with the highest prevalence (27.1%) in north Cairo [*15*]. In Upper Egypt, the overall prevalence of goitre was 34.6% in one study [*16*]. Other studies reported that the highest prevalence of goitre in Egypt (82.3%) was in the New Valley [*8*] followed by Minia (36.9%), Assuit (36.8%), Sohag (30.1%) in Upper Egypt [*9*] then Kafr El Sheikh (27.1%) [*10*] and Aswan (17.5%) [*11*].

The high prevalence observed among the children we studied as well as the previous studies is in contrast to the cut-off level recommended by WHO [*1*]. It is recommended that a total goitre rate of 5% or more in schoolchildren 6–12 years of age is used to signal the presence of a public health problem. This recommendation is based on the observation that in a normal, iodine-replete population, the prevalence of goitre should be quite low. The cut-off point of 5% allows both for some margin of error in goitre assessment and for goitre that may occur in iodine-replete populations due to other causes such as goitrogens and autoimmune thyroid disease [*1*].

Our results are also in agreement with the high prevalence encountered in countries such as in Turkey, where goitre prevalence ranged from 5% to 56%, indicating severe to moderate iodine deficiency in 14, and mild iodine deficiency in 6, of the cities surveyed [*17*]. In the Islamic Republic of Iran, goitre prevalence was 60%; after iodine supplementation, this dropped to 47% [*18*]. A lower prevalence rate was found in Indonesia: 12.5% in Bali, and 8.0% in Java and Sumatra [*19*]. Different prevalence rates were seen in India, ranging from 0.0% in some areas [*20*], to 30.2% in oth-

ers [*21*]. Mild to severe iodine deficiency was also reported in 32 European countries in the late 1990s, and they still have not reached a state of iodine sufficiency [*22*].

The urinary iodine excretion rates recorded in our study agree with those reported in Bali-Indonesia, where the median urinary iodine value was 81.0 µg/L, with 58.3% of the values below 100 µg/L (mild to severe deficiency) and only 14.7% of the values above 200 µg/L [*19*]. In the Islamic Republic of Iran, median urinary iodine concentration was 76 µg/L; this increased to 185 µg/L after iodine supplementation [*18*]. In Turkey, median urinary iodine concentration ranged between 14 µg/L (severe deficiency) and 78 µg/L (mild deficiency) [*17*]. In studies done in the 1990s in Egypt, values ranged between 15.1 µg /L in Kafr El Sheikh and 8.9 µg /L in the New Valley [*8–11*]. Another study reported a median urinary iodine concentration of 5.0 µg/L in goitrous children in Upper Egypt [*16*].

Our study revealed increased free T_3 in patients with moderate and severe iodine deficiency when compared with those with mild iodine deficiency. Increased serum TSH as well as elevated serum thyroglobulin levels were found only in patients with moderate and severe iodine deficiency.

Similar results were reported in 1993 in Indians of southern Venezuela by Cooper et al. who reported that 71% of children had a thyroid volume above normal and iodine deficiency was associated with predictable higher serum free T_3 and TSH concentrations [*23*].

It has been mentioned that the pattern of circulating thyroid hormones in clinically euthyroid children in areas of severe iodine deficiency is characterized by low serum T_4, elevated TSH, and normal or supernormal T_3. The mechanisms responsible for this pattern are unclear but may include thyroidal secretion of T_4 and T_3 in the proportion in which they exist within the gland, preferential secretion of T_3, or increased peripheral conversion of T_4 to T_3. The shift to increased T_3 secretion and increased serum T_3:T_4 ratio may play an important role in the adaptation to iodine deficiency because T_3 possesses about 4 times the metabolic potency of T_4, but requires only 75% as much iodine for synthesis [*5*].

It has been reported that plasma thyroglobulin levels increase in iodine deficiency and in organification defects. Insufficient iodine intake induces proliferation of thyroid cells, which results in hyperplasia and hypertrophy. This leads to an enhanced turnover of thyroid cells, which release thyroglobulin into the circulation [*6*]. In this setting, serum thyroglobulin reflects iodine nutrition over a period of months or years, in contrast to urinary iodine concentration which assesses more immediate iodine intake. The results of our study match well with this hypothesis as 41.9% of participants with moderate and severe iodine deficiency had elevated serum TSH and 19.4% had elevated serum thyroglobulin and an inverse correlation was also found between urinary iodine and serum TSH. After iodine depletion, thyroglobulin rises before TSH shifts to higher values and long before goitre develops. Following iodine supplementation, thyroglobulin normalizes before thyroid volume has decreased. Therefore, an increase in TSH and/or thyroglobulin could be considered the first sign of a fall in effectiveness of iodized oil injection [*7*].

It has to be stressed, however, that the sample size in this study was not large enough to comment adequately on the iodine status of the population. The sample size was constrained by the limited financial resources available, therefore, conclusions should be limited to the relation of

urinary iodine excretion to other indicators of iodine deficiency. Urinary iodine excretion was highly variable in our sample as has been documented before [*3*]. Other indicators for iodine deficiency disorder (free T_3, free T_4 serum TSH, serum thyroglobulin and presence of goitre) are interrelated with urinary iodine excretion and can be used as monitors for the screening of iodine deficiency at an individual level, especially in people with moderate to severe deficiency.

These indicators could be also used for monitoring the success of an iodine supplementation programme. More studies need to be done on a larger scale for assessment of the current status of iodine deficiency in Egypt and for supervision of proper iodine supplementation, which is required to prevent iodine deficiency disorder with all its consequent morbidities.

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Knowledge, attitudes and sources of information on breastfeeding among medical professionals in Baghdad

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المعارف والمواقف ومصادر المعلومات حول الرضاعة من الثدي لدى طلاب الطب والأطباء في بغداد

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الخلاصة: استكمل 320 من طلبة الطب و75 من الأطباء المقيمين و50 طبيباً ممارساً في بغداد، العراق، استبيانات لتقييم المعارف والمواقف والتدريب حول الرضاعة من الثدي. ورغم أن المواقف حول الرضاعة من الثدي كانت على وجه الإجمال إيجابية فإن أقل من 50٪ من المستجيبين قد أجابوا بشكل كافٍ على الأسئلة المتعلقة بالمعارف (كان أكثر من 50٪ منها صحيحاً). واتفق معظم الأطباء الممارسين (86.0٪) على أن الرضاعة من الثدي هي النمط المفضل لتغذية الرضع، فيما لم يوافقهم على ذلك 58.4٪ من طلبة الطب و57.3٪ من الأطباء المقيمين. لقد كانت المصادر الرئيسية للمعلومات حول الرضاعة من الثدي هي المجتمع الطبي ودورات طب الأطفال، فيما عرضت النماذج الرئيسية للتعليمات المتعلقة بالرضاعة من الثدي من خلال المحاضرات والحصص السريرية. وقد استنتج الباحثون أن المنهج التدريسي في الكليات الطبية وفي التدريب أثناء فترة الإقامة لا تُعِدُّ الأطباء إعداداً كافياً لأداء أدوارهم في تعزيز الرضاعة من الثدي.

ABSTRACT A questionnaire to assess doctors' knowledge, attitudes and training about breastfeeding was answered by 320 medical students, 75 resident doctors and ***50*** general practitioners in Baghdad, Iraq. Although attitudes towards breastfeeding were generally positive, less than 50% of medics had adequate scores on knowledge questions (≥ 50% correct). Most general practitioners (86.0%) agreed that breastfeeding was the preferred type of feeding compared with only 58.4% of medical students and 57.3% of resident doctors. General practitioners who had been on training courses scored better than those who had not. The main sources of breastfeeding information were community medicine and paediatric courses and the main modes of breastfeeding instruction were lectures and clinical sessions. Medical school curricula and residency training do not adequately prepare physicians for their role in breastfeeding promotion.

Connaissances, attitudes et sources d'information concernant l'allaitement au sein chez les étudiants en médecine et les médecins à Bagdad

RÉSUMÉ Trois cent vingt (320) étudiants en médecine, 75 internes et 50 généralistes à Bagdad (Iraq) ont répondu à un questionnaire visant à évaluer les connaissances, les attitudes et la formation des médecins concernant l'allaitement au sein. Même si les attitudes vis-à-vis de l'allaitement au sein étaient généralement positives, moins de 50 % des médecins ont eu un score satisfaisant pour les questions relatives aux connaissances (≥ 50 % de réponses correctes). La plupart des généralistes (86,0 %) reconnaissaient que l'allaitement au sein était le type d'alimentation préféré contre seulement 58,4 % des étudiants en médecine et 57,3 % des internes. Les généralistes qui avaient bénéficié d'une formation ont eu un meilleur score que ceux qui n'en avaient pas bénéficié. Les principales sources d'information sur l'allaitement au sein étaient les cours de médecine communautaire et de pédiatrie et les principaux modes d'instruction étaient les cours magistraux et les sessions cliniques. Le programme d'études des écoles de médecine et la formation des internes ne préparent pas suffisamment les médecins au rôle qu'ils ont à jouer dans la promotion de l'allaitement au sein.

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Introduction

It has been estimated that the lives of 1 million infants a year can be saved in the developing world by promoting breastfeeding [*1*]. In addition to the nutritional and psychological values of breast milk, it contains antibodies that help to protect the baby against many common childhood diseases. It is clean, always at the right temperature, inexpensive and nearly every mother has more than enough of this high quality food for her baby. For such a promotional campaign to be effective, attitudes and practices of health providers must be changed [*1–3*]. Health professionals need accurate, current scientific information combined with lactation and breastfeeding management skills [*4–7*]. In order to assure the availability of such professionals, clinical learning opportunities concerning lactation and breastfeeding must become a core unit of medical and nursing education and of postgraduate training in prenatal specialties [*8–13*].

It is now an established fact that breastfeeding is not a purely instinctive behaviour but it is an art transmitted from generation to generation and traditionally the skills of breastfeeding were handed down within families. Female relatives well-versed in the art of breastfeeding cared for new mothers and babies in the early weeks after childbirth. Breastfeeding has been undermined by the medicalization of pregnancy and childbirth and by commercial formula-milk popular since the l950s. In the past 50 years, mothers have given birth increasingly in hospitals, away from the help of their families and cared for by hospital personnel with at best little or no experience in breastfeeding instruction and at worst incorrect knowledge and prejudicial attitudes. Even more recently, mothers and babies are sent home from the hospital just 1 or 2 days after delivery, long before the mother's milk has "come in" [*14*].

It was in this context that the present study was undertaken in Baghdad, Iraq to assess medical students' and physicians' knowledge, attitudes and training in relation to breastfeeding promotion. To the best of our knowledge, there are no pervious published studies on this subject in Iraq.

Methods

The study was carried out between 1 April and 31 July 2000. Three groups of health professionals completed questionnaires:

- Medical students from the 4th, 5th and 6th years at University of Baghdad, Saddam University and Al-Mustansirya University. Questionnaire forms were distributed randomly to 400 medical students in the classroom following lectures.
- Resident doctors from 6 different hospitals selected randomly from Baghdad governorate. With the aid of chief residents of the hospitals, questionnaire forms were distributed randomly to 100 resident doctors.
- General practitioners from 6 different primary health care centres selected randomly from Baghdad governorate. Questionnaire forms were distributed randomly to 75 general practitioners in their primary health care centres.

The self-administered questionnaires included questions to assess basic breastfeeding knowledge, attitudes and training experiences. The form was designed and reviewed by a panel of doctors including a breastfeeding consultant and was pretested on a random sample of 10 medical students and 5 resident doctors to check for clarity of interpretation and ease of completion.

The questionnaire contained 50 items: 30 on knowledge about breastfeeding, 10 on problem-solving techniques, 6 on attitudes to breastfeeding and 4 on training about breastfeeding techniques. Regarding questions related to attitudes and teaching methods, participants were asked to choose the most accurate answer (some were multiple choice and other were yes/no format). For questions about breastfeeding knowledge and training experiences, participants given a series of statements and asked to score T for a true statement, F for a false one and D for don't know. Questions about problem-solving asked about suitable advice to give lactating mothers and suitable management of certain breastfeeding problems.

The pass mark for knowledge and problem-solving questions was 50% or more answers correct. To obtain a mean overall score for positive attitude, the percentages scoring positive for each question were summed and divided by 5.

Results

The total number of respondents was 445 (265 males and 180 females). The response rates were 80.0% (320/400) for medical students, 75.0% (75/100) for resident doctors and 66.7% (50/75) for general practitioners.

Table 1 shows that general practitioners had the most positive attitudes towards breastfeeding when asked "What do you prefer for feeding your baby in the futuer?"; 86.0% thought breastfeeding was the preferred type of infant feeding compared with only 58.4% of medical students and 57.3% of resident doctors. Similarly, responses to all 5 attitude questions showed that more general practitioners had positive attitudes towards breastfeeding (Table 2).

In contrast with the low scores for preferred type of feeding, a high percentage of all respondents said that they encourage their family members and friends to breastfeed their babies (Table 2). Less than half of the medical students and residents (36.3% and 49.3%) agreed they would encourage a working mother to breastfeed her baby in her workplace compared with 60.0% of general practitioners. Only 38.7% of resident doctors and 40.9% of medical students thought it was appropriate for a mother to breastfeed her baby with modesty anywhere compared with 54.0% of general practitioners. A high proportion of all types of medic agreed that it is important to begin breastfeeding immediately after delivery. The mean percentage of general practitioners with positive attitudes was 76.8% compared with 68.8% for medical students and 70.1% for resident doctors.

Table 1 **Respondents' preferences for type of infant feeding**

Type of feeding preferred	Medical students (*n* = 320)		Resident doctors (*n* = 75)		General practitioners (*n* = 50)	
	No.	%	No.	%	No.	%
Breastfeeding	187	58.4	43	57.3	43	86.0
Artificial feeding or mixed feeding	133	41.6	32	42.7	7	14.0

n = ***number of respondents.***

Table 2 **Respondents with positive attitudes towards breastfeeding**

Attitude question	Medical students (*n* = 320) No.	%	Resident doctors (*n* = 75) No.	%	General practitioners (*n* = 50) No.	%
Do you encourage your family members and friends to breastfeed their babies?	314	98.1	73	97.3	50	100.0
Do you encourage a working mother to breastfeed her baby in her workplace?	116	36.3	37	49.3	30	60.0
Do you think it is appropriate for a mother to breastfeed her baby with modesty anywhere?	131	40.9	29	38.7	27	54.0
Is it important to begin breastfeeding straight after delivery?	315	98.4	73	97.3	50	100.0
Is it correct to ban the use of bottles and teats in teaching hospitals unless prescribed by doctors?	224	70.0	51	68.0	35	70.0
Positive attitude (mean of 5 questions)		68.8		70.1		76.8

Values are the number and percentage of respondents giving a positive response to each question.
n **= *number of respondents.***

Table 3 shows that scores on knowledge and problem-solving approaches towards breastfeeding were slightly higher among general practitioners; 50.0% had adequate knowledge ≥ 50% of questions correct) compared with 45.3% of resident doctors and 49.1%, 47.5% and 40.0% of 6th year, 5th year and 4th year medical students respectively. Of the 24 general practitioners who had received training, 75.0% scored over the pass mark on the knowledge questions whereas of the 26 untrained general practitioners, 27.0% scored a pass. The training, which is only available for general practitioners, is a World Health Organization 40-hour course about breastfeeding counselling. It is not a standard course for all general practitioners but any may choose to take it.

The sources of information and modes of instruction about breastfeeding for medical students and resident doctors during their college years are shown in Table 4. Community medicine and paediatric courses were the most common sources of information while the obstetric course was the least frequent source. Lectures and clinical sessions were the most common modes of instruction about breastfeeding while video presentations were the least frequent mode.

Discussion

There were some limitations to the study design; the difficulty in convincing the doctors to participate in the study is reflected

Table 3 **Respondents with adequate scores on knowledge about breastfeeding and problem-solving approaches towards breastfeeding**

Type of question (no. of questions)	Medical students (4th year) (*n* = 80)		Medical students (5th year) (*n* = 120)		Medical students (6th year) (*n* = 120)		Resident doctors (*n* = 75)		General practitioners (*n* = 50)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Knowledge questions (30)	36	45.0	54	45.0	66	55.0	47	62.7	25	50.0
Problem-solving questions (10)	32	40.0	31	25.8	47	39.2	42	56.0	35	70.0
Total (40)	32	40.0	57	47.5	59	49.1	34	45.3	25	50.0

Values are the number and percentage of respondents scoring correctly on ≥ 50% of questions.
n = ***number of respondents.***

in the low response rate from general practitioners.

General practitioners had the most positive attitudes towards breastfeeding of the 3 groups of medics, with 86.0% agreeing that breastfeeding was the preferred method of infant feeding and 76.8% having an overall positive attitude on 5 questions. This might be due to experience of breastfeeding for their own children and the fact that many had attended breastfeeding training courses. The teaching curriculum of

Table 4 **Respondents' sources of information and modes of instruction about breastfeeding**

Sources of information/ instruction	Medical students (4th year) (*n* = 80)		Medical students (5th year) (*n* = 120)		Medical students (6th year) (*n* = 120)		Resident doctors (*n* = 75)	
	No.	%	No.	%	No.	%	No.	%
Sources of information								
Community medicine	61	76.3	89	74.2	58	48.3	34	45.3
Paediatrics	36	45.0	114	95.0	104	86.7	75	100.0
Obstetrics	0	0	8	6.7	12	10.0	16	21.3
Other[a]	0	0	2	1.7	3	2.5	0	0
Modes of instruction								
Lectures	80	100.0	120	100.0	120	100.0	75	100.0
Clinical sessions	48	60.0	80	66.7	74	61.7	47	62.7
Breastfeeding demonstration	19	23.8	20	16.7	28	23.3	28	37.3
Slides	39	48.8	38	31.7	53	44.2	10	13.3
Videotape	5	6.3	4	3.3	17	14.2	7	9.3

[a]***Surgery.***
n = ***number of respondents.***

medical students in Iraqi universities includes little on infant feeding, rarely more than 2 hours of lectures, and residency training includes limited opportunities for direct patient interaction about breastfeeding [*15*].

It was found that a very high percentage of respondents would encourage breastfeeding among relatives and friends. These findings are higher than those of a study by Hollen on paediatricians and obstetricians in Los Angeles, California, which found that less than 45.0% of obstetricians and paediatricians would encourage an undecided mother to breastfeed [*8*]. Surprisingly, the proportion of medics preferring breastfeeding is lower than that encouraging breastfeeding among family members and friends. This discrepancy might be explained if most respondents know the benefits of breastfeeding so they encourage breastfeeding, but at the same time they believe that it is difficult for mothers to breastfeed their infants when they are working outside home most of the time. This reflects gaps in their knowledge about the practice of breastfeeding, milk expression and storage.

The present study also shows that a very high percentage of respondents thought that it was important to begin breastfeeding immediately after delivery. These results are higher than those found in a study done by Hull et al. in Indonesia, where they found that only 46.0% of 167 health professionals thought that breastfeeding should be initiated immediately after delivery [*6*].

Although obstetricians have the most important role on the decision to breastfeed and on the initiation of breastfeeding [*16*], the study shows that breastfeeding and infant feeding are generally dealt with during a course in paediatrics and community medicine. Rarely are these subjects dealt with during training in obstetrics and in other fields, and when they are, the instructions are usually essentially theoretical, while audio-visual materials, which can stimulate discussion or illustrate a specific aspect of the programme, are less frequently used [*17–19*]. These results are similar to that found by Freed et al. on paediatric and obstetric residents and practitioners from American medical colleges [*20,21*].

The highest general positive attitude and success rates among general practitioners were probably due to the training courses that they had taken during their service life. This study found that 75.0% of general practitioners who were trained had adequate knowledge compared with only 27.0% who had not been trained, and this coincides with the results of Rea et al. on health professionals in Sao Paulo, Brazil [*22*].

Conclusion

Although attitudes toward breastfeeding were generally positive among medical students and physicians in Baghdad, there were many areas in which knowledge was incomplete and in which wide variation existed in advice given to breastfeeding mothers. Thus the need for improved training of doctors is clear. It is necessary, however, to learn more about what constitutes effective, high quality training, including content and methodology and necessary hours of teaching and of supervised clinical practice, instead of just the effect of "any" versus "no" training.

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Regional workshop on infant and young child feeding

The World Health Organization organized a regional workshop on infant and young child feeding in Casablanca, Morocco, from 28 to 31 July 2003. The objectives of the workshop were to review the present status of infant and young child feeding in countries of the Eastern Mediterranean Region in relation to the global strategy for infant and young child feeding, and also to develop an outline of a country plan of action for promoting the implementation of the global strategy for infant and young child feeding at the national level in Member States. Experts from Afghanistan, Bahrain, Egypt, Islamic Republic of Iran, Morocco, Oman, Pakistan, Sudan, Syrian Arab Republic and Tunisia participated in the workshop as well as from UNICEF, FAO, USAID/West Bank, some nongovernmental organizations and WHO concerned staff.

Dietary fat and breast cancer in Saudi Arabia: a case–control study

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الدهن الغذائي وسرطان الثدي في المملكة العربية السعودية: دراسة للحالات والشواهد

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الخلاصة: يستعرض الباحثون دراسة للحالات والشواهد واستقصاء الترابط بين الدهن الغذائي وسرطان الثدي لدى نساء المملكة العربية السعودية، اللاتي يراجعن المستشفيات التخصصية في الرياض. وقد شملت الدراسة 499 من النساء المصابات بسرطان الثدي، اللواتي شُخِّصَتْ إصاباتُهن منذ وقت قريب في الفترة 1996 — 2002، إلى جانب 498 من النساء الشواهد اللواتي تم اختيارهن بشكل عشوائي، من المريضات اللواتي يراجعن المستشفيات لأسباب أخرى ومن قريباتهن، وقد استكمَلْنَ استبيانات حول تواتر الأكل، ثم أجري قياس مستويات الكولستيرول الكلي وثلاثي الغليسيريد في المصل، ووُجد ترابط إيجابي هام بين خطر الإصابة بسرطان الثدي وبين دخل الدهنيّات والبروتينات والكالوريات. وقد بلغت نسب الأرجحية المصحَحَّة لأعلى شريحة ربعية من الدخل الغذائي مقارنة بأخفض شريحة ربعية من الدخل الغذائي: 2.43 من الدهنيّات المشبعة، و2.25 من البروتين الحيواني، و2.12 من الدهنيّات المتعددة اللاتشبع، و1.88 من الكولستيرول، و2.69 من مجمل الطاقة المتناولة من الطعام. وقد بلغت نسبة الأرجحية المصحَحَّة لثلاثي الغليسريد في المصل 2.16 من أعلى شريحة ربعية.

ABSTRACT A case–control study investigated the association between dietary fat and breast cancer in Saudi Arabian women attending a specialist hospital in Riyadh. Women with breast carcinoma (***n*** = 499) newly diagnosed between 1996–2002, and control women (***n*** = 498) randomly selected from patients' attendants and relatives, completed a food frequency questionnaire. Serum levels of triglycerides and total cholesterol were measured. A significant positive association was found between risk of breast cancer and intake of fats, protein and calories. Adjusted odds ratios for the highest quartile of intake versus the lowest were 2.43 for saturated fat, 2.25 for animal protein, 2.12 for polyunsaturated fat, 1.88 for cholesterol and 2.69 for total energy from dietary intake. For serum triglycerides the adjusted odds ratio was 2.16 for the highest quartile.

Les graisses alimentaires et le cancer du sein en Arabie saoudite : étude cas-témoins

RÉSUMÉ Une étude cas-témoins a été réalisée pour examiner l'association entre les graisses alimentaires et le cancer du sein chez des femmes saoudiennes consultant dans un hôpital spécialisé à Riyad. Des femmes ayant un cancer du sein (n = 499) nouvellement diagnostiqué entre 1996 et 2002, et des femmes témoins (n = 498) choisies de manière aléatoire parmi les aidants et les parents des patientes ont rempli un questionnaire sur la fréquence de consommation alimentaire. Les taux sériques de triglycérides et de cholestérol total ont été mesurés. Une association positive significative a été observée entre le risque de cancer du sein et l'apport de graisses, de protéines et de calories. Le risque relatif ajusté pour le quartile de l'apport le plus élevé par rapport au quartile le plus bas était de 2,43 pour les graisses saturées, de 2,25 pour les protéines animales, de 2,12 pour les graisses polyinsaturées, de 1,88 pour le cholestérol et de 2,69 pour l'énergie totale provenant de l'apport alimentaire. Pour les triglycérides sériques, le risque relatif ajusté était de 2,16 pour le quartile le plus élevé.

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Introduction

A large body of evidence has accumulated concerning the association between diet and breast cancer. Much of this has focused on the possible causative role of dietary fat. These studies have provided somewhat inconsistent support for an association between fat intake and breast cancer [*1*]. Conclusions from some case–control studies have suggested a positive association between breast cancer and saturated fat intake [*2*], whereas others demonstrated a reduced risk due to total and polyunsaturated fat intake [*3*]. A prominent Harvard cohort study of nearly 90 000 American nurses compared nurses who ate low-fat diets with nurses who consumed higher fat diets and concluded that no relationship existed between the risk of breast cancer and the amount of fat consumed [*4*]. Willett's review of epidemiological studies of the relationship between diet and breast and colon cancers suggested there was a null or weak association between dietary fat and breast cancer [*5*].

In Saudi Arabia, breast cancer is becoming a major health risk and is the most common female malignancy in the country [*6–8*]. Several studies have shown an upward trend in the incidence of breast cancer in Saudi Arabia [*9–13*]. Breast malignancy had the highest relative frequency in the eastern region of Saudi Arabia during 1981–83 in relation to previous studies [*9*]. This shows an upward trend in that region as it rose from the third most common cancer during 1952–60 to the second most common in 1962–73 [*10*]. However, it is the sixth most common malignancy in the southern region [*11*], and for females it is the most common cancer [*12*]. The number of breast cancer cases registered at King Khalid University Hospital, Riyadh were 47, 48 and 107 during the periods 1985–87, 1988–90 and 1990–93 respectively and breast cancer was the second most common malignancy among females in that hospital [*13*]. Data suggests that breast cancer in Saudi Arabia occurs in a relatively younger age group compared with industrialized countries. The mean age of Saudi women with breast cancer is 47 years as compared with 54 years in Western Europe and America [*9*].

With increasing prosperity and commercial exposure of the population of Saudi Arabia, there has been an influx of western affluence foods over the last 3 decades. The increased consumption of new types of food, which are rich in fat, meat and refined carbohydrates, may be a contributory factor for the increase in breast cancer incidence in Saudi Arabia. The national nutrition survey of the population of Saudi Arabia showed that per capita energy intake in Saudi Arabia rose from 1801 kcal in 1971 to 3082 kcal in 1992 [*14,15*]. Percent of energy from carbohydrates decreased from 75% to 43% and from fat increased from 10% to 42% during the same period. Protein intake increased from 49 g/day in 1971 to 114 g/day in 1992, with 60% of protein intake from animal sources, while fat intake increased from 34 g to 144 g during the same period.

Despite concerns about changing dietary habits and the incidence of breast cancer in Saudi Arabia, no study has investigated the association between diet and breast cancer among Saudi females. Therefore, this case–control study at a specialist hospital in Riyadh was conducted to investigate if there is an association between breast cancer and dietary risk factors, including high protein, fat and calorie intake, high body mass index (BMI) and raised serum cholesterol and trigycerides levels.

Methods

Sample

This was a case–control study of women attending the breast cancer clinic at King Faisal Specialist Hospital and Research Centre in Riyadh. Patients attending the hospital are referred from all areas of the country.

The sample size was estimated by assuming the proportion with high fat intake among controls is 9% and among cases 15% to give an odds ratio of 1.78 as an indication of a significant association between fat intake and breast cancer (α = 0.05, 1–β= 0.80). Using *Epi-Info*, version 6, the number of cases required was 500 and controls 500.

The cases were recruited prospectively in the order in which they came to the clinic and were women with newly diagnosed, histopathologically confirmed breast cancer. Control women were selected from the patients' attendants and relatives, frequency matched for age, parity, breastfeeding practice and age at marriage. Data collection took place from September 1996 to April 2002.

The women were enrolled after giving informed consent. Approval for the study was obtained from the Ethics Committee of the Research Centre of King Faisal Specialist Hospital.

Dietary study

An existing food frequency questionnaire, used in the National Nutrition Survey for Saudi Arabia [*14*], was modified to accommodate the food habits of Saudis. To help record the usual intake of food items accurately we used food models. The 40 food items listed in the questionnaire were: beef, lamb, poultry, fish, camel meat, goat meat, eggs, corn oil, olive oil, sunflower oil, *ghee*/*samnah*, butter, *shaham*, *ghusdah*, *tahinah*, other fats and oils, salt, pepper, sauces, vegetables, fruits, cow's milk, *laban* milk, yoghurt, cheese, powdered milk, camel's milk, goat's milk, concentrated milk, sweetened condensed milk, milk with other flavours, tea with milk, coffee with milk, coffee without milk, bran flakes, corn, bread, rice, cakes, pie, pudding, ice cream, crème caramel. The food frequency questionnaire was administered by interview using well-trained nutritionists. Intake frequencies were expressed as number of times each item was consumed per week. The food frequency data were cross-checked with a 3-day food record.

A risk factors questionnaire collected demographic, anthropometric and reproductive information from cases and controls. It included questions on nationality, residence, age, age at menarche, menopausal status, breastfeeding, number of pregnancies, number of abortions, history of oral contraceptive use, family history of breast cancer, weight and height (for calculation of body mass index).

Serum levels of total cholesterol and triglycerides were obtained for patients and controls. For patients, the data was extracted from the laboratory records. For controls, a blood sample was taken and analysed at the hospital laboratory.

Diet analysis software (NSL Diet Analyzer and *WinDiet* version 5) and Saudi food tables [*14*] were used to indirectly calculate nutrients from reported intakes of individual foods. We calculated the daily intake of: total energy (kcal), total fat (g), saturated fat (g), polyunsaturated fat (g), protein (g) and cholesterol (mg) from the self-reported food consumption and validated against the 3-day food record. One case and 2 controls were excluded from the analysis because of unacceptably low or high nutrient values. Thus data from 499 cases and 498 controls were analysed.

Statistical analysis

Means and standard deviations (SD) were compared using the *t*-test and frequencies using the chi-squared test. Odds ratios were estimated and 95% confidence intervals (CI) from multiple logistic regression, adjusting for the following potential confounding factors: age, nationality, province and menopausal status. We modelled nutrients across quartiles using the first quartile as the reference group. A *P*-value less than 0.05 was considered significant.

Results

Table 1 shows the demographic and reproductive characteristics of the study sample. Breast cancer cases relative to controls in this study group were older ($P < 0.001$), less heavy ($P < 0.01$) and shorter ($P < 0.0001$) with similar BMI, had more pregnancies ($P < 0.0001$), had a higher age at menarche ($P < 0.05$) and were less likely to have ever-used oral contraceptives ($P < 0.01$).

Table 2 shows the relationship between breast cancer and serum triglycerides level, cholesterol level and BMI for the case and control samples analysed at the 25th, 50th and 75th percentiles. Univariate analyses showed that cases and controls had no significant association between serum cholesterol level and BMI and breast cancer. However, the cases had significantly higher serum triglycerides levels than the control women. The multivariate odds ratio for raised trigycerides level, adjusted for age, nationality, province and menopause, was 2.16 (95% CI: 1.21–3.88) at the highest quartile ($P < 0.05$).

Table 1 **Demographic and reproductive characteristics of breast cancer cases and control women**

Characteristics	Mean (SD) values		*P*-value
	Cases (*n* = 499)	Controls (*n* = 498)	
Age (years)	44.8 (11.5)	36.8 (12.8)	0.0001
Age at menarche (years)	13.2 (1.5)	13.0 (1.6)	0.037
Age at menopause (years)	48.2 (7.6)	47.9 (8.1)	0.759
Age at first delivery (years)	20.6 (4.9)	20.7 (4.5)	0.759
Age at marriage (years)	20.6(4.8)	20.7(12.1)	0.174
Number of pregnancies	6.6 (3.8)	5.3 (3.8)	0.0001
Number of abortions	1.0 (1.4)	1.0 (1.4)	0.968
Weight at diagnosis (kg)	70.0 (15.3)	72.4 (14.9)	0.014
Height at diagnosis (cm)	154.1 (6.7)	157.1 (6.5)	0.0001
Body mass index (kg/m^2)	29.5 (6.2)	29.4 (6.2)	0.818
% ever-used oral contraceptives	54.1	62.5	0.013
% breastfeeding	89.7	85.9	0.094
% family history of breast cancer	15.0	12.1	0.174

n = ***number of women.***
SD = ***standard deviation.***

Table 2 **Relation between breast cancer and serum lipid levels and body mass index for case and control women analysed by quartiles**

Variables (quartiles)	No. of cases/ controls	Crude odds ratio (95% CI)	Age/province adjusted odds ratio (95% CI)	Multivariate adjusted odds ratio[a] (95% CI)
Triglycerides (mM/L)				
< 0.9	47/95	1 (reference)	1 (reference)	1 (reference)
0.9–1.3	54/80	1.36 (0.84–2.23)	1.03 (0.60–1.74)	0.73 (0.40–1.32)
> 1.3–2.0	75/68	2.23 (1.38–3.60)**	1.75 (1.04–2.94)*	1.67 (0.96–2.93)
> 2.0	77/53	2.90 (1.79–4.81)***	2.21 (1.29–3.79)**	2.16 (1.21–3.88)*
Cholesterol (mM/L)				
< 4.3	122/140	1 (reference)	1 (reference)	1 (reference)
4.3–5.0	117/115	1.67 (0.82–1.67)	0.95 (0.64–1.41)	0.80 (0.51–1.25)
> 5.0–5.7	140/131	1.23 (0.87–1.72)	1.05 (0.72–1.54)	0.92 (0.59–1.43)
> 5.7	120/112	1.23 (0.86–1.75)	1.13 (0.76–1.68)	0.96 (0.63–1.55)
Body mass index (kg/m^2)				
< 24.9	113/135	1 (reference)	1 (reference)	1 (reference)
24.9–28.9	131/118	1.33 (0.93–1.89)	0.91 (0.61–1.36)	0.80 (0.51–1.25)
> 28.9–33.5	125/124	1.20 (0.85–1.71)	0.69 (0.46–1.03)	0.92 (0.59–1.43)
> 33.5	128/120	1.27 (0.89–1.81)	0.66 (0.44–0.99)	0.99 (0.63–1.55)

[a]***Adjusted for age, nationality, province and menopause.***
P< 0.05; **P< 0.01; ***P< 0.001.
CI = confidence interval.

Table 3 shows the association between breast cancer and daily intake of different nutrients for the cases and controls analysed at the 25th, 50th and 75th percentiles of the recommended daily allowance. Crude and adjusted odds ratios of these nutritional factors in relation to breast cancer are also given. Univariate analysis showed that cases and controls were similar in intake of total protein, but cases had significantly lower intake of energy and of all the components of fat (total fat, saturated and polysaturated fats) relative to controls ($P <$ 0.05). When adjusted for age and province, none of the nutrition variables showed an association with breast cancer.

Table 3 also presents the odds ratios for the intake of various nutrients to breast cancer after adjustment for age, nationality, province, menopause and triglycerides levels. This analysis showed that the intake of protein was significantly related to breast cancer risk after adjustment for other possible confounding factors. Multivariate adjustment reversed the associations noted earlier between breast cancer and the various dietary components. The adjusted odds ratios for the highest quartile of intake versus the lowest were 2.43 (95% CI: 1.36–4.34) for saturated fat, 2.25 (95% CI: 1.27–3.99) for animal protein, 2.12 (95% CI: 1.17–3.83) for polyunsaturated fat, 1.88 (95% CI: 1.03–3.44) for cholesterol, 2.69 (95% CI: 1.51–4.81) for total energy obtained from fat, and 2.16 (95% CI: 1.21–3.88) for triglycerides. It is worth noting that the association between triglycerides and the risk of breast cancer remained significantly positive irrespective of all other variables investigated (Table 2).

Table 3 **Relationship between breast cancer and self-reported daily intake of dietary nutrients for case and control women analysed by quartiles**

Daily intake of nutrient (quartiles)	No. of cases/ controls	Crude odds ratio (95% CI)	Age/province adjusted odds ratio (95% CI)	Multivariate adjusted odds ratio[a] (95% CI)
Total energy from fat (kcal)				
< 1084.1	131/118	1 (reference)	1 (reference)	1 (reference)
1084.1 < 1426.2	130/119	0.98 (0.69–1.40)	1.24 (0.84–1.83)	2.65 (1.44–4.86)**
1426.2 < 1872.9	132/118	1.00 (0.71–1.43)	1.27 (0.85–1.88)	3.19 (1.74–5.83)***
> 1872.9	106/143	0.67 (0.47–0.95)*	0.84 (0.56–1.24)	2.69 (1.51–4.81)**
Total protein (g)				
< 52.2	127/122	1 (reference)	1 (reference)	1 (reference)
52.2 < 68.9	130/119	1.05 (0.74–1.49)	1.14 (0.77–1.68)	2.65 (1.41–4.98)**
68.9 < 88.1	135/115	1.13 (0.79–1.60)	1.16 (0.78–1.72)	3.12 (1.71–5.70)***
> 88.1	107/142	0.72 (0.51–1.03)	0.74 (0.50–1.09)	2.25 (1.27–3.99)**
Total fat (g)				
< 35.4	134/115	1 (reference)	1 (reference)	1 (reference)
35.4 < 51.1	128/121	0.91 (0.64–1.29)	1.08 (0.73–1.60)	1.65 (0.90–3.02)
51.1 < 70.9	138/112	1.06 (0.74–1.50)	1.34 (0.91–1.99)	2.67 (1.47–4.83)**
> 70.9	99/150	0.57 (0.40–0.81)**	0.73 (0.49–1.09)	1.64 (0.92–2.95)
Polyunsaturated fat (g)				
< 19.9	138/111	1 (reference)	1 (reference)	1 (reference)
19.9 < 30.4	127/122	0.84 (0.59–1.19)	0.96 (0.65–1.41)	2.15 (1.17–3.92)*
30.4 < 41.3	126/124	0.82 (0.58–1.16)	1.12 (0.76–1.67)	2.43 (1.30–4.53)**
> 41.3	108/141	0.62 (0.43–0.88)**	0.78 (0.53–1.16)	2.43 (1.36–4.34)**
Polyunsaturated fat (g)				
< 15.6	131/118	1 (reference)	1 (reference)	1 (reference)
15.6 < 21.3	144/105	1.23 (0.87–1.76)	1.56 (1.05–2.31)	2.19 (1.18–4.07)*
21.3 < 29.2	124/126	0.89 (0.62–1.26)	1.15 (0.78–1.70)	2.73 (1.53–4.87)**
> 29.2	100/149	0.61 (0.42–0.86)**	0.78 (0.52–1.15)	2.12 (1.17–3.83)*
Cholesterol (mg)				
< 169.6	135/114	1 (reference)	1 (reference)	1 (reference)
169.6 < 266.4	128/121	0.89 (0.63–1.27)	1.00 (0.68–1.48)	1.64 (0.90–2.98)
266.4 < 400.7	125/125	0.84 (0.59–1.20)	0.99 (0.67–1.46)	2.11 (1.16–3.84)*
> 400.7	111/138	0.68 (0.48–0.97)*	0.81 (0.55–1.20)	1.88 (1.03–3.44)*

[a]***Adjusted for age, nationality, province, menopause and triglycerides.***
*P***< 0.05; ****P***< 0.01; *****P***< 0.001.***
CI = confidence interval.

Discussion

Breast cancer is the most common cancer among women in Saudi Arabia. The number of reported cases of breast cancer in Saudi Arabia in 1999–2000 was 1157 (out of a female population of 7 788 754) [*8*]. There is no available data showing the number of deaths that can be attributed to breast cancer in Saudi Arabia. The descriptive epidemiology of breast cancer has

demonstrated a rapid increase in the incidence rates in developing countries [*16,17*]. Identification of the contributing factors for the increasing rate would contribute substantially to our understanding of the epidemiology of breast cancer [*16*]. Environmental factors rather than genetic factors have been considered as the reason for variation in breast cancer rates among countries [*17*].

Socioeconomic development is normally associated with increasing wealth, changing lifestyle, disease pattern and increasing life expectancy. This association of changes, known as epidemiologic transition, is seen in many parts of the world and is very well demonstrated in Saudi Arabia, which has experienced rapid socioeconomic changes during the last 3 decades. As food habits mimic changes in lifestyle, there has been a dramatic shift from traditional foods which are based on whole wheat flour, milk and dates towards an affluent diet which is rich in total calories, meat, fat and refined carbohydrates. This change in dietary habit may be related to the increase in the number of breast cancer cases in Saudi Arabia [*6–8*].

Dietary fat has been proposed as one of the etiologic factors for breast cancer [*2,4,5*]. However, the relationship between fat intake and the risk of breast cancer has been examined in a number of case–control and cohort studies. The findings reported in the literature are not conclusive enough to establish a pattern for the real cause of the disease [*4,5*].

Our data suggest that, among women living in Saudi Arabia, a diet that is high in fat predisposes to breast cancer development. In terms of nutrients, this high-risk dietary profile translates to a modest, positive association with total fat intake, saturated fat, and cholesterol. This is in contrast to an earlier study, which has cast doubt on a positive association between dietary fat and breast cancer [*4*]. However, our findings agree with those of Toniolo et al. [*18*] and Zaridze et al. [*19*] who showed a positive association between high dietary fat intake and breast cancer. Also high animal protein intake was significantly associated with breast cancer in our study, which supports the findings of De Stefeni et al. [*20*] and Levi et al. [*21*] who showed a positive relationship between high dietary meat consumption and breast cancer. Boyd et al. in their quantitative summary of all papers published up to July 2003 on dietary fat and the risk of breast cancer found intake of saturated fat and meat consumption is associated with an increased risk of breast cancer [*22*].

High consumption of sugar-rich foods, meat and other animal products rich in saturated fats has been recorded in Saudi Arabia [Khan MA, unpublished report, 1996]. Despite the inconclusive evidence about diet and disease, it is important to educate the population about the possibility of a link between dietary habits and cancer and to encourage them to adopt a diet that is low in calories, saturated fat and meat intake.

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Obesity and cardiovascular disease risk factors in Tehran adults: a population-based study

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السِّمْنَة وعوامل اختطار الأمراض القلبية الوعائية لدى البالغين في طهران: دراسة مستعرضة سكّانيَّةُ المرتَكَز

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الخلاصة: تم تقييم العلاقة بين السِّمْنَة وعوامل اختطار الأمراض القلبية الوعائية لدى 3622 من الذكور و5025 من الإناث ممن تتراوح أعمارهم بين 20 و70 عاماً في دراسة طهران للغلوكوز والشحميَّات. وتم حساب مَنْسَب كتلة الجسم، ومحيط الخصر، ومَنْسَبَيْ الخصر للطول والخصر للورك. وقد وجد أن الأشخاص السِّمَان يتعرضون لاختطار عالٍ من الإصابة بارتفاع ضغط الدم، وفرط الكوليستيرول الكلي وفرط ثلاثي الغليسريدات، وفرط كوليستيرول البروتينات الشحمية الخفيضة الكثافة، وانخفاض كوليسترول البروتينات الشحمية الرفيعة الكثافة، بأكثر مما يتعرض له غير السِّمان. أما من تتركز السِّمنة لديهم في أوسط البَدَن فهم أكثر تعرضاً لفرط ثلاثي الغليسيريد وارتفاع ضغط الدم وفرط الكوليستيرول الكلي. والسمينات أكثر تعرضاً للإصابة بارتفاع ضغط الدم وبفرط ثلاثي الغليسيريد وبفرط الكوليستيرول الكلي، وفرط كوليستيرول البروتينات الشحمية الخفيضة الكثافة، وانخفاض كوليسترول البروتينات الشحمية الرفيعة الكثافة، مقارنة بغيرهن من غير السمينات. أما من تتركز السِّمنة لديهن في أوسط البَدَن فلديهن أرجحية أعلى من غيرهن للإصابة بفرط ثلاثي الغليسيريد وانخفاض كوليسترول البروتينات الشحمية الرفيعة الكثافة. وتوضح الدراسة مدى الحاجة للتثقيف حول التغيير في أنماط الحياة في جمهورية إيران الإسلامية.

ABSTRACT The relationship between obesity and cardiovascular disease risk factors was assessed in 3622 males and 5025 females aged 20–70 years. Body mass index, waist circumference, waist-to-height and waist-to-hip ratios were calculated. Obese men had a higher risk of hypertension, high total cholesterol (TC), high triglycerides (TG), high low-density lipoprotein cholesterol (LDL-C) and low high-density lipoprotein cholesterol (HDL-C) levels than non-obese men. Centrally obese men were more susceptible to high TG, hypertension and high TC. Obese women had a higher chance of being hypertensive and having high total TC, high TG, high LDL-C and low HDL-C levels than non-obese females. Centrally obese women had higher odds for high TG and low HDL-C. There is a need for education about lifestyle change in the country.

Obésité et facteurs de risque de maladies cardio-vasculaires chez l'adulte à Téhéran : étude transversale dans une population définie

RÉSUMÉ La relation entre l'obésité et les facteurs de risque de maladies cardio-vasculaires a été évaluée chez 3622 hommes et 5025 femmes âgés de 20 à 70 ans. L'indice de masse corporelle, le tour de taille, le rapport tour de taille/taille et le rapport tour de taille/tour de hanches ont été calculés. Les hommes obèses avaient un risque plus élevé d'hypertension, de cholestérol total élevé, de triglycérides élevés, de cholestérol des lipoprotéines de basse densité (LDL) élevé et de cholestérol des lipoprotéines de haute densité (HDL) bas que les hommes non obèses. Les hommes ayant une obésité centrale étaient plus susceptibles d'avoir des triglycérides élevés, une hypertension et un cholestérol total élevé. Les femmes obèses risquaient davantage d'être hypertendues et d'avoir un taux élevé de cholestérol total, de triglycérides, de cholestérol LDL et un faible taux de cholestérol HDL que les femmes non obèses. Les femmes ayant une obésité centrale avaient une plus forte probabilité d'avoir un taux élevé de triglycérides et un faible taux de cholestérol HDL. Ces résultats mettent en évidence la nécessité d'une éducation concernant le changement de mode de vie en République islamique d'Iran.

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Introduction

Obesity, determined as excess body fat, is one of the most common health problems worldwide, with an estimated 1.2 billion people affected [*1*]. Studies in the Islamic Republic of Iran have shown an increasing prevalence of obesity, which is expected to rise in the future due to increasing urbanization [*2–4*]. The prevalence of obesity and overweight in Tehran among individuals aged over 20 years is 23% and 40% respectively [*5*]. Obese people are more susceptible to chronic non-communicable diseases such as cardiovascular disease (CVD), diabetes and some cancers [*6*]. In contrast to trends observed in northern Europe and the USA [*7*], recent data show that mortality from CVD is increasing in the Islamic Republic of Iran [*5*] and this may be attributed to a rising prevalence of obesity.

Most published papers discussing the relation of CVD and obesity are from the industrialized countries and limited data exists in developing countries. According to our knowledge, no epidemiological study has been published about the relationship between obesity and risk factors for CVD in the Islamic Republic of Iran. The present study was conducted within the framework of the Tehran Lipid and Glucose Study, the design and objectives of which have been published earlier [*8*]. Briefly, it is a prospective study to determine the prevalence of non-communicable disease risk factors in residents of district 13 of Tehran with the goal of developing guidelines for a healthy lifestyle. This paper reports the findings about the relationship between obesity and selected CVD risk factors in people aged 20–70 years old.

Methods

In the Tehran Lipid and Glucose Study, 15 005 people aged 3 years and over living in district 13 of Tehran were selected by a multistage cluster random sampling method; 9984 of them were aged 20–70 years. Those with at least one missing variable (n = 1337) were excluded from the study and thus data were analysed for 8647 participants (3622 men and 5025 women). The proposal for the study was approved by the research council of the Endocrine Research Centre of Shaheed Beheshti University of Medical Sciences and informed written consent was obtained from each subject.

Data collection

Participants were interviewed privately, face-to-face, by trained interviewers using pre-tested questionnaires. Initially, information on age, educational level and smoking habits was collected. Weight was then measured while the subjects were minimally clothed without shoes using digital scales and recorded to the nearest 100 g. Height was measured in a standing position without shoes using a tape meter while the shoulders were in normal position. Body mass index was calculated as weight (kg) divided by height (m^2). Waist circumference (cm) was measured at the point of noticeable waist narrowing, and hip circumference (cm) was measured over light clothing at the widest girth of the hip [*9*]. To avoid subjective error, all measurements were done by the same person. Waist-to-hip and waist-to-height ratios were calculated by dividing waist circumference by hip circumference and height respectively. Obesity was defined by World

Health Organization criteria as BMI ≥ 30 kg/m^2 [*10*]. Waist circumference cut-off points used were > 90 cm for men and > 80 cm for women [*11*]. For waist-to-hip ratio a cut-off value of > 0.9 was used for men and > 0.8 for women [*11*]. The cut-off for waist-to-height ratio was ≥ 50 for both sexes [*12*].

Blood pressure measurement

Before measuring the blood pressure, the participant was asked about tea or coffee consumption, physical activity, smoking and a full bladder (which might elevate blood pressure).

Participants were initially made to rest for 15 minutes. Then a qualified physician measured their blood pressure 2 times in a seated position following 1 initial measurement for determining peak inflation level using a standard mercury sphygmomanometer. Based on the circumference of the participant's arm, a regular adult cuff was chosen. The cuff was placed on the participant's right arm, at the heart level and inflated as rapidly as possible until the cuff pressure was 30 mmHg above the level at which the radial pulse disappeared. There was at least a 30-second interval between these 2 separate measurements; thereafter the mean of 2 measurements was considered as the participant's blood pressure. The systolic blood pressure was defined as the appearance of the first sound (Korotkoff phase 1) and diastolic blood pressure was defined as the disappearance of the sound (Korotkoff phase 5) during deflation of the cuff at a 2–3 mm per second decrement rate of the mercury column.

Hypertension was defined as systolic blood pressure ≥ l40 mmHg or diastolic pressure ≥ 90 mmHg or current treatment for hypertension, according to the criteria of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-VI) [*13*].

Serum lipid analysis

A blood sample was drawn between 07.00 and 09.00 hours into vacutainer tubes from all study participants after a 12–14 hours overnight fast. Blood samples were taken in a sitting position according to the standard protocol and centrifuged within 30 to 45 minutes of collection. All blood lipid analyses were done at the Tehran Lipid and Glucose Study research laboratory on the day of blood collection. The analysis of samples was performed using a Selectra 2 auto-analyser (Vital Scientific, Spankeren, Netherlands). Total cholesterol and triglyceride kits (Pars Azmoon, Islamic Republic of Iran) were used. Total cholesterol (TC) and triglycerides (TG) levels were assayed using enzymatic colorimetric tests with cholesterol esterase and cholesterol oxidase and glycerol phosphate oxidase respectively. High-density lipoprotein cholesterol (HDL-C) was measured after precipitation of the apolipoprotein B-containing lipoproteins with phosphotungstic acid. Low-density lipoprotein cholesterol (LDL-C) was calculated from serum TC, TG and HDL-C using the Friedwald formula [*14*]. It was not calculated when TG concentration was > 400 mg/dL.

Assay performance was monitored every 20 tests, using the lipid control sera Precinorm (for normal range) and Precipath (for pathological range) wherever applicable (Boehringer Mannheim, Germany). The Calibrator for Automated Systems (Boehringer Mannheim, Germany) was used to calibrate the Selectra 2 auto-analyser for each day of laboratory analyses. All samples were analysed when internal quality control met the acceptable criteria.

Inter- and intra-assay coefficients of variation were 2.0% and 0.5% for TC and 1.6% and 0.6% for TG respectively. Cut-off points corresponding to Adult Panel Treatment III criteria [*15*] for borderline high TC, TG, LDL-C and low HDL-C levels were used to define high TC (≥ 200 mg/dL), high TG (≥ 150 mg/dL), high LDL-C (≥ 130 mg/dL) and low HDL-C (< 40 mg/dL). TC/HDL-C ratio > 4 was also considered as an adverse serum lipid profile [*16*].

Statistical analysis

The participants were divided into 5 age groups; 20–29, 30–39, 40–49, 50–59 and 60–70 years. Statistical analysis was performed with an IBM computer using *SPSS*, version 9.05 statistical software package, and data were presented as mean, standard deviation (SD) and percentages. The age-specific distributions for high TC, high TG, high LDL-C and low HDL-C were calculated separately for males and females. Bivariate analysis was carried out, using the odds ratio (OR) to test for associations between obesity indicators and CVD disease risk factors. An OR with a 95% confidence interval that did not include the value of 1.00 in its range was considered statistically significant. For each cardiovascular risk factor, logistic regression models were run. Confounding variables such as age, educational level and smoking habits were included as covariates in all models.

Results

Prevalence of obesity and CVD disease risk factors

Of the 8647 participants, 2015 were obese (BMI ≥ 30 kg/m^2), giving an overall prevalence of obesity of 23.3%. A higher proportion of women were obese (1487, 29.6%) than men (528, 14.6%) ($P < 0.0$l). A further 3459 (40.0%) participants were overweight (BMI 25–< 30 kg/m^2), slightly more men (1534, 42.4%) than women (1925, 38.3%). The highest rate of obesity in both sexes was observed in the 50–59- years age group. The prevalence of obesity increased with age up to 60 years in males and females.

The mean (SD) of anthropometric indices by sex and age group are presented in Table 1. Although BMI was similar for men and women in the 20–29 years age group, men had lower BMI and waist-to-height ratio and higher waist-to-hip ratio than women of other age categories. Men aged 20–29 and 30–39 years had higher waist circumferences than women of corresponding age groups. Men over 40 years had lower waist circumferences than women. For all age groups of men, the mean BMI was approximately 2 kg/m^2 lower than for women, waist-to-height ratio was 4 units lower and waist-to-hip ratio was 0.08 greater. The highest BMI was in the 50–59-years age category in both sexes, whereas for the anthropometric indices BMI was highest in the 60–70-years category.

The prevalence of CVD disease risk factors is shown in Figure 1. For men, high TC/HDL was the most prevalent risk factor and for women it was high TC. An increase in prevalence of all risk factors was seen with increasing age, with the exception of a slight drop in the rate of high TG and low HDL-C in the older age groups, in both males and females.

The prevalence of high LDL-C and high TC in the 20–29-years group and hypertension in the 30–39-years group was the same in both sexes. However, among those aged < 40 years, men had a higher prevalence of risk factors compared with women of the same age, and among participants > 50 years, women had a higher prevalence of all CVD disease risk factors, except for low HDL-C and high TC/HDL as compared

Table 1 **Mean body mass index, waist circumference, waist-to-hip ratio and waist-to-height ratio by sex and age categories in the Tehran Lipid and Glucose Study**

Age group (years)	No. of subjects	Mean (SD) values			
		BMI (mg/kg^2)	Waist circumference (cm)	Waist-to-hip ratio	Waist-to-height ratio
			Men		
20–29	762	24.0 (4.4)	81.5 (11.3)	0.85 (0.06)	47.0 (6.6)
30–39	957	25.9 (4.0)	87.5 (10.8)	0.90 (0.06)	51.0 (6.3)
40–49	708	26.1 (3.8)	89.7 (10.3)	0.92 (0.06)	52.9 (6.1)
50–59	569	26.5 (3.8)	91.8 (10.4)	0.94 (0.06)	54.7 (6.2)
60–70	626	26.2 (3.7)	92.3 (10.5)	0.95 (0.06)	55.5 (6.2)
All	3622	25.7 (4.1)	88.2 (11.4)	0.91 (0.07)	51.9 (7.0)
			Women		
20–29	1208	24.1 (4.5)	77.8 (11.0)	0.77 (0.06)	48.8 (7.0)
30–39	1324	27.2 (4.6)	85.1 (11.1)	0.81 (0.07)	54.0 (7.2)
40–49	1040	29.4 (4.7)	91.6 (11.6)	0.85 (0.07)	58.6 (7.5)
50–59	818	29.6 (4.6)	94.9 (10.8)	0.89 (0.07)	61.4 (7.1)
60–70	635	28.7 (4.5)	95.0 (11.1)	0.91 (0.07)	62.3 (7.3)
All	5025	27.5 (5.0)	87.5 (13.0)	0.83 (0.08)	56.0 (8.8)

***BMI** = body mass index.*
***SD** = standard deviation.*

with men. Hypertension and high TC were more prevalent in women in the 40–49-years age group whereas high TG, high LDL-C and low HDL-C were more prevalent in men of this age group.

Relationship between obesity and cardiovascular disease

The relationship of obesity to CVD disease risk factors is presented as odds ratios for men and women in Table 2, controlling for confounding variables such as age, smoking habits and educational levels.

Compared with non-obese men, obese men had a higher chance of being hypertensive (OR = 2.80) and having high TG (OR = 1.76), low HDL-C (OR = 1.73), high TC (OR = 1.55) and high LDL-C (OR = 1.36). Men suffering from abdominal obesity (high waist-to-hip ratio) had higher odds for high TC (OR = 1.31), high TC/HDL-C (OR = 1.57) and hypertension (OR = 1.45). High waist-to-height ratio was associated with higher risk of having high TC/HDL-C (OR = 2.31), high TG (OR = 1.86), high LDL-C (OR = 1.77), high TC (OR = 1.54) and low HDL-C (OR = 1.39).

Compared with non-obese women, obese women had a higher chance of having all CVD disease risk factors, of which high TG and high TC/HDL-C were the most evident (Table 2). Women with central obesity (high waist-to-hip ratio) had higher odds for having high TG (OR = 1.80), low HDL-C (OR = 1.56) and high TC/HDL-C (OR = 1.53). Women with high waist-to-height ratio had a greater chance of being hypertensive (OR = 2.20) and having high TG (OR = 1.68), high TC (OR = 1.59) and high LDL-C (OR = 1.46).

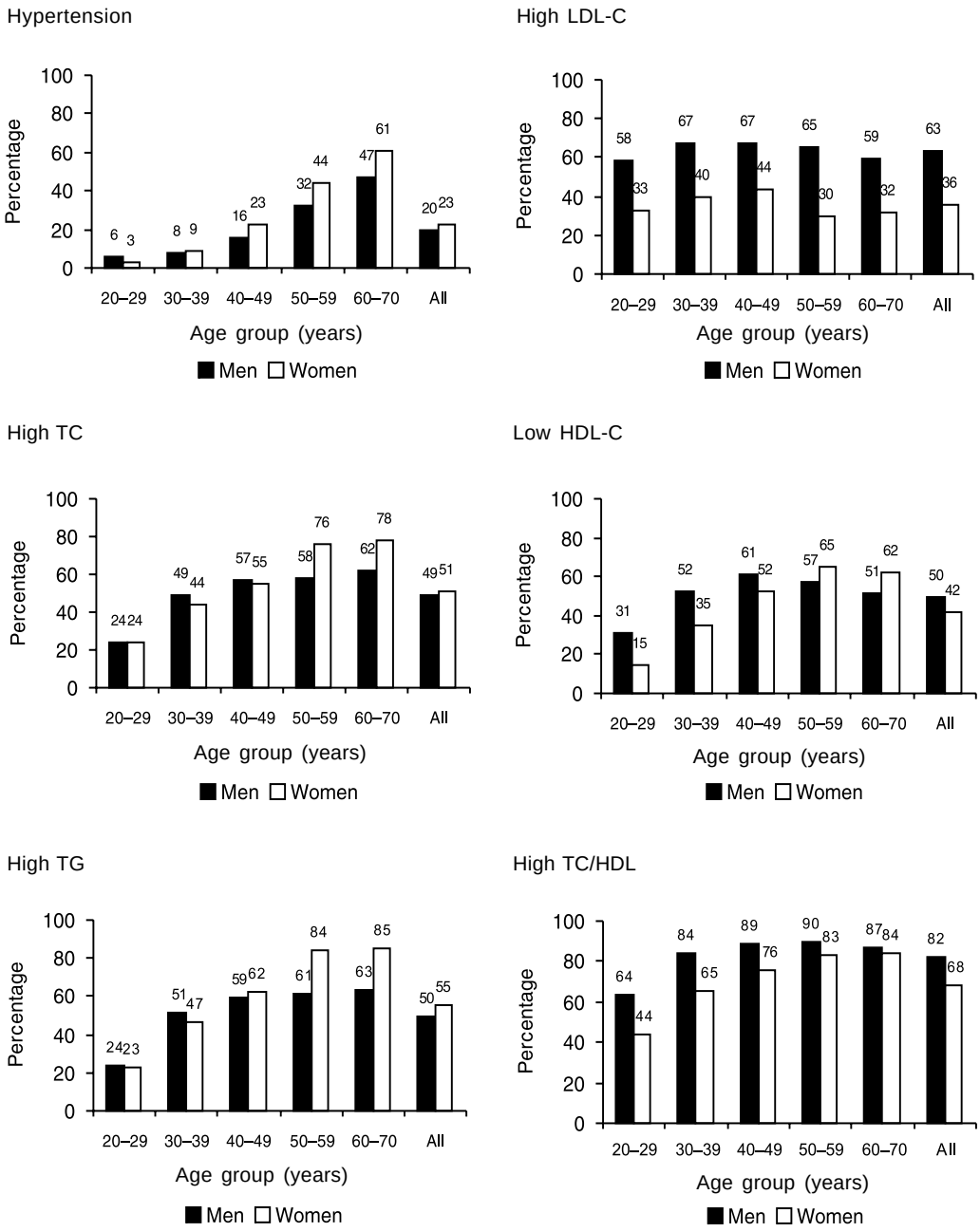


Figure 1 **Prevalence of cardiovascular disease risk factors by sex and age categories for 3622 men and 5025 women in the Tehran Lipid and Glucose Study (TC = total cholesterol; TG = triglycerides; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol)**

Table 2 Odds ratio for cardiovascular disease risk factors according to obesity indices in men and women

Risk factor	Odds ratio (95% CI)			
	BMI (mg/kg²)	Waist circumference (cm)	Waist-to-hip ratio	Waist-to-height ratio
	Men (*n* = 3622)			
Hypertension	2.80 (1.88–4.16)**	1.09 (0.80–1.49)	l.45 (1.03–2.03)*	1.15 (0.77–1.71)
High TC	1.55 (1.13–2.12)**	0.95 (0.74–1.20)	1.31 (1.04–1.65)*	1.54 (1.18–2.20)**
High TG	1.76 (1.28–2.40)**	1.08 (0.85–1.38)	1.80 (1.43–2,26)**	1.86 (1.42–2.43)**
High LDL-C	1.36 (1.00–1.85)*	0.80 (0.63–1.01)	1.19 (0.94–1.50)	1.77 (1.35–2.32)**
Low HDL-C	1.73 (1.25–2.39)**	0.93 (0.73–1.20)	1.25 (0.98–1.58)	1.39 (1.05–1.82)*
High TC/HDL-C	1.31 (0.81–2.14)	1.00 (0.66–1.51)	1.57 (1.13–2.18)**	2.31 (1.57–3.39)**
	Women (*n* = 5025)			
Hypertension	2.47 (1.79–3.41)**	0.95 (0.63–1.43)	1.11 (0.82–1.50)	2.20 (1.34–3.61)
High TC	1.66 (1.32–2.10)**	1.03 (0.78–1.30)	1.08 (0.88–1.32)	1.59 (1.19–2.33)**
High TG	2.58 (2.05–3.26)**	0.97 (0.73–1.29)	1.80 (1.46–2.22)**	1.68 (1.23–2.29)**
High LDL-C	1.41 (1.13–1.77)**	0.97 (0.74–1.27)	1.08 (0.88–1.32)	1.46 (1.10–1.94)**
Low HDL-C	1.92 (1.54–2.40)**	1.19 (0.91–1.57)	1.56 (1.28–1.91)**	0.91 (0.68–1.21)
High TC/HDL-C	2.58 (2.03–3.27)**	1.00 (0.86–1.48)	1.53 (1.25–1.87)**	1.20 (0.91–1.58)

*P ***< 0.05;*** **P ***< 0.01 versus normal subjects.***
CI = confidence interval.
TC = total cholesterol; TG = triglycerides; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol.

Discussion

The present study, conducted in an urban population of Tehran, showed a high prevalence of CVD disease risk factors and a positive association of these with obesity. In this study, the prevalence of obesity in men was nearly 15%, which was similar to the prevalence reported from Hakimieh district of north-east of Tehran [*17*] and the rural areas of Tehran [*18*] but higher than that reported from rural areas of Zanjan (north-west of the country) [*19*]. Nearly 30% of women in this study were obese, a rate higher than rural areas of Zanjan [*19*] and lower than that of Hakimieh [*17*] and the rural areas of Tehran [*18*]. The total prevalence of overweight and obesity in our population was 63.3%, which shows the increasing trend of overweight and obesity in Tehran compared with previous reports from this city [*20,21*].

In the present study, 20% of men and 23% of women were hypertensive and the prevalence of hypertension increased with age. In some studies in the Islamic Republic of Iran the prevalence of hypertension was different from our study [*22–24*]. The prevalence in our study is also higher than that reported in Eastern Mediterranean countries [*25*] and is approximately equal to the prevalence of American [*13*] and European [*26*] countries. This difference may be due to the age of the subjects and envi-

ronmental and cultural conditions. Moreover, the sample size used in the present study is larger than previous studies. There is a wide range of prevalence of hypertension in other reports in the Islamic Republic of Iran. Many factors such as heredity, environment, intake of sodium, calcium and other ions, salt sensitivity, renin levels and insulin resistance have long been assumed to be important in the genesis of hypertension [*27*]. The higher prevalence in this study compared with previous studies may also be attributed to recent socioeconomic changes in our country.

This study showed a high prevalence of dyslipidaemia in a Tehran population. Fifty per cent of men had high TC and 50% had high TG. The prevalence of these 2 risk factors was 55% and 42% in women respectively. The prevalence of high LDL-C was 49% for men and 51% for women and that of low HDL-C was 63% and 36% respectively. Using different cut-off points in this study makes it difficult to compare the results with those of other studies. Previous results obtained from the Tehran Lipid and Glucose Study [*28*], however, showed that lipid disorders in Tehran were more prevalent than in Turkey [*29*], Canada [*30*] and England [*31*]. This may be attributed to lifestyle changes in the Tehran population, such as better availability of food, increasing consumption of high fat foods and lower levels of physical activity.

Assessing the risk for the presence of major CVD risk factors in adults, especially young adults, is of particular importance since it allows us to easily identify those at high risk for development of clinical CVD later in life. In this context, anthropometric measurements that provide obesity indices such as BMI, waist circumference, waist-to-hip ratio and weight-to-height ratio are useful non-invasive methods of obtaining information on CVD risk. The results of this study showed that all anthropometric indices used, except for waist circumference, were related to higher levels of CVD disease risk factors.

The lack of association of waist circumference, which showed no relationship with CVD risk factors either in men or women, may be attributed to the site of waist measurement, because past research has showed that the location of waist measurement affects the relation of central obesity to CVD risk factors [*32,33*]. In this study, waist circumference was measured at the point of noticeable waist narrowing, which may have resulted in lower waist circumference values than might be obtained using other common sites of measurement. The WHO Expert Committee on Physical Status recommend measurement at a point midway between the lower rib and the iliac crest [*34*]; however, the National Health and Nutrition Examination Survey guidelines recommend a point just above the right ileum [*35*], and the North American Association for the Study of Obesity and the National Heart, Lung and Blood Institute recommend the right iliac crest [*36*]. The lack of an international standard for waist circumference measurements is unfortunate, and makes comparison with other studies difficult. We believe that the waist measurement at the narrowest point offers greater ease of acceptance and interpretation by the public and may facilitate self-measurement in addition to clinical use. Another explanation for the lack of relationship between waist circumference and CVD risk factors in the present study is the complex relationship between anthropometric indices and lifestyle-related factors such as smoking and physical activity. In this study, the effect of smoking was controlled, but physical activity, which was not assessed, remains a confounding variable. The other possibility is that the

power of waist circumference for predicting disease risk is population-dependent [*37*] and could vary from race to race [*38*].

Our findings of a relationship between obesity (high BMI, high waist-to-height ratio and high waist-to-hip ratio) and CVD disease risk factors (hypertension, cholesterol and triglycerides levels) in the Islamic Republic of Iran are in line with studies from other countries [*39–41*]. This should be kept in mind especially by Iranian health policy-makers for the implementation of appropriate interventions to curtail the rising trend of obesity and cardiovascular disease.

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Review

Food habits of the Egyptians: newly emerging trends

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SUMMARY Accelerated changes are taking place in the food habits of the present day Egyptians. Examples are drawn from foods that continue to be consumed by those considered guardians of the Egyptian tradition (Coptic Christians and isolated farming communities) and from interpretation of archaeological evidence. Recent decades have witnessed the progressive erosion of the traditional Egyptian diet and the introduction of new foods and eating habits. Sociocultural and economic changes are accelerating this erosion. The main features of the traditional Egyptian way of eating are presented along with a review of the emerging trends and of some of the important factors underlying food consumption patterns. Attention is drawn to the potential risk to health that these new trends represent, in particular to child nutrition and development.

Background

This paper is derived from a longitudinal study that started 5 decades ago and which is aimed at identifying the ancient origins of the foods prepared and consumed by present-day Egyptians [H. Hassan-Wassef, unpublished document, 2005]. The study focuses on the inhabitants of the Nile valley and delta, and does not encompass the nomadic populations of the desert. The purpose of this investigation is to define and to make known what can be truly labelled Egyptian foods and food habits. It involved noting how the traditional dietary habits evolved in response to a host of external as well as internal factors.

For all long-standing food habits and culinary traditions that have developed through the ages, the end product is a balanced diet in harmony with the physiological needs of the people and their occupation, climate, agriculture, and natural resources [*1,2*]. The Egyptian has inherited an indigenous food system and traditional food habits that can guarantee a balanced diet.

Having a rich and fertile soil that is easy to cultivate, and benefiting from favourable climatic conditions, the Nile valley has since ancient times been renowned for an abundance of cereals and the variety of cultivated legumes and vegetables it produces [*3*]. Barring the occasional bad years when the floodwaters were low, food and agricultural production adequately provided for the nutritional and other needs of its people. The new food crops and fruit trees that were introduced into Egypt at various times did not significantly change the basic traditional crop composition, and consequently, food consumption patterns. The relative abundance and rich variety of foods available in Egypt in comparison to its neighbours resulted in waves of migrants, especially to rural areas, who easily adopted the Egyptian way of eating. They did not leave any appreciable mark on local food habits [*4*]. The case was different for the higher social classes and the rich urban dwellers who often copied the eating manners and foods of the succession of foreign rulers who occupied the country [*5*].

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The ancient agricultural methods and crop composition, which had remained unchanged over thousands of years, allowed ample time for food habits to take root and for the gradual emergence of a nutritionally balanced diet that is in harmony with the existing ecosystem and which satisfies the nutritional requirements of the people. Continuity was guaranteed through the keepers of culinary tradition, namely the *fellaheen* (farming community) women, and through the ritual foods of the Copts, the Orthodox Christians of Egypt. The traditional kitchens and earthenware utensils of the *fellaheen*, which have survived till today, have contributed to the perpetuation of many food habits.

Modernization of the ancient agricultural methods started only 200 years ago, thus initiating the first large scale modifications in the crop composition. This agricultural revolution marked the beginning of a series of major irrigation projects and efforts to control the Nile waters [*3*]. Up to the time of the Second World War, significant changes in food habits essentially followed changes in agricultural policy that determined land use and crop composition. Given the limited total cultivated area of the Nile valley and delta, important increases in land allocations to a particular crop was done at the expense of another, sometimes with repercussions that could potentially disrupt the balance of the traditional food system and led to the emergence of nutritional disorders in the long term. The widespread pellagra (vitamin B3 deficiency) that became manifest towards the end of the nineteenth century is a case in point. It was a consequence of the market driven decision to increase the production of cotton, which was done at the expense of wheat production. The growing dependence on maize flour in lieu of wheat in the making of bread, the staple food, soon led to the emergence of nutritional deficiency.

Methods

The period under review is from the early 1950s to the end of the 20th century. Changes in the food habits and in newly emerging food consumption trends were noted. Sources of information varied widely. Historical data and evidence were used to define the basic features of the traditional food system, and information collected from the field allowed the identification of current food habits and the emerging trends. The study of food habits included collecting information on foods eaten as well as on the way they were prepared, food associations and methods of food conditioning and conservation. The supply, availability and accessibility of foods, and other factors that influence food habits were taken into account.

Archaeological evidence and historical data

Archaeological studies and Egyptian collections in museums around the world yielded a wealth of information on the foods consumed by the ancient Egyptians and the evolution of eating habits [*6–8*]. Accounts made by travellers to Egypt through the ages provided valuable descriptions of foods and beverages and of food consumption patterns [*9,10*]. The ancient origins of foods and of their methods of preparation were identified through a "live" reading of historical evidence coupled with an intimate personal knowledge of current food habits. The ritual foods of the Copts, which have been transmitted from generation to generation for nearly 20 centuries, provide an insight into the culinary traditions of the ancients [*11*].

Historical events that significantly contributed to changes in food habits were studied and factors that influenced both the facilitation of and the resistance to change are described. The impact on the traditional

Egyptian food system was assessed in terms of food habits and situations where there was sustained exposure to alien foods and habits, e.g. through trade, conquest, occupation or the settlement of significant numbers of migrants from neighbouring countries.

Information collected from the field

Urban and rural communities were visited in the Nile delta, on the Mediterranean coast, in Middle and Upper Egypt and in the Nubian regions in the south (Fayoum, Beni-Suef, Minia, Luxor, Aswan, Qalyubia, Sharkia, Gharbia, Dakahlia, Beheira, Damietta, Alexandria and Cairo governorates). Data were collected over a period of 50 years, in all seasons. Interviews were conducted in > 40 households in each governorate (> 100 in Cairo and Alexandria governorates).

Food consumption and nutrition-related information was obtained through a 24-hour recall of food consumed the day preceding the interview, followed by in-depth inter-personal interviews lasting about 1 hour and group interviews attended by 8–12 housewives, neighbours and relatives from the same location, usually lasting for 1.5–2 hours. The respondent was mostly the housewife, who was responsible for feeding the family. The sample was, however, varied covering variations in age, sex, education, occupation, income and social echelon. Information collected was not only on types of food but also the ingredients used in preparing it, how it was served, and eating habits. This also included management of leftovers, food associations and other details about ritual foods, taboos, variations within the family and child feeding, and the composition of dry uncooked meals. Information was sought on eating outside the home, including the food consumed by schoolchildren during the school day and what labourers (e.g. peasants, factory workers, construction workers) ate at the workplace.

Inspection visits were then made to kitchens, gardens, and food storage facilities. Traditional methods for food preservation and food conservation still in use were recorded. The array of spices on the spice shelf was noted. The frequency of home baking and the use of the traditional oven were recorded, as well as the nature and form of the cooking utensils, in particular the presence and use made of the ancient traditional ones such as the *ghorbal* (sieve made of lamb gut), the *matraha* (long-handled wooden board for flattening dough) or the *salaya* (quern). Home production and consumption of protein-rich foods was investigated, and the practice of the age-old habit of gathering (or buying) and consuming edible wild plants was noted whenever relevant.

The proportion that the garden produce contributed to the total family vegetable consumption was estimated and the reasons underlying the choice of vegetables grown noted. The presence of yard animals and keeping of animals (especially rabbits and fowl) in urban settings, and the uses made of them, was also recorded.

The markets and food shops were visited and the degree of market dependence for some food items that contribute towards maintaining the integrity of the food system (e.g. dark green leafy vegetables and dairy products) was assessed. The growing increase in dependence on the local bread made from high extraction wheat produced by a wide network of state subsidized bakeries was investigated. The special foods consumed during feasts and religious fasts and rituals, both Muslim and Christian, were noted.

Special attention was accorded to urban dwellers, who represent about 45% of the total population [*12*] and who are more exposed to factors that can engender signifi-

cant changes in food habits. Changes in the geographic distribution of food consumption patterns and trends that developed over the past half century among the people living in Greater Cairo (which hosts nearly a quarter of the total population) were also noted. The foods and beverages consumed outside the home in the 1950s, from fast food outlets and ambulant vendors, were compared to the type of foods and beverages commonly consumed outside the home fifty years later. These included shops, kiosks, and sidewalk vendors who sell biscuits, candy and a variety of other food items and beverages to children outside school gates.

An attempt was made to identify factors that enhanced or precipitated changes in eating habits as well as those which helped preserve traditions and counteract change. Special attention was accorded to variations in the supply and demand for dark green leafy vegetables and to factors influencing their consumption. An overview is given of some of the significant changes in food consumption habits that occurred during the past half century. The emergence of manifestations of unbalanced dietary intake was monitored, in particular, among the more vulnerable child population. New trends and factors that undermine the food system and the potential health implications of such trends are reviewed.

Results

A balanced heritage

Certain characteristics of the Egyptian traditional food system are the outcome of the specific ecology of Egypt and the Nile valley. A crop composition that remained practically unchanged for many millennia allowed ample time for the development of a balanced food system over the ages. Because of the fertile and easily cultivated soil, Egypt stood out from its neighbours owing to the abundance of cereals and the wide range of edible vegetables that could be grown.

The Egyptian dietary pattern became structured around the flood cycle of the river Nile. The diet was more dependent on cereals, dried legumes and preserved foods when the land was under water. From necessity, Egyptians perfected a number of food preservation techniques over the ages. They preserved cheese, cereals, fruit, legumes, vegetables (including dark green leafy vegetables), fish, meat, grains, aromatic seeds and condiments. Onions and garlic were available all year round. This know-how has survived to the present time and is manifest by the important place that dried legumes, cereals and dried and preserved foods occupy in the diet of the modern Egyptian and in the composition of food stores in a traditional home.

The difference in food habits between the north and the south of Egypt is a function of factors such as climate, crop composition (conditioned by the type of irrigation and the agricultural cycle), the daily occupation of the inhabitants and the degree of exposure to and interaction with external influences. Certain eating habits are dictated by the extreme heat of the summer months where temperatures can reach well over 40 °C in the south.

Food analysis tables for prepared foods have shown that the traditional food associations and preparation methods contributed considerably to raising the nutritional value of the foods consumed [*13*]. The Egyptian food system is full of examples of the use of such mixtures and of food associations that compensate for the essential nutrients that may be deficient in 1 component of the meal. The classic example is that of the stewed *ful* (fava bean) meal, which is the most popular and most widely consumed food. Taken individually, bread and beans,

which are the main components, are deficient in a number of essential nutrients. However, the analysis of the prepared *ful* dish, as it is eaten, shows that the presence of the other ingredients has appreciably raised the nutritional value of the meal. The generous amounts of a mixture of dark green leafy vegetables and herbs that are commonly added to a variety of dishes in the last few minutes of preparation, e.g. to cooked colcasia (taro, *Colocasia esculenta* Schott) and some legumes, is another example. *Khodra* (greens), used in a proportion of about 1:5 of the dry weight of the legume, is a complementary source of a number of vital nutrients. Dark green herbs and leafy vegetables, eaten daily either fresh or cooked, are an essential ingredient in the Egyptian diet, and are associated with many dishes (Table 1). Dried chickpeas, sesame and fenugreek are some food items that can raise the nutritional quality of the foods they are associated with. The enhancement of the nutritional value of foods through germination (e.g. fava beans), sprouting (e.g. fenugreek), or fermentation is still commonly practised. The latter is used in the making of *kishk*, sun-dried balls of wheat fermented in sour milk.

Maintaining the nutritional quality of the Egyptian food system depended not only on the types of foods eaten, but also on the way they were consumed, on food associations, on methods of food preparation and conservation, and also on the quantities consumed. The food groups that are considered the pillars of the traditional Egyptian food system include cereals (unrefined), legumes, dark green leafy vegetables, other vegetables and fruits, cheese, oils and white and red meat.

Basic features of the Egyptian diet

Bread, the staple food, enjoys a very special place in the diet. It is still made from high extraction wheat flour or wheat mixed with other ingredients. It is the main component in all meals. Egyptians eat food with bread, and not bread with food. Food other than bread is colloquially referred to as *ghomous* (literally, a dip): a piece of bread is broken off and dipped in the *ghomous*. Food eaten with bread can be as simple as salt or a mixture of salt, cumin and sesame seeds, an onion, white radish leaves, some aged white cheese, or the more complete meal of cooked vegetables or legumes. More recently, the habit of eating bread in the form of sandwiches using European style white bread has taken hold, in particular among children. Cheese, processed, tinned or cooked meats, fried potatoes, pickled aubergines, eggs, and even bananas are some of the fillings that are used. For those who can afford them, the hamburger, pizza or the generously garnished composite modern sandwich are becoming popular.

Cereals and legumes constitute the mainstay of the diet in the population as a whole and are the main sources of calories and proteins [*14,15*]. The nutritional balance of a diet based on a cereal/legume mix is maintained through the regular intake of small amounts of white cheese or other dairy products, fresh dark green leafy vegetables, and less regularly eggs, poultry and birds, fish and occasionally red meat. Fresh and cooked vegetables and fruits complete the system. For the average Egyptian, fruit consumption is not meal-related and is usually dependent on seasonal availability. This was not a source of worry for the first generation of Egyptian nutritionists as long as the essential nutrients provided by a daily fruit intake were supplied from other sources, also consumed fresh. In this respect, the tomato was sometimes referred to as the poor man's apple since it was rich in vitamin C and was available all year round (A. Hassan, personal communication).

Table 1 **Dark green leafy vegetables commonly consumed by Egyptians**

Vegetable		Mode consumed		
Common name	**Latin name**	**Raw**	**Dried**	**Cooked**
Aromatic herbs				
Parsley	***Petroselinum sativum***	+	–	+
Coriander	***Coriandrum sativum***	+	+	+
Dill	***Anethum graveolens***	+	–	+
Chervil (***regl el ghorab***)	***Carum amioides***	+	–	–
Mint	***Mentha sativa***	+	+	–
Green leafy vegetables				
Romaine lettuce	***Lactuca sativa***	+	–	+
Garden rocket (***gargeer***)	***Eruca sativa***	+	–	–
Jew's mallow (***molokheya***)	***Corchorus olitorius***	–	+	+
Spinach	***Spinacea oleracea***	–	–	+
Mallow (***khobeza***)	***Malva parviflora***	–	–	+
Swiss chard (***sal'***)	***Beta vulgaris***	–	+	+
Purselane (***regla***)	***Portulaca oleracea***	–	–	+
Green leaves of roots/bulbs				
White radish	***Raphanus sativa***	+	–	–
Turnip	***Brassica rapa***	–	–	+
Onion (green onion)	***Allium cepa***	+	–	+
Egyptian leek	***Allium kurrat***	+	–	+
Celery	***Apium graveolens***	–	–	+
Leaves of edible plants[a]				
Garden pea	***Pisum sativa***	–	–	+
Cowpea	***Vigna sinensis***	–	–	+
Egyptian bean (***lablab*** or ***gashrangeig***)	***Dolichos lablab***	–	–	+
Okra	***Hibiscus esculentus***	–	–	+
Edible leaves of fruits				
Vine	***Vitis vinifera***	–	–	+
Edible wild plants[a]				
Hare's lettuce (***go'deid***)	***Sonchus oleraceus***	+	–	–
Rampion (***serees***)	***Campanula rapunculus***	+	–	–
Prickly goldenfleece (***galawein***)	***Urospermum picroides***	+	–	–
Sheep sorrel (***hommeid***)	***Rumex acetosella***	–	–	+
Wild lettuce (***lebbeen***)	***Lactuca virosa***	+	–	–
Purselane (***regla***)	***Portulaca oleracea***	+	–	+
Mallow (***khobbeza***)	***Malva parviflora***	–	–	+
Sprouted legumes				
Fenugreek sprouts	***Trigonella fœnum-græcum***	+	–	–

[a]Collected by the peasants from the fields (of clover, wheat and beans) and canal banks, these wild weeds as well as the tender leaves of edible crops are usually gathered for personal consumption. Common local names are given in italics.

Although there is no special penchant for excessive salt seasoning, Egyptians tend to consume more salt during the summer months through eating old white cheese, olives, pickled vegetables, and salted fish. The last is a regional habit popular in the very hot southern governorates. Salt, cumin and coriander seeds have been the main seasoning agents since ancient times. Till now, black pepper is absent from many of the kitchen shelves of the more isolated southern villages of the Nile valley. Egyptians are not lovers of hot chilli peppers like their western and southern neighbours. They tend to follow the Eastern Mediterranean countries in this respect. Vinegar and limes have been extensively used since ancient times [*16*] in food preparation and in particular in the making of pickled vegetables and olives.

Traditionally, the diet is low in saturated fats, and oil is commonly used for cooking rather than butter. Deep-frying is an imported habit that is less than 200 years old. At the present time, it is used in the cooking of the very popular fried fava bean patties known as *ta'ameyya* or *falafel*, a relatively new introduction. Recipes tend to be simple and straightforward, and ingredients are usually mixed raw and cooked in the oven in earthenware pots or boiled. Slow cooking overnight is used for stewing cereals and dried legumes such as wheat and fava beans. Steaming continues to be done in specially designed pots, metal now replacing the original earthenware utensils. Birds and fish are often grilled. Pigeon and quail can also be eaten stuffed with *fereek* (rubbed green wheat) or rice. Larger birds such as poultry, geese and ducks are usually boiled. The traditional method of searing the boiled bird or meat for a few minutes in a very hot traditional oven has now been replaced by frying in oil or clarified butter. The Egyptian is not traditionally renowned for having a sweet tooth. A wide variety of dry biscuits of all shapes that are salty or lightly sweetened, and containing a mixture of aromatic or oily seeds such as fennel, aniseed, caraway, sesame or linseed are widely consumed. Dried fruit pastes or cooked honey are the traditional sweet fillings for some of these biscuits. For the average Egyptian, sweetmeats and desserts are not a regularly consumed food item but are more related to religious feasts and various other celebrations. For the Prophet Muhammad's ﷺ birthday, a wide variety of sugar-based sweetmeats and colourfully decorated sugar dolls and knights on horseback are produced. This tradition, particular to Egypt, is a legacy of the Fatimid period (969–1171 AD) when the craftsmanship for cane sugar artistry flourished.

The heritage of ritual food habits and culinary traditions of the Copts [*11*] represents an unbroken continuity with ancient habits. The foods consumed during the meatless fasts that are observed for about two thirds of the year are derived with cereals, legumes, vegetables, green leafy vegetables and fruits. Given their pre-Christian origin, these foods are eaten by all Egyptians, though to a lesser extent by those urban dwellers who have adopted imported food habits.

The Muslim fasting month of Ramadan is associated with a set of traditions related to food that make many people eat a richer diet during the non-fasting hours that extend from sundown to sunrise. Consumption of dried fruits, all kinds of nuts, oriental desserts rich in fat and sugar, as well as a daily cooked meal for breaking the fast often adds up to a higher calorie content than the usual, non-fasting, daily intake. Meat and poultry consumption is increased as families tend to serve meat each day even if they did not usually eat that much meat. The government makes special provision for the nationwide increase in food consumption during Ra-

madan. Preparations for this month involve the import of large quantities of nuts and dried fruits, to which are added the local dates and peanuts. However, alongside this rich food, 2 traditional food items appear daily on nearly every table in rich and poor homes alike. These are *ful*, stewed fava beans, and all kinds of dark green leafy vegetables (Table 1).

A wide variety of drinks and beverages are an important component of the food system as they are consumed in considerable amounts during the hot summer months. Many of the traditional drinks based on natural products (e.g. *karkadeh* and fenugreek) are known to have a beneficial effect on health (Table 2). Their replacement by commercially produced carbonated drinks, other soft drinks and fruit nectars entailed a significant increase in the daily sugar intake apart from depriving the body of the health benefits of the natural beverages. The habit of consuming small glasses of sweetened black tea is also popular. It is an important source of ready calories for workers during the long interval between the waking up drink and the next meal. While tea drinking can be labelled a national habit, coffee drinking is less popular. Generally speaking, coffee is rarely consumed among the *fellaheen* and manual labourers; it is more common in urban populations. The serving of unsweetened coffee at a wake is, however, a traditional custom observed by most Egyptians.

It may be opportune to comment on the way that meat is perceived by Egyptians and its place in the diet. With plenty of fish in the river and poultry and pigeons in the back yard, red meat is not a regular element in the diet of the *fellaheen*, or for the average Egyptian with a limited income, or for the Copts who observe a meatless fast for more than half the year. Meat is more commonly consumed on Fridays (the religious

Table 2 **Some traditional non-alcoholic beverages still consumed in Egypt**

Traditional beverages
Cold infusions
Red sorrel (***karkadeh***) ***Hibiscus sabdariffa***
Tamarind
Carob (***kharrub***)
Licorice drink (***erq'soos***)
Dom ***Hyphaene thebaica***
Hot infusions
Tea (black)
Coffee
Fenugreek (whole)
Ginger (ground)
Hibiscus (***karkadeh***)
Cinnamon (ground)
Mint leaves
Cumin seeds
Fennel seeds
Caraway seeds
Aniseed
Barley
Juice (freshly pressed)
Sugar cane, pomegranate and other fruits in season
Composite recipes
Moghat (traditionally given to parturient mothers, with ground wild pomegranate root as the basic ingredient)
Sahlab (a milk drink made with ground orchis root as the main ingredient) ***Orchis latifolia***
Sherbets and syrups (now mostly commercialized)
Rose petal syrup
Violet petal syrup
Fruit based syrups, made from juice of mulberries, pomegranate, strawberries, etc.
Syrups made from concentrated extracts of tamarind and carob
Reconstituted sun-dried sheets of fruit pulp
Apricot (***qamareddin***)
Mango
Other (salted)
Pickling water of turnips
Seasoned water of boiled chickpeas

day of rest for Muslims) and is eaten during feasts or for meals celebrating special occasions. Well-to-do households that can afford it tend to consume high amounts of animal protein. Meat tends to be regarded as a status symbol or a prestige item for households with limited incomes. Nevertheless, the ancient habit of serving several meat dishes when giving a banquet [*6*] continues to be the practice. Today, families with modest incomes still make a point of serving 2 or more meat dishes when entertaining guests.

Meals and meal patterns

The first meal of the day is small. It is made up of a drink taken alone or accompanied by a piece of bread, a dry biscuit, a bowl of stewed whole wheat, or just some broken dry bread soaked in milk or other hot infusion. Children usually have a glass of milk or tea with milk and a sandwich. What the average Egyptian refers to as "breakfast" is what is eaten between the waking up drink and the main cooked meal. It is a between-meal snack of varying importance, from a few dry biscuits to a cheese sandwich or more often a *ful* or *ta'ameyya* (fried bean patty) sandwich or a pastry.

The Friday breakfast, eaten at leisure and *en famille*, is a more generous meal. Stewed beans, eggs, green leafy vegetables, onions, tahina (sesame paste) salad, *ta'ameyya*, pickled vegetables, cheese, stewed whole wheat (*belila*) or home made noodles, butter or cream, honey, molasses and all kinds of jams are some of the food items that can appear on a Friday breakfast table.

The main cooked meal is usually made up of bread eaten with cooked vegetables or legumes, with pickles and green leafy vegetables or a finely chopped mixed salad on the side. Meat, for those who can afford it, is cooked with the vegetables and less often cooked and served apart. Fruit may or may not be eaten at the main meal. It is more usual to end the meal with a glass of tea or other hot infusion (Table 2).

For the majority of the *fellaheen*, manual labourers and artisans, the midday meal consumed at the workplace is a smaller and usually uncooked meal made up essentially of bread eaten with cheese and/or fava beans, onions and green leafy vegetables, often accompanied by tomatoes, pickled aubergines, or other pickled vegetables.

Till about 2 decades ago, the main cooked meal for millions of public sector employees, who worked 6 days a week from 08.00 to 14.00, was at around 15.00. With the new 5-day working week and longer working hours adopted by the growing private sector as well as some of the government institutions and services, there has been a shift of several hours in the timing of the main cooked meal. The presence, in this group, of relatively high salaried private sector and banking employees who already lead a modern lifestyle makes this group a prime consumer of the modern type of fast foods (Table 3). The main meal is consumed upon return home, i.e. around 18.00 hours. This late timing brings it nearer to the traditional timing of the main cooked meal eaten by peasants and labourers at the end of their long working day. However, it appears that the 2 eating patterns, the old and the new, sometimes co-exist. Those who have eaten at 18.00 can again eat a full cooked meal if invited out. A rapidly growing demand has been observed among urban populations with long working hours for the modern take-away type of meals commonly consumed at the workplace. For them, this is a between-meal snack and not counted as a meal. Many of them tide over this period with only beverages and a pastry.

With the growing industrialization of the country, meal times for industrial workers have also been changing, with no unified pattern. Some work 8-hour shifts with no lunch break while others can work for a long day with a 1-hour midday break. For

Table 3 **Changes in availability of fast food from 1950 to 2000 in different outlets in traditional and western style neighbourhoods**

Type of food	Neighbourhood			
	Traditional		Western	
	1950	2000	1950	2000
Fast food outlet				
Hamburger meal	–	–	–	+
Pizza	–	–	–	+
Fried chicken	–	–	–	+
Grilled chicken	–	–	–	+
Cafeteria style shops	–	–	±	±
Grilled pigeons	±	+	+	+
Grilled kebab and kofta	+	+	+	+
Ful (fava beans) and ***ta'ameyya*** (fried bean patty) meal	+	+	+	±
Koshari (rice and lentil dish)	+	+	–	±
Veal head, offal and rice sausage	+	+	–	–
Fixed stand/counter				
Feteera, pastry with a variety of fillings	+	+	–	–
Fried fish	+	+	+	+
Grilled fish	+	+	+	+
Grilled beef or chicken ***shawerma*** sandwiches	–	–	±	+
Western style panini sandwiches with composite filling	–	–	–	+
Simple sandwiches	+	+	+	±
Regheef el-hawawshi, minced meat in flat local bread	+	±	–	–
Mobile cart or stand				
Koshari, rice and lentil dish	+	+	–	–
Ful and ***ful*** sandwiches	+	+	+	+
Shamsi[a] bread and old white cheese	+	±	–	–
Ambulant vendor				
Borek, pastry with white cheese filling	+	+	+	–
Semeet, bread rings with ***rumi*** (hard) cheese or ***dokka***[b]	+	+	+	+
Veal head, offal and rice sausage	+	±	–	–

+ available, ± occasionally available, – not available.
[a]Traditional Upper Egyptian bread.
[b]Mixture of salt with ground cumin and sesame seeds and other aromatic ingredients.

Egyptians this is not a main meal. This pattern is similar to the traditional pattern of a midday meal consumed at the workplace and the main cooked meal eaten upon return home in the evening. The group that works a straight 8-hour shift without a break will return home for the main meal in a pattern similar to that of public sector employees, except that they have no access to the pre-main meal snack.

There is a rapidly growing number of working women at all social levels. Children who return from school at an earlier time than their working parents do not always have a meal upon their arrival home. They may have to wait for the return of their parents to eat with them. Parents do not seem to mind that their children tide this long period between breakfast and the main meal with a sandwich, a soft drink, candy, or with any of the rapidly growing array of junk foods [*17*]. This means that the peak hunger period for the growing child is appeased with foods of doubtful nutritional quality, which are often eaten under little control or supervision. As a consequence, the children are poor eaters when they sit at the main meal [*18,19*]. The ill-effects on the health of children of a cycle of irregular mealtimes and nutritionally imbalanced food intake may be further complicated by long hours of television watching accompanied by more consumption of junk foods, soft drinks, candy and sweets [*20*]. While the rise in the incidence of iron deficiency anaemia and obesity among children has already been reported [*21*], no investigation has yet been undertaken of the set of symptoms and complaints that are commonly reported these days by the mothers themselves. These symptoms include constipation, irritability and recurrent headaches that are not related to any sickness.

For those whose main meal is consumed at lunch time, the evening meal is lighter and usually made up of what is referred to locally as dry foods (i.e. without a sauce). Leftovers from lunch are often served again in the evening. Some of the common evening meal components apart from bread include fava beans and lentil based dishes, cheese, dark green leafy vegetables, pickled vegetables, tomatoes and cucumbers. Melon or watermelon eaten with white cheese and bread make up a popular summer menu. For children, a favourite nutritious evening meal is bread dipped in a molasses-tahina mix. Tinned foods such as mackerel, sardines, tuna, beef, processed beef or poultry can be eaten with bread or made into sandwiches with a salad or pickled vegetables on the side. Few households serve a second cooked meal at night. This is usually reserved for the instances when guests are invited.

A food habit that has survived till today is that of nibbling different snacks. Nibbling is favoured following the evening meal, and snacks are more often consumed outdoors during the long summer evenings. With television watching, nibbling (and food consumption in general) can continue late into the night. Traditional snack foods (Table 4) comprise a variety of different food items and continue to be enjoyed by the rich and the poor of all ages. Some of them are highly nutritious and can represent a non-negligible supplement to the daily nutrient intake of a child. Their replacement by sweets, candy and junk foods is much less advantageous to the food system.

The onset of change

In the mid 20th century, the basic elements of the traditional Egyptian diet were for the

larger part still preserved, more so among the rural communities and the Copts whose diet and ritual foods are little affected by change. The legacy of the succession of external influences leading to changes in food habits was more evident in the larger urban communities and the coastal towns. The higher social classes were much more readily influenced by the food habits of the foreign ruling elite. Most of the influence was eastern Mediterranean and, to a lesser extent, European, North African and Arab (Arabian peninsula). The simply prepared foods of the traditional diet gave place to elaborate dishes requiring complex, lengthy preparation and generous amounts of clarified butter, with less attention to the consumption of fresh vegetables. Deep-frying, the use of rich, composite sauces and the growing popularity of rich sweetmeats and desserts containing nuts and soaked in heavy syrup considerably raised the overall intake of sugars and saturated fats. White bread, in many instances, replaced the traditional high extraction local bread. Many of the nutritionally valuable traditional food associations were ignored. For people living in poverty or those with limited incomes, changes were more related to the need to cope with rising food costs and to making nutritionally correct choices. By necessity, they depended on the cheaper traditional foods and the subsidized local bread. For this group, the continued consumption of fresh dark green leafy and other vegetables was a nutritionally valuable traditional habit.

Table 4 **Some traditional snack food consumed by Egyptians**

Traditional snack food
Legumes
Green chick peas (***malana***)
Boiled chick peas
Roasted chick peas
Green fava beans (***ful herati***)
Roasted germinated fava beans (***ful meqeli***)
Germinated fava beans
Lupine (soaked and boiled)
Sprouted fenugreek seeds
Roasted peanuts
Vegetables
Egyptian red carrots
Romaine lettuce
Tubers (***habb el aziz***)
Tiger nuts
Grains and seeds
Popped corn (maize)
Grilled fresh corn on the cob
Roasted wheat grains
Roasted pumpkin seeds
Roasted cucurbit seeds
Roasted melon seeds
Fruits
Christ thorn (***nabq***)
Jojoba (***ennab***)
Golden berry (***harankash***)
Dom palm fruit
Sycamore fig
Prickly pear
Other
Sugar cane

A series of changes in the food habits and lifestyles of the rural populations followed the acceleration of rural development programmes (and modernization) which gradually ended the traditional isolation of the *fellaheen*. Rural populations became exposed to a host of unfamiliar external influences and lifestyles with little prior preparation or guidance on how to deal with new situations and new food products.

Two major developments directly influenced changes in food habits. The first was the creation of a nationwide network of cooperative societies, *game'eyya ta'awoneyya*, (a successor to the food rationing

system introduced during the Second World War) to serve as distribution outlets for subsidized or price-controlled foods. These cooperatives were instrumental in introducing rice, a hitherto unfamiliar food for the southerners who traditionally consumed *fereek* (rubbed green wheat) instead. Equipped with cold storage facilities for the distribution of frozen foods, the cooperative societies were the end point in a cold chain for the distribution of imported frozen foods. Subsidized imported meat and chicken were important supplements to the food system during the economically difficult decades after the end of the war. The Egyptians, who always preferred to eat freshly slaughtered meat or poultry, were very slow in accepting frozen meats. The same cold chain served to distribute cheap frozen fish from Lake Nasser, which reached the tables of a growing number of Egyptians, adding a precious source of high quality protein. Cooperatives also served as outlets for the sale of price-controlled chicken and eggs produced by the growing numbers of state-backed commercial chicken farms. All these developments led to an increase in the consumption of animal protein in groups of the urban population with modest incomes.

The second development was the establishment of a network of mechanized bakeries producing mainly the high extraction local bread, and to a lesser extent, a thin flat white bread known as *shami* bread. These bakeries, using subsidized flour and selling a price-controlled loaf, produced bread that was considerably cheaper for the *fellaheen* than home production. Home baking became reserved for special occasions, feasts and celebrations. The younger generations, both rural and urban, are turning more to white bread, preferring the European-style loaf. They find it more suited to their sandwiches [*22*].

The last decades of the twentieth century witnessed a further acceleration of change in the form and substance of the Egyptian diet. Change was accelerated by the liberalization of the market and the "open door" economic policy, which gave rise to indiscriminate and uncontrolled consumer desire for imported commodities and western lifestyles [*20*]. The spread of this trend was facilitated by the rapid social mobility [*23*] that followed in the wake of the 1952 revolution and the access by middle income and low income groups of the population to the much higher earnings of family members working in the Gulf countries. This increase in the purchasing power of Egyptians was also a result of the gradual increase in the per capita gross domestic product over the same period [*24,25*].

Government efforts to extend the public broadcasting (radio and television) service to all the inhabited areas in the country brought inside homes images of unfamiliar modern lifestyles. Aggressive marketing campaigns for the modern foods that accompanied the new lifestyles found their mark in the targeted population of youth and children. The phenomenal popularity of junk foods among children does not seem to be confined by any socioeconomic or geographic barriers, making this group a prime consumer of junk foods. Families in all walks of life were overtaken by the demands of the unfamiliar lifestyles and patterns, in particular, the longer working hours and the inevitable change in the eating pattern. Deprived from the support traditionally enjoyed as members of an extended family, parents in the modern nuclear families found themselves ill equipped and unable to cope. Problems were felt more where both parents worked or in families with a woman as head of household. The ability to cope was further cur-

tailed by the low purchasing power of low-income families.

Discussion

The variety and abundance of food in Egypt over the ages preserved it from change [*3*]. The food balance of the country started to break down in the middle of the 20th century, which marked the start of food importation and the beginning of a gradual decline in the tradition of food self-sufficiency [*4*]. The demands of an increasing population that were not paralleled by an increase in the total inhabited and cultivated surface area widely surpassed local food production. In 1947, there were 19 million inhabitants living on 4% of the total surface area of Egypt. This rose to almost 66 million living on about 5.3% of the surface area in the year 2000. It took several centuries for the Egyptian diet to develop and take root. The Egyptians who were well settled in their habits were not all able to adjust to or cope with the rapid changes that occurred during the past half century, and in particular the past 2 decades. Those changes were in the greater part related to the modernization and industrialization of the country. The increase in the number of women working outside the home, women heads of household and nuclear families did not make matters easier. Little help or guidance was offered on how to adapt to a changed pattern of life or on how to make the right choices to ensure a balanced daily food intake.

The traditional diet of Egyptians is made up of basic elements regarded as the essential components of the system. Any changes in food habits strong enough to disrupt the balance of the system without being compensated for will, unless corrected, lead to malnutrition and ill health. It would be a cause for concern if the imbalance affected those food elements, such as high extraction bread, legumes, fresh dark green leafy vegetables, and other vegetables and fruits, which are the pillars of the system and which have high nutritional value.

It became evident towards the end of the last century that the healthy diet of Egyptians, developed over thousands of years and which had till then retained its essential features, was progressively losing some of its essential elements and rapidly disintegrating. The rapidity of change in food habits accompanied equally rapid social and economic transformations. The changes were accelerated in the 1970s with the liberalization of the economy. It is apparent that people at all levels of society were overwhelmed by the rapidity of the change.

The change was quicker to take hold in the urban populations, which represent nearly half the total population of the country. Not having access to nutrition guidance, they adopted ready solutions that were not backed by nutritional awareness or discrimination. These new choices were made easy by a higher purchasing power and a strong desire for modernization. The choices were also influenced by aggressive advertising campaigns and the easy accessibility of junk food, candy and soft drinks.

It is disturbing to observe the way present day Egyptians are trading their dietary heritage for unbalanced, unhealthy foods. Much time and effort could be spent on a fine analysis of the causal web of factors that makes the Egyptian lose grip on the traditional diet. It would be more cost-effective to investigate why the new trends are taking hold, to find ways to protect good food habits and to identify the interventions or the means which would preserve the integrity of a balanced food system.

One of the important approaches in a multi-pronged strategy to improve the nutritional quality of the Egyptian diet would be the creation of nutritional awareness and developing the capacity for nutritional discrimination among the Egyptian public. This could be achieved through the mobilization of well-informed and coordinated support from those involved in monitoring the nutrition situation and in formulating policy and interventions that could preserve the nutritional quality of the traditional food system. Their task would be to promote an evolution of the food system and enable it to cope with and accommodate the changes that have occurred. The information generated could become instrumental in the creation of an enlightened consumer and a consumer society that would have the power to influence and shape the food market.

A second approach, complementary to the above, would be to support and guide families in adjusting meal patterns and composition to cope with new lifestyles and changes in daily routine. No carefully planned adjustment has been made to accommodate the long working hours which have been in operation now for nearly 2 decades. Egyptian families were not adequately prepared to cope with the problems that the longer working day created. Shifting the main cooked meal to late afternoon has been the solution adopted by most families. The problem of no provision for a meal on children's return from school, commonly the case in nuclear families where both parents are working, and in the absence of the support of the traditional extended family, has not been properly investigated.

A third approach would be to help families regain confidence in traditional foods and in the possibility of eating modern meals without losing the essential features of the Egyptian food system. This practical approach would need to highlight those foods that are better adapted to the demands of modern life and provide information on meal composition and on ways of reducing food preparation time. It should draw attention to foods that combine low cost with high nutritional value. Guidance in managing child feeding will need to be based on the results of a comprehensive evaluation of the situation and the problems that children face.

All approaches in a strategy to protect the traditional system will need to be adapted to the demands and requirements of all socioeconomic strata of the population in all situations and settings, whether wealthy or deprived, rural or urban.

The shortcuts and easy solutions that offer themselves, such as the consumption of the new fast foods, may solve immediate problems and satisfy immediate needs in the short term. In the long term, however, ignoring the needs of children or complacency about the types of food that they consume will certainly give rise to malnutrition. Iron deficiency anaemia, obesity and undernourishment are becoming more and more common among Egyptian children [*21*]. Correcting the dietary deficiencies alone will not solve the problem. Help and guidance needs to be provided to reorganize family meals in a way that satisfies the nutritional needs of children.

The growing trends for increased consumption of fast food, junk food, sweets and candy instead of the more wholesome traditional snacks, and for consuming soft drinks with a high calorie content instead of the traditional natural beverages are viewed as a social and a market phenomenon. These products have become popular with all ages and all social groups. Aggressive marketing campaigns are finding fertile, ground especially among the younger gen-

erations. The cost on health of the spread of these habits is high because of the higher calorie and fat intake, lower intake of vitamins and minerals, unaccustomed increase in the daily intake of animal proteins, and most importantly exposure to toxic substances and mutagens identified in some fast food meals and in junk foods that often contain artificial colours, flavours, and unidentified food additives [*26*]

What the Egyptians do not know is that the traditional diet that they are abandoning is what the western world is now seeking to eat [*2,27*]. Also, from a nutritional point of view, the uncontrolled consumption of these modern foods does not represent progress, but a regression. The intellectual impulse to blame market forces is misplaced. The market is only a reflection of the desires of the people at a given point in time and space. Industry makes extensive studies into the behavioural patterns of the people in order to be able to satisfy them and, in turn, to guarantee their own gains. It is the duty of nutritionists to work on a medium/long-term basis to shape those desires. This would be instrumental in encouraging the government to develop a policy to shape the market according to the new desires that we have helped to form. The case of a soft drink company responding to the desire to consume less sugar by producing a diet version of their cola, and removing the stimulating substance in the drink and marketing a decaffeinated version are examples of response to the desires of the discriminating client.

Interdictions do not give rise to results. When nutritionists succeed in shaping habits by the creation of a discriminating consumer, a strong consumer society will in turn be able to influence the market. If a national campaign for promotion of change is decisive enough, the market will follow because this is where the profit lies. Once the market responds and reflects the desires of enlightened, discriminating consumers, they will then become its strongest ally when it promotes modified, healthier products.

Conclusion

Egypt has a valuable heritage of a well-established and balanced diet which persisted practically unchanged for the best part of 5000 years. This valuable indigenous food system must be protected and compensated for losses suffered through the adoption of new food habits. A number of appropriate interventions need to be identified suited to the current circumstances for each sector of the population. These interventions should be able to protect the essential features of the traditional system and offer options to compensate for deficiencies. An enlightened and discriminating consumer can shape the market and reverse the ill effects of the trend towards excessive consumption of fast foods and other unhealthy foods. Reorganization and adjustment of mealtimes and meal composition to meet the demands of altered lifestyles would be a valuable backup to the discriminating consumer. Nutritionists need to formulate a multi-pronged national policy for teaching nutritional discrimination, not only nutritional education, so as to enable people to differentiate the good from the bad, in relation to “me” and “my needs”. This is an exercise that needs to start with the younger generation in particular in schools.

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This work is dedicated to the memory of my mentor and teacher, Professor Ali Hassan, the father of nutrition in Egypt. His life-long research contributed to a better understanding of the traditional wisdom that guided the evolution of Egyptian food habits across the ages.

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Report

Anaemia among schoolchildren in Qena Governorate, Upper Egypt

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SUMMARY A study was carried out during January/February 2001 in Deshna and Armant Districts of Qena Governorate, Upper Egypt, to establish the prevalence of anaemia among schoolchildren aged 6 to 11 years and define appropriate control interventions in the area. Haemoglobin levels were measured directly in schools using a portable spectrophotometer. The mean (SD) level of haemoglobin in 1844 schoolchildren in 37 schools was 12.79 (1.15) g/dL. Only 12% of children were below the WHO cut-off for anaemia for this age group (< 11.5 g/dL) and no cases of severe anaemia (< 7.0 g/dL) were detected. The low prevalence of mild to moderate anaemia indicates that mass iron supplementation is not justifiable, but routine monitoring of haemoglobin levels should be part of the public health activities in the schools.

Introduction

Anaemia is a serious public health problem in low- and middle-income countries, especially among women of childbearing age (15–49 years old) and their children [*1*]. It has negative effects on working capacity, intellectual performance and pregnancy [*2*]. Iron-deficient populations are also more susceptible to infectious diseases [*3*], because the immune system is adversely affected.

In Egypt, nutritional anaemia is the most common type of anaemia. It is mostly caused by iron deficiency or, less frequently, insufficient intake of folate and/or vitamin B_{12}. Besides insufficient dietary intake, deficiency of these essential nutrients in children may be due to factors such as reduced absorption during meals (e.g. due to tannin in tea and phytate in unleavened bread) [*4*] or to infection with intestinal helminths which cause blood loss (e.g. *Trichuris trichiura*, *Schistosoma mansoni*, hookworms, *Fasciola* spp.) or interfere with iron absorption in the intestinal tract (e.g. *Giardia intestinalis*, *Ascaris lumbricoides*) [*5*].

Iron supplementation is considered a valid action to control nutritional anaemia while underlying causes are identified and corrected [*6*].

In Qena Governorate, as elsewhere in Egypt, the prevalence of anaemia in children is considered to be a major problem [*7*], but population-based data, especially on children, are limited. A national survey, recently conducted on adolescents, detected an overall prevalence of anaemia of 46.6% among the age group 10–19 years [*8*].

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Although children from 6 to 11 years of age are not considered at-risk of anaemia, the present study targeted schoolchildren because a former study in Behera Governorate detected a high prevalence of anaemia in this age group [*9*]. Furthermore, children attending primary schools are easily accessible and the selection of this target group enhances the cost-effectiveness of targeted interventions. The aim of this study was to collect population-based data on the prevalence of anaemia among schoolchildren aged 6–11 years to define appropriate control interventions.

Methods

Sample

The field assessment was carried out during January and February 2001 in Deshna and Armant districts, which are considered typical rural districts of Qena Governorate, Upper Egypt.

The study group included children from 6 to 11 years of age attending the primary schools in the 18 villages of the 2 districts. The minimum sample size was calculated for Armant as 337 schoolchildren, with an expected frequency of 35%, a worst acceptable frequency of 25% and a confidence level of 99.99% [*10*]. Following the same procedure, the minimum sample size for Deshna district was calculated as 682 children. Therefore, the total minimum sample size for the two districts was 1019 schoolchildren.

For the definition of the anaemia control intervention, it was relevant to relate anaemia data to the population of the 18 villages of the 2 districts, therefore the selected schools were chosen with a probability of inclusion proportionate to the village size. In total, 16 schools were selected in Armant district and 21 schools in Deshna district. In each school, 50 pupils were selected from classes 1 to 5 and for each class the first 10 on the register were selected. The calculated total sample size was 1850 schoolchildren from 6 to 11 years of age.

Blood analysis

Haemoglobin levels were assessed directly in the schools, using a portable haemoglobin spectrophotometer (*HemoCue*, Sweden). The sample was performed on capillary blood from the fingertip of each child after discharge of the first drop by painless sterile safety blood lancets. A trained laboratory technician from the region performed the test, assisted by the school doctor.

According to World Health Organization (WHO) standards [*11*], anaemia was defined in school-age children as a haemoglobin level < 11.5 g/dL and severe anaemia as < 7.0 g/dL.

All children found to be anaemic were treated according to the Egyptian Ministry of Health and Population guidelines and, if other pathologies were detected, children were referred to the appropriate level of care.

Analysis

Data were analysed by *Epi-Info* software, version 6.04.

Results

Out of the 1850 expected blood samples, results of haemoglobin assessments were available from 795 children of Armant district (424 male and 371 female), and from 1044 children of Deshna district (534 male and 515 female). This gave a total of 1844 schoolchildren from 6 to 11 years of age, of whom 958 (52%) were boys and 886 (48%) were girls.

The mean level of haemoglobin in the study population was 12.79 g/dL (standard deviation = 1.15). Out of the total number of examined children, 123 boys (6.7%) and 99 girls (5.4%), a total of 222 children (12.0%), were below the WHO cut-off point indicative for anaemia for the age group 6–11 years old (haemoglobin < 11.5 g/dL). No case of severe anaemia (< 7.0 g/dL) was detected. The prevalence of anaemia was 12.8% among boys and 11.2% among girls, but this difference was not statistically significant. In Armant district, out of 795 children, 96 (12.1%) were anaemic and in Deshna district, out of 1044 children, 126 (12.1%) were anaemic.

As shown in Figure 1, the prevalence of anaemia was higher among the pupils in grade 1 (16.9%) and gradually decreased towards grade 5 (9.5%).

Only 5 villages out of 18 reported a prevalence of anaemia higher than 20% among this age group of children.

Discussion

The results show that, among schoolchildren from 6 to 11 years of age living in rural Upper Egypt, the prevalence of anaemia is low and its severity is moderate. On the basis of the perceptions of health personnel and other studies performed on adolescents [*12*] in similar areas, a higher prevalence of anaemia among school-age children was expected. To interpret this result we can assume that the dietary intake in the area is currently just sufficient to satisfy the iron needs of the majority of school-age children. The higher prevalence of anaemia found among adolescents may be attributed to increased needs for iron due to rapid growth and the menarche [*13*]. Furthermore, a low prevalence and moderate intensity of intestinal helminth infections in the region have been reported in former studies [*14*] and the relationship between anaemia and infection with intestinal helminths (*Trichuris*, *Schistosoma* or *Ascaris* spp.) is well known [*15*]. The habit of consuming tea after meals has been demonstrated to affect iron absorption [*16*], but according to discussions with doctors and leaders of the local community, it is an uncommon practice in the research area, since the consumption of tea among rural school-age children is generally limited to

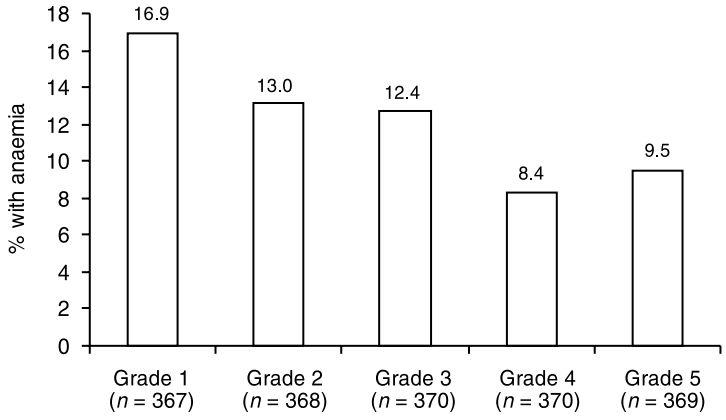


Figure 1 **Percentage of schoolchildren with anaemia at each school grade (*n* = number of haemoglobin assessments)**

breakfast and in most cases together with milk.

Socioeconomic conditions were not investigated in this study, since only public schools are available in this area, so the great majority of children of the 2 rural districts attend the same schools, irrespective of their socioeconomic status.

In conclusion, the study showed that the problem of anaemia among school-age children in the Qena region is not severe and therefore mass iron supplementation in primary schools is not recommended. However, children in the first year of school reported the highest rates of anaemia and they should be a priority target for a control programme. In the villages where schools had anaemia rates higher than 20% of pupils, weekly iron supplementation to all school-age children should be considered. In view of the prevalence of mild to moderate anaemia in the area, however, haemoglobin levels should be closely monitored and be part of the routine public health activities in primary and secondary schools.

Acknowledgements

The present study was implemented in the framework of the bilateral cooperation programme "Strengthening Rural Health Services in Behera, Qena and Dakhalia Governorates" between the Primary Health Care Department of the Ministry of Health and Population (MoHP), Egypt, and the Directorate General for Development Cooperation, Ministry of Foreign Affairs, Italy. The authors would like to thank all the district and regional MoHP personnel of Qena Governorate who actively participated to achieve the success of this fieldwork.

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Note from the Editor

We would like to draw our readers' attention to the evaluation form at the end of this issue. We welcome comments from our readers, which can help us improve the EMHJ. We would appreciate it therefore if readers could kindly take the time to complete this form and return it to us. Alternatively, the form can be completed online at: http://www.emro.who.int/publications/emhj/evaluationform.asp

Short report

Urinary iodine/creatinine ratio in patients with stomach cancer in Urmia, Islamic Republic of Iran

R. Behrouzian[1] and N. Aghdami[1]

SUMMARY We carried out a case–control study is to investigate the relationship between iodine deficiency and stomach cancer. We compared the ratio of urinary iodine to urinary creatinine in 100 patients diagnosed with stomach cancer and 84 people in a control group. Mean urinary iodine levels were lower in the patients with stomach cancer, 61.9 μg/g creatinine, compared to 101.7 μg/g creatinine in the control group (***P*** < 0.0001). More of the cancer patients (49.0%) had severe iodine deficiency (< 25 μg/g creatinine) than people in the control group (19.1%) (***P*** < 0.0001). We found the relationship between stomach cancer and iodine deficiency to be significant.

Introduction

Stomach cancer was reported as the leading cause of cancer-related deaths among American men in 1930. Despite the general decrease in its prevalence, it was estimated in 1989 that 20 000 new cases were diagnosed in the United States of America (USA) and that 13 900 Americans died of the disease [*1*]. Epidemiological studies conducted in Italy indicate that there is a relationship between increasing incidence of goitre due to iodine deficiency and incidence of gastric cancer in some regions of the country [*2*].

Although a review of the literature shows there have been a limited number of studies concerning the prevalence of stomach cancer in the Islamic Republic of Iran, considering the high rate of patients referred to endoscopy clinics, it may be one of the most prevalent cancers in West Azerbaijan.

The thyroid is derived both embryogenetically and phylogenetically from the primitive gut and thyroid cells can therefore be considered to be primitive gastroenteric cells that migrated during evolution and specialized in iodine uptake, storage and utilization [*3*]. The stomach and thyroid share an iodine concentrating ability as well as morphological and functional features such as apical microvilli, amino acid hormones, the ability to digest and reabsorb, and to form iodotyrosines by peroxidase activity [*4*]. The gastric iodide pump is, however, phylogenetically more primitive than that of the thyroid, has a lower affinity for iodide and does not respond to thyroid stimulating hormone [*5*].

Mammary cells are also known to have a high ability to concentrate iodine and incorporate it into proteins by mammary peroxidase during pregnancy and breast-feeding, which are considered protective factors against breast cancer [*6*].

In the normal thyroid of rats, iodine decreases hydrogen peroxide levels [*7*]. This protects the cells against lipid peroxidation. It has been shown that iodine deficiency or

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excess constitute risk factors for stomach cancer and atrophic gastritis by modifying gastric response and by antagonizing the activities of inhibitors such as nitrates, thiocyanates and salt. Iodine appears to have an antioxidant role in the more ancient organs, particularly the stomach [*5*].

The known risk factors for stomach cancer include a high salt diet, eating roasted foods, smoking, previous surgery on the stomach, atrophic gastritis, stomach polyps, being male, pernicious anaemia and *Helicobacter pylori* infection [*1*].

We carried out this study to determine the ratio of urinary iodine to creatinine in people with stomach cancer in Urmia, West Azerbaijan and to compare it with the ratio in people who did not have stomach cancer.

Methods

We carried out a case–control study over a 2-year period (1999–2001) on (1999–2001) 115 patients with stomach cancer who were referred to the endoscopy clinic of Imam Khomeini Hospital and whose diagnosis was confirmed by endoscopy and pathology. Exclusion criteria were history of previous gastric surgery, stomach polyp and medication with levothyroxine or antithyroid drugs. The control group was selected from the people attending the ophthalmology department of the hospital. We selected 100 people consecutively who had no symptoms or diagnosis of gastric carcinoma. They were matched for age and sex with the patient group. After elimination of confounding factors, we had 100 participants with gastric cancer, 67 males and 33 females, and 84 in the control group, 50 males and 34 females.

A morning urine sample was collected from all of the participants. The samples were sent to Urmia reference laboratory for analysis. Urinary iodine and urinary creatinine were measured and ratios of iodine to creatinine were calculated [*8*]. We considered values < 25 μg iodine/g creatinine as severe deficiency, 25–50 μg iodine/g creatinine moderate deficiency and > 50 μg iodine/g creatinine normal.

Results

Because these were matched samples, there was no marked difference between numbers of males and females in the 2 groups ($P = 0.82$). Nor was there any significant age difference ($P = 0.12$). The mean age of patients was 56.6 years (median 60 years; range 22–85 years) and in the control group it was 52.8 years (median 55 years; range 15–84 years). There was no marked difference regarding the use of iodized salt, 89.6% of the patient group and 88.9% of the control group were using iodized salt ($P = 0.1$).

Comparison of urinary iodine/creatinine ratios for the 2 groups indicated that the prevalence of severe iodine deficiency (iodine/creatinine < 25) was greater in the group with stomach cancer, 49.0% (Table 1). Correspondingly, the number of people with a normal iodine/creatinine ratio (> 50) was greater in the control group, 66.7%.

Mean urinary iodine level in patients with stomach cancer was about 40 units lower than that of people in the control group (61.9 μg iodine/g creatinine in patients, 101.7 μg iodine/g creatinine in the control group) ($P < 0.0001$). Mean urinary iodine levels for those using iodized salt was also lower in those with stomach cancer (61.4 μg iodine/g creatinine) than in the control group (102.7 μg iodine/g creatinine) ($P < 0.0001$), but there was no significant difference between the 2 groups for those who did not use iodized salt, 72.6 μg iodine/g creatinine in the patient

Table 1 **Iodine deficiency in patients with stomach cancer and a control group**

Iodine/ creatinine ratio[a]	Patients, *n* = 100 No.	%	Control group, *n* = 84 No.	%	*P*-value
< 25[b]	49	49.0	16	19.1	0.0001
25–50[c]	11	11.0	12	14.3	0.5
> 50	40	40.0	56	66.7	0.001

[a] *μg urinary iodine/g creatinine.*
[b] *Severe deficiency.*
[c] *Moderate deficiency.*

group, 95.1 μg iodine/g creatinine in the control group ($P = 0.62$).

Discussion

Venturi et al. have suggested that dietary iodine was associated with the development of some cancers of the stomach and breast as well as thyroid cancer. In Italy, gastric cancer is more frequent in iodine-deficient populations living in mountainous regions than in fishermen. The decrease in gastric cancer in Italy in the last 2 decades of the 20th century was correlated to a higher dietary consumption of iodine-rich fish over the same period [*9*]. Urinary iodine excretion was < 100 μg/day. The Food and Agricultural Organization recommends a level of 400 μg/day to compensate for environmental dietary goitrogens [*10*].

Urinary iodine excretion in Scandinavian countries now reaches 250 μg/day since introducing iodized salt, and in the USA it is 300–400 μg/day [*11,12*].

Urinary iodine excretion in Italian populations of the central Apennines was < 100 μg/day, lower among older people, farmers and those in poorer social classes, the people most at risk for goitre as well as gastric cancer [*2,9,13,14*].

It has previously been demonstrated that the frequent association between atrophic gastritis and goitre dysthyroidisms (thyrogastric syndrome) and between gastric antimucosa and antithyroid antibodies, which might be attributable to common organ specific antigens, are due to the same embryogenetic derivation [*11*].

Venturi et al. have shown the atrophic regulating action of iodine on gastric mucosa to be similar to the action on the thyroid. They also found a correlation between iodine deficiency, goitre and atrophic gastritis through gastric biopsy. Prevalence of atrophic gastritis was significantly correlated to the degree of iodine deficiency and goitre [*15,16*]

Prevalence of atrophic gastritis, which is considered a risk factor for stomach cancer in iodine deficient regions, has been very obvious in West Azerbaijan. Our findings also indicate a correlation between stomach cancer and iodine deficiency which is still valid even after the elimination of confounding factors such as age, sex and use of iodized salt.

The following questions should be considered in planning future research:

- Was iodine deficiency in patients with stomach cancer extant before or after cancer was diagnosed?
- Why was iodine absorption low in the patients with stomach cancer even though iodine intake was similar to that of the control group?
- Do the people who have stomach cancer have a genetic defect which affect iodine absorption?
- Would the prescription of iodine (other than iodized salt) prevent the development of stomach cancer?

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Recent WHO publications on nutrition

Diet, nutrition and the prevention of chronic diseases: report of a joint WHO/ FAO expert consultation, Geneva, 28 January–1 February 2002 Report of a
Geneva, World Health organization, 2003 (WHO Technical Report Series, No. 916).

This report examines the science base of the relationship between diet and physical activity patterns, and the major nutrition-related chronic diseases. Recommendations are made to help prevent death and disability from major nutrition-related chronic diseases. These population nutrient intake and physical activity goals should contribute in the development of regional strategies and national guidelines to reduce the burden of disease related to obesity, diabetes, cardiovascular disease, several forms of cancer, osteoporosis and dental disease. The recommendations contained in this report are based on the examination and analysis of the best available evidence and the collective judgement of a group of experts from WHO and FAO (Food and Agriculture Organization).

Nutrition labels and health claims on foods: the global regulatory environment
by C. Hawkes
Geneva, World Health Organization, 2004

This review aims to provide an overview of existing international, regional and national regulations and a description of past and future regulatory developments. It compiles, categorizes and tabulates international, regional and national regulations, and compares differing regulatory systems in 74 countries and areas. The document is available free on line at: http://whqlibdoc.who.int/publications/2004/9241591714.pdf

Set of serious childhood problems in countries with limited resources and Management of the child with a serious infection or severe malnutrition
Geneva, World Health Organization, 2004

Set of 2 complementary publications: 1) ***Management of the child with a serious infection or severe malnutrition: guidelines for care at the first-referral level in developing countries*** and 2) ***Serious childhood problems in countries with limited resources***. The first volume provides clinical guidelines and the second volume is aimed at medical, nursing and other healthcare students, and presents a summary of the technical background and the evidence-base underlying the clinical guidelines. For treatment recommendations, the first manual should be consulted. The second volume focuses on the major causes of childhood mortality dealing with disease definition, burden of disease, etiology, pathophysiology, clinical features, and management.

Towards healthier mothers, children & families: a nutrition guide for community health workers
Geneva, World Health Organization, 2002

This manual is primarily aimed at community health and/or nutrition workers. It offers practical information and simple ways to encourage mothers, caregivers, children and families to adopt good nutrition practices for health. Primary and secondary school teachers may also find this book useful for disseminating information on nutrition for better health. The manual is divided into three parts. Part 1 is concerned with nutrition for the family and outlines the nutritional and care needs of the different stages in the life cycle.

Part 2 deals with the needs of individuals with nutritional problems. It covers the signs and symptoms, risk factors, prevention and recommended actions for each condition. Part 3 covers food and nutrients. It includes basic nutrition knowledge such as nutrients in food, food properties and micronutrient supplementation. Community health and nutrition workers are encouraged to read this part before using the manual.

CD-ROM Food safety for nutritionists and other health professionals. Teacher's handbook
Geneva, World Health Organization, 2000

This training manual was produced for use in courses aimed at helping nutritionists and other health professionals understand the basic principles of food safety, the causes of foodborne disease, and opportunities for prevention, whether in food service establishments or homes. Intended to support an eight-day course, the manual can also be used to train food and public health workers, nurses, home economists, and other health professionals. Prepared jointly by WHO and the Industry Council for Development, the manual adopts a practical approach, emphasizing knowledge and skills needed to recognize unsafe food and food-handling practices, understand the implications for health, and develop appropriate intervention strategies.

The manual features 27 lectures presented in 11 modules. Each lecture consists of a series of sheets for overhead projection, accompanied by concise lecture notes. The modular approach allows trainers to adapt the suggested timetable to both local concerns and the background and interests of participants. While the course is primarily aimed at students having a limited knowledge of microbiology, students with more advanced knowledge can benefit from more time spent on the Hazard Analysis and Critical Control Point system and related training exercises.

The first module explains the behaviour of microorganisms, their ecology, and modes of contamination and transmission. The major foodborne infectious and toxigenic pathogens are profiled in module two, which includes information on epidemiology, groups at risk, clinical features, foods most commonly implicated, and conditions favourable to growth. Module three describes the significance of foodborne diseases in terms of both the impact of diarrhoea on nutritional status and the broader socioeconomic implications. Hazards associated with chemical contamination are covered in module four.

Subsequent modules consider strategies for prevention. Module five covers factors that affect the survival and growth of microorganisms and the food technologies that can control these factors. The epidemiology and prevention of foodborne disease are addressed in module six, which includes facts and figures illustrating both the magnitude of the problem and the best approaches to prevention. These approaches are further elaborated in modules on food hygiene and application of the Hazard Analysis and Critical Control Point system. The remaining modules discuss food safety aspects of biotechnology, and outline a work plan for trainers.

***Management of nutrition in major emergencies*, 2nd edition**
Geneva, World Health Organization, 2000

This is a practical guide to measures needed to ensure that the food and nutrition needs of disaster-stricken populations, refugees, or internally displaced persons are adequately met. Noting that nutrition is always a key concern in emergency management, the book offers expert advice based on both the latest knowledge in the nutritional sciences and advances in concepts of emergency management that stress preparedness and long-term recovery. The engagement of local

health services and authorities is emphasized as the best strategy for building national capacity and ensuring rapid recovery. The book covers the concepts, principles, and precise measures needed to ensure adequate nutrition in both the relief phase and the subsequent rehabilitation and development phases. Details range from a list of the equipment needed for a weight-for-height survey, through a diagram illustrating arrangements for ration distribution in camp situations, to instructions for preparing feeding mixtures for the treatment of specific deficiency diseases. Throughout, particular attention is given to conditions in developing countries, where inadequate nutrition and infectious diseases can make populations especially vulnerable to malnutrition in emergencies.Se:

The book has seven chapters. The first, on meeting nutritional requirements, explains the importance of nutritional assessment as a fundamental management tool for calculating food needs, monitoring the adequacy of food access and intake, and ensuring adequate food procurements. The chapter also sets out recommendations for mean daily per capita intakes of energy and protein and for micronutrients and other specific nutrients.

The major nutritional deficiency diseases are covered in chapter two, which includes detailed information on the signs, symptoms, prevention, and treatment of protein-energy malnutrition, iron-deficiency anaemia, vitamin A deficiency, iodine deficiency disorders, beriberi, pellagra, and scurvy. Chapter three describes the methodology for measuring malnutrition. Information includes target audiences for assessment, advice on body measurements and clinical indicators of malnutrition, and precise instructions for conducting rapid nutritional surveys, individual screening, and nutritional surveillance.

Chapter four provides a detailed guide to the planning, organization, and delivery of general feeding programmes aimed at the affected population as a whole. Topics covered include basic requirements for suitable food commodities, principles of good organization and coordination, and the composition of a general ration calculated to meet the populations' minimum requirements for energy, protein, fat, and micronutrients. Guidelines for selective feeding programmes are presented in chapter five, which covers both the supplementary feeding of vulnerable groups and the therapeutic feeding of individuals suffering from deficiency diseases.

In view of the close link between infectious diseases and malnutrition, chapter six offers advice on the organization of services to ensure priority immunizations and to monitor and treat each of twelve infectious diseases commonly seen in developing countries. The book concludes with advice on the planning, administration, and logistics of emergency preparedness and response programmes, emphasizing the need to detect vulnerability to nutritional deficiencies and monitor early warning indicators.

Bibliography of papers on nutrition published in the *Eastern Mediterranean Health Journal*

Anaemia in the Eastern Mediterranean Region
Verster A and van der Pols JC
East Mediterr Health J. 1995; 1(1):64–79

This study was done to assess the prevalence of iodine deficiency (ID) among primary schoolchildren in Cairo. A stratified random sampling technique covering the five geographic zones of Cairo was used. Data revealed that the goitre rate was 13.5%**;** being 10.8% among males and 16.2% among females. Prevalence among females was higher than that of males in all categories. Based on the data found by this study, it can be concluded that ID constitutes a mild public health problem among Cairo primary schoolchildren, and a salt iodization programme is highly recommended.

Assessment of the prevalence of iodine deficiency disorders among primary school children in Cairo
El Sayed NA, Ismail HM, Hussein MA and Kamel AA
East Mediterr Health J. 1995; 1(1):55–63

This study was done to assess the prevalence of iodine deficiency (ID) among primary schoolchildren in Cairo. A stratified random sampling technique covering the five geographic zones of Cairo was used. Data revealed that the goitre rate was 13.5%**;** being 10.8% among males and 16.2% among females. Prevalence among females was higher than that of males in all categories. Based on the data found by this study, it can be concluded that ID constitutes a mild public health problem among Cairo primary schoolchildren, and a salt iodization programme is highly recommended.

Low birth weight in the Taif Region, Saudi Arabia
Madani KA, Nasrat HA, Al-Nowaisser AA, Khashoggi RH and Abalkhail BA
East Mediterr Health J. 1995; 1(1):47–54

The present study is a prospective case–control study on low-birth-weight (LBW) infants born at the maternity hospital in Taif city in Saudi Arabia. The results showed a lower incidence (1 3.6%) of LBW than that reported from other developing countries. However, this incidence was almost double that reported from other cities in Saudi Arabia. Almost all forms of fetal morbidities among LBW infants and mortalities showed significant increase. Although the 2 500 gram figure for identifying low birth weight is important for comparison across different cultures, the results of this study suggest that each population should also establish its own birth weight centile.

Pattern of growth and development of premature children at the age of two and three years in Alexandria, Egypt (Part II)
Khalil KA, El-Amrawy SM, Ibrahim AG, El-Zeiny NA and Greiw AE
East Mediterr Health J. 1995; 1(2):186–93

This is the second part of a paper on a study conducted in Alexandria on 68 premature children. Controls were full-term children, double the number of prematures, and matched by age and sex. The first part presented differences in growth and development in relation to prematurity. This part deals with risk factors for prematurity. The study revealed that low educational level of fathers and parental smoking were significant risk factors for prematurity. The mean age of both parents and mothers' gravidity were signifi-

cantly higher for prematures. Other risk factors were identified. Mothers with diabetes and chronic nephritis were more likely to have a premature child.

Pattern of growth and development of premature children at the age of two and three years in Alexandria, Egypt (Part I)
Khalil KA, El-Amrawy SM, Ibrahim AG, El-Zeiny NA and Greiw AE
East Mediterr Health J. 1995; 1(2):176–85

A case–control study was conducted in Alexandria on 68 premature children: 32 of them at the age of 2 and 36 at the age of three years. The aim was to depict the pattern of growth and development among them. Controls were full-term children, who were double the number of prematures and matched by age and sex. It was found that the growth pattern of full-term children aged two and three years was better than that of prematures. Moreover, prematures were significantly delayed in some developmental areas as language, fine motor-adaptive sectors and personal–social domains than their corresponding controls. The study suggests that the provision of quality medical care could eliminate the growth and developmental lag of premature children.

Nutritional outcome of appropriate feeding during and after acute diarrhoea in children
Madkour AA, Massoud MNZ, El-Azzouni OEF, Amer MA, Ragab MAF and El-Sawy EHA
East Mediterr Health J. 1995; 1(2):162–75

A sample of 120 children with acute diarrhoea was divided into two equal study groups. There was no difference between groups in pre-intervention and post-intervention findings during the acute phase of diarrhoea. Upon discharge, Group A patients were supplied weekly with sufficient milk formula and cereal together with adequate nutritional advice while Group B patients were supplied with food or nutritional advice only if requested by the mothers. Forty nine patients from each group were followed each week for four weeks. Group B infants showed a higher incidence of recurrent diarrhoeal attacks and a significantly longer duration of recurrent diarrhoea than Group A infants. Moreover, Group A infants scored a significantly higher weight increment than Group B ones after four weeks of follow up.

Growth pattern of Saudi schoolboys in a high-altitude area of Saudi Arabia
Abolfotouh MA and Badawi IA
East Mediterr Health J. 1995; 1(2):205–9

The aim of the present study was to examine the growth of schoolboys in a high-altitude area of Saudi Arabia, and to investigate the appropriateness of using the US National Center for Health Statistics (NCHS) standards for the assessment of children's growth in such areas. The study concluded that the use of NCHS standards is not appropriate for the assessment of growth of schoolboys in Asir Region. Further studies are needed to determine whether the findings of this study are altitude-dependent or not.

An overview of emerging foodborne and waterborne diseases
Bartlett CLR
East Mediterr Health J. 1996; 2(1):51–60

Several foodborne and waterborne diseases have emerged in the past two decades as a consequence of changes in etiological agents, hosts and the environment. The burden of foodborne and waterborne disease is not uniformly distributed globally: because of the inequitable distribution of the world's resources some countries carry a disproportionately heavy burden of infectious disease, and what is considered a re-emergent pathogen in one location may be endemic in another.

Possible effects of iodized salt on the taste, colour and consistency of traditional pickles
Badran O, Qaraqash W and Gamah S
East Mediterr Health J. 1996; 2(2):219–23

A national survey was conducted in Jordan in 1991 to determine the prevalence of iodine deficiency disorders. A sample of 2679 children aged 8–10 years was screened and the results revealed that 37.7 % of the study sample were suffering from iodine deficiency

disorders. Iodization of salt is the preferred approach for supplementation. The present study was conducted to identify the effect of iodized salt on the colour, taste and consistency of traditionally prepared pickles. It was concluded that iodized salt has no effect on any of the sensory characteristics of traditionally prepared pickles.

Current nutritional status of mothers and children in Al Ain, United Arab Emirates
Dawson KP, Hughes P, Mpofu D and Patel M
East Mediterr Health J. 1996; 2(2):224–8

Forty-six mothers and children from the United Arab Emirates participated in a pilot study to determine possible micronutrient deficiencies in the country. Thirty-five per cent (35 %) of the children and 21 % of the mothers had low serum ferritin levels, while 30 % of the mothers had low serum 25-hydroxyvitamin D with 28 % of mothers having a low serum folate status. These deficiencies are widespread in the nationals of the United Arab Emirates. In view of the increasing importance of intrauterine and early infant nutrition, further investigation and a national study seem warranted.

Nutrition surveillance in the Sudan: a community-based approach
Ahmed AEM and Ahmed IAM
East Mediterr Health J. 1996; 2(2):229–35

In 1992, a pilot project for collecting information on the socioeconomic and nutritional status of children and their mothers as part of the early warning system was implemented in two villages in Kassala Province, Sudan. The objectives were to test the feasibility of local participation in socioeconomic and nutritional data collection, analysis and utilization; and to incorporate socioeconomic data into the food and nutrition information system, and examine its usefulness in early warning. The pilot project also included the introduction of new parameters such as adult anthropometry, i.e. body mass index of the mothers of the children seen, to monitor the nutritional status of both children and their mothers at the same time. This led to very interesting results which played a major role in determining the type of intervention needed.

Progress towards elimination of IDD in the Islamic Republic of Iran A KAP survey of iodized salt consumption
Sheikholeslam R
East Mediterr Health J. 1996; 2(2):236–42

It has been recognized for a number of years that iodine deficiency disorders constitute a health problem in the Islamic Republic of Iran. A programme for the prevention of such disorders was established in 1989 and intensive efforts have been made to overcome obstacles hindering its implementation. This study investigates the difficulties encountered, common factors behind the prevalence of iodine deficiency, the progress made in combating it and the results of a nationwide campaign to raise awareness of the need to consume iodized salt. The final part of the study presents general conclusions and recommendations which may be of use to countries facing a similar problem in the field of health and nutrition.

Dietary management of surgical patients: effects on incisional wound healing
Elbanna HM, Tolba KG and Darwish OA
East Mediterr Health J. 1996; 2(2):243–54

A study of 38 patients was undertaken at the main University Hospital in Alexandria. The sample was divided into a control group and an experimental group. Findings show statistically significant differences between the two groups in the level of education, but no difference in blood picture, body mass index or nutritional status. There was a difference in the rate of wound healing in the two groups, and a relationship between the nutritional status and wound healing in the control group. Total hospital stays for the control group were longer than those for the experimental group. The nutritional status of surgical patients, as well as their food intake, should be evaluated at short intervals before and after surgery.

Underestimation of malnutrition among Pakistani infants weighed with clothes on
Faisel A and Ahmed T
East Mediterr Health J. 1996; 2(2):255–60

Many growth monitoring programmes at health facilities and in communities in Pakistan weigh children with their clothes on. The nutritional status of infants at the Rawalpindi General Hospital was estimated from weight without clothes on and showed that about 8% of malnourished children were being missed. This underestimation mostly affected children with grade II and grade III malnutrition. Generally, more boys have normal nutritional status than girls. Accordingly, weight with clothes on was found to underestimate the malnutrition status of girls more than that of boys. Children should be weighed without clothes on so as estimate their nutritional status and risk accurately.

Composition and nutritional value of traditional rural Iranian foods
Azar M and Aminpour A
East Mediterr Health J. 1996; 2(2):261–7

There are a limited number of studies available on the composition and nutritional value of traditional rural foods in the Islamic Republic of Iran. In this study, an attempt was made to collect information on these foods through a questionnaire by health workers in rural areas of northern, southern, eastern, western and central regions of the country. A total of 24 traditional rural foods and composite dishes were identified. ***Eshkeneh-daneh*** and ***ab-baneh*** contained high energy and protein contents among plant and mixed (plant and animal) foods, respectively. Their energy density and protein–energy ratio were very high. The calcium content was relatively high in ***ab-baneh***, but the iron content rather low in both. Melon seed in ***eshkeneh-daneh*** and local nuts in ***ab-baneh*** were the main ingredients in these composite dishes.

Nutritional status survey of preschool children in Kuwait
Amine EK and Al-Awadi FA
East Mediterr Health J. 1996; 2(3):386–95

The nutritional status of 645 male and 635 female preschool children in Kuwait was assessed. Mothers were interviewed to collect data on socioeconomic variables. The length/height and body weight of the children were recorded and haemoglobin concentration was determined. The results show that 11.5% of the boys and 9.9% of the girls were stunted; the prevalence of wasting was fairly similar in both sexes (10.1%–10.9%). Obesity was more prevalent in girls (18.4%) than boys (16.1%). Anaemia was more prevalent in boys (32.9%) than girls (25.8%). Factors such as birth order, family income and mother's education and employment were found to affect the prevalence of undernutrition.

Maternal characteristics and infant and young child feeding in Benghazi
Balo NNM, Shembesh NM and Singh R
East Mediterr Health J. 1996; 2(3):432–9

Two hundred (200) mothers consecutively attending Al-Fateh Paediatric Hospital, Benghazi in 1992 were interviewed. The majority of women were under 30 years of age, had primary or no education, were housewives, had no experience of pregnancy wastage or child loss, used no contraception, had one to three living children, had information about breast-feeding from the mother-in-law, a relative or a neighbour, considered breast-feeding a natural way, nutritionally superior and hygienic, and practised mixed feeding. The reasons for introducing artificial feeding were maternal in 49.7% of cases, filial (related to the baby) in 36.5% and due to social pressure in 13.8%. Measures for successful breast-feeding are emphasized.

Iodine deficiency disorders among primary-school children in Kafr ElSheikh, Egypt
El-Sayed NA, Gad ZM, Nofal LH, Ismail HM, El Sahn FF and Gad A
East Mediterr Health J. 1997; 3(1):29–37

The prevalence of iodine deficiency in primary-school children in Kafr El-Sheikh governorate was assessed. A total of 2250 primary-school children aged 8–10 years

were selected by a two-stage cluster sampling technique. The results revealed that the prevelance rate of goitre was 27.1% and it was significantly higher in females (29.2%) than males (25.1%). The median urinary iodine level was 6.7 µg/dl and 3.9 µg/dl for grade 1 and grade 2 goitre respectively. It was concluded that iodine deficiency is a public health problem of moderate severity in primary-school children in Kafr El-Sheikh governorate. This necessitates an intervention programme through salt iodization.

Breast-feeding and weaning patterns in Benghazi, Libyan Arab Jamahiriya
Shembesh NM, Balo NNM and Singh R
East Mediterr Health J. 1997; 3(2):251–7

An interview survey of 200 mothers attending the emergency service of Al-Fateh Paediatric Hospital, Benghazi, showed that prelacteal feed was given to 18.5% of babies and breast-feeding was ever initiated in 90.5%. After three months exclusive breast-feeding was continued in less than 30%, mixed feeding in 44%–71% and supplementary feeding (with and without breast-feeding) in 65%–97%. Locally consumed food like fruit juice, vegetables, cooked rice and cereals and boiled eggs in mashed form were used as supplementary foods. No association was revealed between the type of feeding and childhood episodes of any illness, including diarrhoea or acute respiratory infection. Measures for prolonged breast-feeding, substitute artificial feeding (when indicated) and supplementary feeding are suggested.

Recent trends in infant feeding patterns and weaning practices in Kuwait
Al-Awadi FA and Amine EK
East Mediterr Health J. 1997; 3(3):501–10

A multistage stratified sample of 782 mothers of infants under two years of age was taken to investigate infant feeding patterns and weaning practices. The rate of breast-feeding was 26.1% and that of bottle-feeding 41.9%. Breast-feeding was more common among late order children and those born to illiterate mothers. The mean duration of breast-feeding was 4.9 months and was longer among illiterate mothers. Infants were weaned because of insufficient mother's milk, mother's desire and infant refusal of the breast. The results indicate that there has been a sharp decline in breast-feeding. The reasons for this are discussed and measures to reverse the trend are recommended.

Current status of breast-feeding in Alexandria governorate: a community-based study
Kamel NM, Ibrahim AG, Aref SR and Ziyo FY
East Mediterr Health J. 1997; 3(3):511–8

This study was carried out to provide baseline data for various indicators measuring breast-feeding and bottle-feeding practices in Alexandria. In 1995, a total of 1080 children aged below 24 months, equally distributed among six age groups, were selected for a household 24-hour dietary survey. The findings indicated that only 42.2% of infants below 4 months were currently exclusively breast-fed, while 21.1% were predominantly breast-fed. Hence, the rate of breast-feeding was 63.3%. The prevalence rate of timely complementary feeding was 62.3%. Continued breast-feeding rate at 1 year was 64.4%, and at 2 years was 33.9%. The bottle-feeding rate (among infants less than 12 months) was 44.3%.

Dietary energy and protein requirements for Saudi Arabia: a methodological approach
Khan MA and Al-Kanhal MA
East Mediterr Health J. 1998; 4(1):68–75

Based on the available scientific information on human requirements, recommended dietary allowances of energy and protein for different age and sex groups of Saudis were estimated. The per capita requirements of energy and protein (NPU 0.8) at national level were calculated to be 2100 kcal per day and 53 g per day respectively. For men of reference body size 65 kg, the average recommended allowances are 2800 kcal per day and 65 g of protein per day. For women of reference body weight 56 kg, these are 2100 kcal per day and 56 g of protein per day. Additional recommended daily allowances for pregnant and lactating women are given. Pro-

tein–energy ratio percentage was calculated as 6%–12%. RDAs and reported energy and protein intakes are compared.

Feeding patterns in the first two years of life in Basra, Iraq
Benyamen YS and Hassan MK
East Mediterr Health J. 1998; 4(3):448–51

The feeding patterns of 694 children ranging from 12 to 24 months of age were studied. Approximately 91% were exclusively breastfed at 1 week of age with a further 4% receiving supplementary foods at this stage. At 1 year of age, 52% were receiving breast milk as the only source of milk and 13% were receiving infant formula in addition to breast milk. Inadequate breast milk was the most common reason reported by mothers for discontinuing breast-feeding. Of children receiving formula, 42.9% were receiving diluted formula. 70.9% of mothers introduced solid foods at 4 to 6 months of age while 5.8% did not introduce solid foods until after the age of 8 months.

Self-efficacy for dietary behaviour concerning heart disease among Alexandria school pupils
Mounir GM, Fatohy IM and Mahdy NH
East Mediterr Health J. 1998; 4(3):452–69

A study of 1134 preparatory-school pupils was conducted to measure children's self-efficacy for selecting healthy food for the heart, to examine the relationship between self-efficacy and self-reported usual food consumption and to estimate test-retest reliability. Results revealed an acceptable estimate of internal consistency of dietary self-efficacy (Cronbach alpha = 0.76). Over half the students exhibited a moderate level of self-efficacy and 42% a high level. Test-retest reliability of the scale was good (***r*** = 0.65, Cronbach alpha = 0.79). Usual food choice was the first best predictor of dietary self-efficacy (***r*** = 0.44), followed by sex (boys had higher self-efficacy than girls) and then knowledge (***r*** = 0.37).The three factors contributed to explain 25% of the variance.

Food consumption pattern in the Islamic Republic of Iran and its relation to coronary heart disease
Kimiagar SM, Ghaffarpour M, Houshiar-Rad A, Hormozdyari H and Zellipour L
East Mediterr Health J. 1998; 4(3):539–47

A study was conducted to determine and evaluate the Iranian food consumption pattern in relation to coronary heart disease and dietetic risk factors. Nationwide data collected in our recent surveys were analysed. The findings reveal plant foods to be the basis of the Iranian diet. Of the total energy intake, 66% and 22% came from carbohydrates and fats respectively. The share of fat from different food groups was: meat and eggs 22%, dairy products 10%, fats and oils 58%. The percentage of saturated, monounsaturated and polyunsaturated fatty acids was 11.3%, 6.8% and 2.1% of the total energy intake respectively. Although the general food pattern of the population falls within the accepted ranges, the trend in the past 30 years reveals a twofold increase in fat intake.

Infant-feeding practices in Al-Ain, United Arab Emirates
Osman NA and El-Sabban FF
East Mediterr Health J. 1999; 5(1):103–10

A survey was conducted to study the practices of infant-feeding and the influencing factors in Al-Ain, United Arab Emirates. It involved 375 mothers of different nationalities and backgrounds and 300 healthy infants. The mothers were interviewed at four primary health care clinics in Al-Ain. Results showed that 46% of infants were breastfed for 4–6 months. The mother's nationality and her educational status were significant influences on the mother's decision to exclusively breast-feed the infant, for how long and when to introduce supplementary food. Fresh cow and goat milk were the most common supplements. Inclusion of baby formula as a supplement generally occurred early, perhaps because of advertising and the affluence in Al-Ain.

Long-term administration of vitamin A and the process of spermatogenesis
Sadek IA and Abdul-Mohsen MH
East Mediterr Health J. 1999; 5(1):123–9

The effect of retinoids on spermatogenesis in adult male gerbils (***Gerbillus cheesemani***) was studied using light and electron microscopy. Treatment with either 13-cis-retinoic acid or retinol acetate was given for 6 weeks and their effects were compared with controls. It was found that 13-cis-retinoic acid induced almost complete cessation of spermatogenesis and produced alterations in the cytoplasm of Leydig cells. No differences were seen in the testis of animals treated with retinol acetate compared with controls using light microscopy but it appeared to produce noticeable ultrastructural changes in Leydig cells. The changes observed were reversed 12 weeks after stopping treatment. Caution should be exercised regarding the use of dietary retinoids in the prevention of cancer.

Iron status of Libyan infants with urinary tract infection
El-Foghy Z, Sagher F and Al-Agili S
East Mediterr Health J. 1999; 5(2):344–9

Serum iron, serum total iron binding capacity and tranferrin saturation levels were measured in 45 infants, of whom 19 had urinary tract infections confirmed by positive suprapubic aspiration. The control group comprised 26 healthy infants with negative results. Mean serum iron and transferrin saturation values were significantly lower in infants with urinary tract infection compared with the control group ($P < 0.01$ and $P < 0.001$ respectively), especially if the cultured organism was Escherichia coli ($P < 0.01$, $P < 0.02$). Total iron binding capacity was within the normal range. We conclude that iron deficiency is not a major factor in the etiopathogenesis of urinary tract infection in Libyan infants.

Eating disorders: a transcultural perspective
Shuriquie N
East Mediterr Health J. 1999; 5(2):354–60

It is plausible that eating disorders have a sociocultural cause. They are classically perceived as western culture-bound syndromes associated with culture-driven factors, such as unrealistic expectations of slenderness and attractiveness, changes in the role of women, and social standards and attitudes towards obesity. The drive to be thin is not universal. In many non-Western countries plumpness has traditionally been considered attractive and associated with fertility and caring. While many non-Western societies show a positive relationship between increased body weight and higher social class, the opposite relationship is found in Western societies. This paper examines differences in cultural perceptions of body weight and its effect on eating disorders.

Maternal smoking and breastfeeding
Najdawi F and Faouri M
East Mediterr Health J. 1999; 5(3):450–6

A 2-month study was undertaken to investigate the effects of maternal smoking on breastfeeding. A total of 500 mothers were interviewed twice postpartum and information about maternal smoking and sociodemographic factors was collected. After adjustment for maternal smoking and other confounders, results suggested that smoking had a direct effect on breastfeeding. The prevalence of breastfeeding reduced significantly among smokers but there was no significant reduction among non-smokers. Education and social class were related positively to continued breastfeeding but negatively to smoking. Because breastfeeding decreased with smoking, smoking should be discouraged, particularly in developing countries where breastfeeding constitutes an essential child survival measure.

Prevalence of xerophthalmia among children in Beheira governorate, Egypt
Curtale F, Tammam H, Hammoud ES and Aloi A
East Mediterr Health J. 1999; 5(5):984–91

A survey was conducted on a sample representative of the entire Beheira governorate to identify high-risk areas of vitamin A deficiency (VAD) and assess xerophthalmia prevalence. The study also tested the reliability of a household cluster survey for assessing xerophthalmia prevalence. A trained ophthalmologist examined 10 664 children. The results showed that VAD was present in

the region, but did not appear to be a public health problem. Ocular signs of VAD were more prevalent among older children, suggesting an improvement in socioeconomic conditions and health care over the past few years. The household cluster survey appeared to be a reliable method for assessing xerophthalmia prevalence in the region.

Community-based nutritional intervention for reducing malnutrition among children under 5 years of age in the Islamic Republic of Iran

Malekafzali H, Abdollahi Z, Mafi A and Naghavi M
East Mediterr Health J. 2000; 6(2/3):238–45

A project was conducted in a rural area in September 1994 with the aim of decreasing the incidence of protein-energy malnutrition among children under 5 years, by nutritional intervention through the primary health care system. An initial situation analysis revealed the region's resources and causes of malnutrition. Practical instruction on feeding methods, deworming, environmental sanitation, the promotion of home-grown vegetables and reinforcement of the growth monitoring programme were chosen as the routes for intervention. All indices were reassessed in the region after 1 year. Results showed that nutritional awareness had grown among mothers, and that the incidence of malnutrition had dropped from 6.5% to 1.8%, as measured against the weight-for-height index.

Prevalence of overweight and obesity in diabetic and non-diabetic Saudis
El-Hazmi MAF and Warsy AS
East Mediterr Health J. 2000; 6(2/3):276–82

A total of 14 660 individuals were included in the study. A fasting blood sample and 2-hour post-glucose load blood sample from each participant were analysed for blood sugar. Participants were classified as diabetic or non-diabetic and as either obese (BMI >30 kg/m^2), overweight (BMI 25–29.9 kg/m^2) or normal (BMI < 25 kg/m^2). The prevalence of obesity was calculated in the total sample and separately for diabetic and non-diabetic males and females. The results showed obesity and overweight in 13.05% and 27.23% of males and 20.26% and 25.20% of females respectively. The prevalence of both obesity and overweight were significantly higher among diabetics than non-diabetics. In each province, diabetics had a significantly higher prevalence of obesity than non-diabetics. Several interprovincial variations were seen. Public education on obesity and overweight and ways to decrease them are recommended in Saudi Arabia.

[The relation between protein–energy malnutrition and gingival status in children] [Article in Arabic]
Dashash MA
East Mediterr Health J. 2000; 6(2/3):507–10

[The purpose of this study was to investigate the relation between protein-energy malnutrition and gingivitis in children in Damascus and its suburbs. For this purpose we used a random sample of 840 male and female children aged 6-12 years. Their gums were examined. The bleeding indexes were recorded for both primary and permanent teeth. Anthropometric measures were taken: Weight for age, Height for age and Weight for Height. We found that gingivitis increased among low weight children (44%) compared to normal children (31%). It was more severe in low-height children in comparison to others. These findings necessitate the promotion of preventive care in order to insure gingival hygiene, particularly by following a balanced diet.]

Anaemia among young male workers in Alexandria, Egypt
Curtale F, Abdel-Fattah M, El-Shazly M, Shamy MY and El-Sahn F
East Mediterr Health J. 2000; 6(5/6):1005–16

In a cross-sectional survey, we investigated exposure to and the presence of factors associated with anaemia, such as socioeconomic conditions, dietary habits, intestinal parasitic infections and lead among 355 young male workers (7–19 years of age) employed in private workshops. Of the total study sample, 44.5% (158 participants) were found to be anaemic. The major risk factors for anaemia

were multiple parasitic infection, high intensity of parasitic (***Ascaris lumbricoides***) infection and drinking tea soon after a meal. A significantly lower prevalence of anaemia was noted after Ramadan; it appeared to be the main factor associated with the presence or absence of anaemia and warrants further attention.

Anaemia among Egyptian adolescents: prevalence and determinants
El-Sahn F, Sallam S, Mandil A and Galal O
East Mediterr Health J. 2000; 6(5/6):1017–25

We aimed to estimate the nationwide prevalence of anaemia among adolescents in Egypt and to study possible risk factors. A cross-sectional approach was used. Blood samples were collected from 1980 adolescents for haemoglobin estimation. The overall prevalence of anaemia was 46.6%, most of which was mild or moderate, with severe cases in less than 1.0% of the sample. Gender difference was almost nonexistent. A significant inverse relationship was observed between the level of anaemia and age (especially among boys), socioeconomic level and educational level. Anaemia was more prevalent in rural areas and in Upper (southern) Egypt. Anaemia is a major public health problem among Egyptian adolescents and wide-scale public health education is warranted.

Nutritional status of Yemeni schoolchildren in Al-Mahweet Governorate
Raja'a YA, Sulaiman SM, Elkarib SA and Mubarak JS
East Mediterr Health J. 2001; 7(1/2):204–10

The nutritional status of 948 children selected randomly from Al-Mahweet Governorate schools was investigated. Age range was 5–18 years with a mean of 10.6 ± 2.8 years. Among the children, 3.4% had depleted iron and 43.4% had below average skin-fold thickness. Approximately half of the children were either stunted or chronically underweight and 1 child in 20 was underfed. Depleted fat stores affected two-fifths of the children and approximately one-fifth were anaemic. Urban residents scored significantly higher on nutritional parameters than rural children. Serum ferritin levels were significantly greater among males than females whereas mean height-for-age, weight-for-age and skin-fold thickness were lower.

National study on the prevalence of iodine deficiency disorders among schoolchildren 8–12 years of age in Bahrain
Moosa K, Abdul Wahab AW, Al-Sayyad J and Baig BZ
East Mediterr Health J. 2001; 7(4/5):609–16

A cross-sectional survey of primary-school children in Bahrain was conducted to estimate the prevalence of goitre and iodine deficiency according to age, sex and area of residence. During January–May 1999, 1600 children were randomly chosen from all government schools. Children were examined for goitre and of those, 50% were randomly selected for urinary iodine level assessment. Only 26 children (1.7%) had goitre. Although median urinary iodine was above 100 microg/L, 121 of 749 children (16.2%) had low urinary iodine levels. Although iodine deficiency does not pose a significant public health problem in Bahrain, education about the nutritional value of iodized salts in the prevention of this disorder could increase public awareness.

Iron status and socioeconomic determinants of the quantity and quality of dietary iron in a group of rural Iranian women
Djazayery A, Keshavarz A, Ansari F and Mahmoudi M
East Mediterr Health J. 2001; 7(4/5):652–7

Iron intake and status were investigated in 471 mothers (age range: 16–53 years) from rural areas in Khorramabad, Islamic Republic of Iran. Although average total iron intake was acceptable, only 6.4% of women derived at least 4% of their total intake from animal iron. Average energy and protein intakes were inadequate. Low iron status was seen in 8.2%–28.7%, depending on the parameter used, with 28.3% experiencing iron-deficiency anaemia. Significantly higher animal iron intakes were found in literate or employed

women, or those of family size fewer than six people. Increasing employment opportunities, income levels and literacy rates for women will result in better iron intake and status and should receive particular attention in national planning.

Incidence and determinants of low birth weight in Syrian government hospitals
Wannous S and Arous S
East Mediterr Health J. 2001; 7(6):966–74

The incidence and determinants of low birth weight were studied in a stratified sample of 10 585 deliveries at 18 Syrian government hospitals. For each low-birth-weight baby born, two normal-birth-weight babies were recruited as a comparison group. A questionnaire was given to mothers and clinical examinations were performed on the neonates. The incidence of low birth weight was 6.6%. It varied according to geographic region and hospital. The study confirmed that low birth weight could be the result of prematurity. Factors amenable to intervention, such as birth interval, maternal nutrition, maternal weight and smoking, appeared to have a role in low birth weight.

Nutritional status of Libyan children in 2000 compared with 1979
Hameida J and Billot L
East Mediterr Health J. 2002; 8(2/3):261–71

This cross-sectional study examined the growth and nutritional status of Libyan preschool children and the socioeconomic status of their parents in 2000 and compared the results with those of a similar study conducted in 1979. The investigation involved 1614 healthy children of both sexes under 5 years of age in two regions of the Libyan Arab Jamahiriya. Simple random sampling and cluster sampling techniques were used to enlist participants. Body weight, height, and head and arm circumference of the children were recorded and mothers were interviewed about their child's health and the socioeconomic status of the family. Significant improvements in nutritional status since 1979 were found that could be attributable to factors such as socioeconomic development, longer breastfeeding, greater availability of high energy foods, supplementation with semi-solid or solid foods and heavy government subsidy of basic foods.

Nutritional stunting in Egypt: which nutrient is responsible?
Ibrahim SA, Abdel-Maksoud A and Nassar MF
East Mediterr Health J. 2002; 8(2/3):272–80

We looked at the relationship between linear growth retardation and deficiencies of certain nutrients in Egyptian children. A group of 107 stunted children aged between 10 and 18 years were subjected to history-taking, physical examination and laboratory investigations. Selected cases were referred to radiology for assessment of bone age. Thirty-nine children were enrolled as controls. Serum haemoglobin, alpha-tocopherol, retinol and magnesium levels were significantly decreased in stunted children compared with the controls. Serum zinc levels were also lower in the stunted group but not significantly so. We conclude that several nutrient deficiencies occur simultaneously in stunted children and all of them may be responsible for stunting.

Evaluation of erythropoiesis in protein energy malnutrition
El-Nawawy A, Barakat S, Elwalily T, Abdel-Moneim Deghady A and Hussein M
East Mediterr Health J. 2002; 8(2/3):281–9

This study evaluated erythropoiesis in 50 infants hospitalized with protein energy malnutrition and in 50 control infants. The red cell count, mean corpuscular haemoglobin and reticulocyte index were significantly lower, while the white blood cell count, median corpuscular fragility and red cell distribution width were significantly higher on admission than in controls. Total serum protein, albumin, fasting blood glucose, and serum folate were significantly lower on admission than in controls. Serum ferritin was significantly higher and total iron-binding capacity was significantly lower on discharge compared to controls. The serum erythropoietin was significantly higher on admission and dis-

charge than in controls. The anaemia of protein energy malnutrition is due to mixed deficiencies resulting in ineffective erythropoiesis despite an increased level of erythropoietin.

Impact of nutritional rehabilitation on enzymatic antioxidant levels in protein energy malnutrition
Shaaban SY, Nassar MF, Ibrahim SA and Mahmoud SE
East Mediterr Health J. 2002; 8(2/3):290–7

To assess the role of enzymatic antioxidants in the pathogenesis of protein energy malnutrition (PEM) and the effect of nutritional rehabilitation, we studied 30 infants with PEM (mean age 10.63 +/- 4.39 months: 10 marasmic; 8 with kwashiorkor; 12 with marasmic kwashiorkor) and 15 controls. All underwent clinical examination and laboratory investigations, including superoxide dismutase (SOD) and glutathione peroxidase (GPx) estimation before and after nutrition rehabilitation. SOD and GPx were significantly lower in all malnourished infants compared to controls, and significantly increased after nutritional rehabilitation. These significant correlations suggest that antioxidants could be introduced during PEM nutritional rehabilitation to decrease morbidity and mortality.

Suitability of soluble transferrin receptor for the clinical diagnosis of different types of anaemia in children
Ragab L, Ibrahim HA, Eid AS, Kotb T and Konsowa MF
East Mediterr Health J. 2002; 8(2/3):298–307

We evaluated the ability of serum transferrin receptor (sTFR) to identify different types of anaemia in children. Thus 150 Egyptian children suffering from anaemia (iron deficiency anaemia, anaemia of chronic disease and beta-thalassaemia) were enrolled, together with 50 controls. There was a significant increase in the mean levels of sTFR in the groups with iron deficiency anaemia and thalassaemia, and a significant decrease in mean sTFR levels in the group with anaemia of chronic disease. Serum ferritin levels were significantly higher in all patient groups except the group with iron deficiency anaemia. There were also significant correlations between the sTFR and sTFR/log ferritin ratio (sTFR-F index) and different indices of iron status and of erythropoiesis. The sTFR-F index could be used as a diagnostic or screening tool for iron deficiency anaemia, anaemia of chronic disease and thalassaemia.

Growth of preschool children in the Libyan Arab Jamahiriya: regional and sociodemographic differences
Hameida J, Billot L and Deschamps JP
East Mediterr Health J. 2002; 8(4/5):458–69

This cross-sectional study was performed in two regions of the Libyan Arab Jamahiriya. The aim was to study the growth and nutritional status of children under 5 years of age and the effect of socioeconomic factors on child development. Anthropometric indices (weight-for-age, height-for-age and weight-for-height) differed in the two regions. The prevalence of stunting was significantly higher among children from mainly rural Al Jabel Al Garby (6.1%) than those from urban Tripoli (2.5%). The z-scores that correlated strongly with under-nutrition included: mother's education, child's age and sex, and region. Stunting was significantly related to age and region and to maternal education level and family size. Wasting was highly correlated with maternal education

Overweight and obesity among Saudi Arabian children and adolescents between 1994 and 2000
Abalkhail B
East Mediterr Health J. 2002; 8(4/5):470–9

Overweight and obesity trends were investigated for schoolchildren and adolescents in Jeddah using data from 1994 and 2000. Individuals aged 10-20 years were selected using multistage stratified random sampling and direct measurements were made of body weight and height. Percentiles were calculated for body mass index (BMI), body weight and height for specific age and sex strata. For both sexes, BMI increased between 1994 and 2000 at the 50th percentile but higher still at

the 85th and 95th percentiles. The increase in body weight and BMI were marked for all age groups; however boys showed the largest increase aged 10–16 years, whereas girls showed the lowest at 14–16 years. Public health intervention is crucial to prevent or reduce overweight and obesity among youth.

Antioxidant micronutrients in children with thalassaemia in Egypt
Nasr MR, Ali S, Shaker M and Elgabry E
East Mediterr Health J. 2002; 8(4/5):490–5

Repeated blood transfusions in patients with thalassaemia subject them to peroxidative tissue injury by secondary iron overload. To study the relationship between iron overload and antioxidant micronutrient status among children with thalassaemia, we measured serum levels of vitamins A and E, zinc, selenium, and copper in 64 children with beta-thalassaemia major and 63 age- and sex-matched controls. All of these elements were significantly lower in the thalassaemic children compared with controls. There was a highly significant inverse correlation between serum ferritin and serum retinol levels, and significant inverse correlations between serum iron and retinol and between serum iron and selenium. Serum ferritin showed a significant positive correlation with duration of chelation and transfusion treatments. Ways are needed to counteract this oxidative damage and its deleterious effect on the prognosis of thalassaemia.

Xerophthalmia among hospitalized Iraqi children
Al-Kubaisy W, Al-Rubaiy MG and Nassief HA
East Mediterr Health J. 2002; 8(4/5):496–502

To determine the impact of sanctions on the nutritional status of Iraqi children aged < 6 years, a random sample of 700 patients (age range: 0-6 years) from the Saddam Paediatric Hospital, Diyala Province, Iraq were examined ophthalmologically for evidence of xerophthalmia. Data on the history of infection, feeding and night blindness were also collected. The prevalence of xerophthalmia was 29%, mostly among children aged 1–3 years. Xerophthalmia was significantly inversely associated with breastfeeding and highly associated with common childhood infections such as measles, diarrhoea and respiratory tract infection. Xerophthalmia is a common problem among sick Iraqi children. Efforts to identify, evaluate and monitor vitamin A deficiency and to advocate and plan its eradication should be implemented.

Primary prevention of acute coronary events through the adoption of a Mediterranean-style diet
Panagiotakos DB, Pitsavos C, Chrysohoou C, Stefanadis C and Toutouzas P
East Mediterr Health J. 2002; 8(4/5):593–602

We evaluated the role of a Mediterranean-style diet in preventing acute coronary syndromes (ACS). Data from CARDIO2000, a multi-centre retrospective case-control study investigating the association between ACS and demographic, nutritional, lifestyle and medical risk factors were used. We studied 661 patients hospitalized for a first ACS event and 661 matched controls without clinical suspicion of cardiovascular disease. The Mediterranean diet significantly reduced (by 16%) the risk of developing ACS. The association remained significant in the presence of hypertension, hypercholesterolaemia, sedentary lifestyle, diabetes mellitus or a combination of two of these cardiovascular risk factors. Our findings illustrate the importance of the Mediterranean diet in the primary prevention of acute coronary events.

[Food intake, and anthropometrical and biological parameters in adult Tunisians during fasting at Ramadan] [Article in French]
Beltaifa L, Bouguerra R, Ben Slama C, Jabrane H, El-Khadhi A, Ben Rayana MC and Doghri T
East Mediterr Health J. 2002; 8(4/5):603–11

[We evaluated the effects of fasting during Ramadan on nutritional intake and plasma lipoproteins in 20 healthy adults of normal weight. A 5-day food questionnaire was completed for every participant. Clinical investigations, anthropometrical measurements and laboratory analysis were also undertaken.

Body weight, blood pressure and blood glucose were not influenced by fasting but there were non-significant modifications in the plasma lipid fractions. The total cholesterol remained unchanged. Total daily energy intake was comparable before, during and after Ramadan despite the decrease in meal frequency during fasting. Thus fasting in Ramadan did not affect dietary intake, clinical, anthropometrical and most biological parameters.]

Mid upper arm and calf circumferences as indicators of nutritional status in women of reproductive age
Khadivzadeh T
East Mediterr Health J. 2002; 8(4/5):612–8

Mid upper arm circumference (MUAC) is recognized as an effective means of screening for poor nutritional status in adults. The efficacy of calf circumference (CC) as a screening tool, however, is not well reported. We studied 2000 healthy women (age range: 15–49 years) in Mashed, Islamic Republic of Iran, to assess anthropometric measurements at reproductive age and the usefulness of MUAC and CC for estimating body mass index (BMI) and screening of women at nutritional risk. We found a strong correlation between MUAC and CC with weight and BMI, suggesting that MUAC and CC can be used to estimate BMI and detect nutritional disorders.

Prevalence of iodine deficiency disorders in the United Arab Emirates measured by raised TSH levels
Al-Hosani H, Osman H, Abdel Wareth L, Saade1 D and Salah M
East Mediterr Health J. 2003; 9(1/2):123–30

The United Arab Emirates National Screening Programme for Congenital Hypothyroidism was established in January 1998. The programme measures neonatal thyroid-stimulating hormone (TSH) levels of blood samples collected on filter paper on day 5 by heel prick. The prevalence of raised TSH levels (>5 mU/mL whole blood) during 1998 and 1999 was used to evaluate the degree of iodine-deficiency disorders (IDD) in the population in different regions. The ratio of TSH profile in the present study and goitre rate in schools in a 1994 study were discrepant, although there was good correlation between the ratio of TSH profile and urinary iodine. The prevalence of raised TSH levels was < 3% in the Emirates overall, which is normal, and IDD varied from mild to normal problems in different regions.

Determination of cadmium, lead, copper and zinc in Yemeni khat by anodic stripping voltammetry
Matloob MH
East Mediterr Health J. 2003; 9(1/2):28–36.

Trace element concentrations in khat were investigated as they can disturb trace element levels in the body. Cadmium (Cd), lead (Pb), copper (Cu) and zinc (Zn) levels in khat and 6 leafy vegetables commonly consumed in the Republic of Yemen were determined by differential pulse anodic stripping voltammetry after wet digestion of the organic matter. Khat had significantly higher concentrations of Cu and Zn than did the leafy vegetables, but similar amounts of Cd and Pb. The average daily intake of khat consumers of Cd, Pb, Cu and Zn from khat only was estimated to be 2.0–10.2 microg/day, 23.6–118.0 microg/day, 530–2654 microg/day and 662–3311 microg/day respectively. Although high, these values were within Food and Agriculture Organization/World Health Organization tolerance limits.

[Food intake during and outside Ramadan]
[Article in French]
Gharbi M, Akrout M and Zouari B
East Mediterr Health J. 2003; 9(1/2):131–40.

[We explored the effect of fasting in the month of Ramadan on the dietary pattern of a group of 130 healthy adults. During Ramadan, there was an increase in total energy intake, as a result of protein and lipid intake but not carbohydrate intake compared to the diet throughout the rest of the year, in both students and parents. The meal eaten after sunset was an important contributor to calories (65%), lipids (74%), proteins (71%) and carbohydrates (56%). These findings show the eating behaviour during Ramadan may contribute to

improved nutritional status of people at risk of nutritional deficiency.]

Effect of natural starters used for sourdough bread in Morocco on phytate biodegradation
Chaoui A, Faid M and Belhcen R
East Mediterr Health J. 2003; 9(1/2):141–7.

Phytase activity was studied in natural sourdough bread starters to determine physicochemical characteristics (phytic acid hydrolysis, dough rising capacity and pH) in the flour and during sourdough fermentation. Fermentation microorganisms (yeasts and lactic acid bacteria) were also characterized. Results showed a decrease of phytic acid in sourdoughs started with traditional starters, and wide variation in phytase activity. Microorganism counts were high at the end of fermentation, indicating higher fermenting activity of the starters. Yeast populations showed wide variation and lactic acid bacteria had high counts in the fermentation. Phytase activity was demonstrated in starter cultures made of lactic acid bacteria and yeast isolates, the most interesting of which were ***Saccharomyces cerevisiae*** combined with ***Lactobacillus plantarum*** and ***Leuconostoc mesenteroides.***

Breastfeeding indicators in Dakahlia Governorate
El-Gilany A-H
East Mediterr Health J. 2003; 9(5/6):961–73

This study was carried out in Dakahlia Governorate to assess current breastfeeding practices using the standardized breastfeeding indicators developed by the World Health Organization and to highlight the impact of some socioeconomic and maternal factors on these indicators. An interview was carried out with mothers of 1200 infants and children < 24 months during a poliomyelitis immunization campaign in urban and rural areas. The findings indicate that 84.6% of infants aged 0–4 months are fully breastfed, with 42.5% and 42.1% of them exclusively and predominantly breastfed respectively. Rural infants are more likely to be exclusively breastfed, to continue breastfeeding for 1 year and to initiate breastfeeding early. Non-working mothers are more likely to breastfeed exclusively and more likely to continue breastfeeding for 1 year.

Influence of mothers' characteristics on their perceptions and use of the growth chart
Al-Nahedh N and Bamgboye EA
East Mediterr Health J. 2003; 9(5/6):974–80

Although growth charts are recommended for monitoring children, recent reports indicate poor use by mothers. We investigated maternal knowledge and perceptions of growth charts and identified characteristics affecting use. At outpatient paediatric clinics of a Riyadh hospital, 305 mothers with children under age 5 were interviewed by questionnaire during May–June 2001. Overall awareness of growth charts was 35.8% and ever-use was 8.6%. Education, parity and number of living children were significantly associated with knowledge. Among mothers who ever used growth charts (8.7%), only 10% reported doctors recommended changes in health care because of them. Overall, 71% wanted to monitor their child's growth, but 20% did not know how. Increased health education in all health care delivery systems is needed.

[Cortisol rhythm during Ramadan] [Article in French]
Ben Salem L, B'chir S, Bchir F, Bouguerra R and Ben Slama C
East Mediterr Health J. 2003; 9(5/6):1093–8

[We studied the nyctohemeral cortisol secretion rhythm and the cortisol response to 1-24 corticotropin during Ramadan in 11 healthy, male volunteers aged 20–35 years. Their response to 250 mg 1-24 corticotropin was investigated 2 weeks before Ramadan by testing daily at 08:00 and 20:00 hours. After 16–22 days of fasting, their cortisol levels were measured at 08:00 hours and their response to 1-24 corticotropin at 20:00 hours. Before Ramadan, the baseline cortisol level was significantly higher at 08:00 hours than at 20:00 hours and the cortisol response to 1-24 corticotropin was also higher at 08:00 hours but this difference was not significant. During

Ramadan, the cortisol level at 08:00 hours was lower than at the same time before Ramadan; the level at 20:00 hours was slightly higher than at the same time before Ramadan. There was no significant difference between the cortisol response to 1-24 corticotropin at 20:00 hours during Ramadan and the responses before Ramadan at 20:00 hours and 08:00 hours.

[Metabolic effects of Ramadan fasting on type 2 diabetes] [Article in French]
Bouguerra R, Belkadhi A, Jabrane J, Hamzaoui J, Maâtki C, Ben Rayana MC and Ben Slama C
East Mediterr Health J. 2003; 9(5/6):1099–1113

[We assessed the effects of Ramadan fasting on metabolic control, particularly change of HDLcholesterol in 25 type 2 diabetic patients treated with diet or oral agents, with good metabolic control. Clinical and biochemical parameters and food intake were evaluated 3 weeks before Ramadan, in the fourth week of Ramadan and 3 weeks after Ramadan. There were no changes in body weight and blood pressure nor any metabolic complications. The mean plasma fasting glucose, serum fructosamin and haemoglobin A1c did not change. We found a negative relation between cholesterol intake during Ramadan and the change of HDLcholesterol. When cholesterol intake was lower than 400 mg/day, plasma HDL-cholesterol increased by 13% at the end of Ramadan and by 23% 3 weeks after Ramadan.]

Note from the Editor

We would like to inform our readers that as of Volume 11 the *Guidelines for Authors*, which are published at the back of each issue of the journal in English and Arabic, will also be published in French as of Vol. 11.

We wish to remind our potential authors of the importance of applying the editorial requirements of the EMHJ when preparing their manuscripts for submission for publication. We regret that we are unable to accept papers that do not conform to the editorial requirements.

Eastern Mediterranean health journal reviewers' panel, 2004[1]

The *Eastern Mediterranean health journal* thanks the following experts for their kind assistance in the review of papers considered for publication during the year 2004.

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Note of appreciation

The scientific integrity and standard of the information disseminated through EMHJ depends greatly on the critical judgement of our reviewers listed above.

We would like to extend our sincere thanks and gratitude to them all for giving voluntarily of their time so willingly.

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4. Three copies of each manuscript should be provided. The text, together with the accompanying tables and figures, should not exceed 15 double-spaced typewritten or printed A4 pages (4500 words) and should be printed on one side only. When the manuscript is accepted or conditionally accepted, the author will be requested to submit a 3.5 inch computer diskette containing the text, tables, graphs and illustrations. For English and French papers, please provide the text, upon the editor's request, in both wordprocessed format (we prefer Microsoft Word for the PC but can translate most other formats) and also saved as a text/ASCII file. Papers submitted in Arabic should follow the same guidelines as papers written in English or French. If the paper is a translation of all or part of another unpublished work, a copy in the original language should be submitted too. Where possible, graphs should be provided in Harvard Graphics under Windows or Excel, and the illustrations and photographs should be provided in EPS or TIFF format. However, it is necessary to provide three sets of original photographs and figures with the background data. If there is any text or lettering on the photographs, an additional clean set should be provided without the text/lettering.

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8. Papers reporting original research findings should follow the IMRAD format: Introduction; Materials (subjects) and methods; Results; Analysis; and Discussion. An abstract of no more than 100 words should be supplied, clearly and briefly stating the objectives, context, results and conclusions.

9. Authors should verify where appropriate that all persons on whom research has been carried out have given their informed consent, and where participants (living or dead) were unable to give such consent, that surrogate consent was obtained.

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Book:
Al Hamza B, Smith A. *The fifth sign of identity*. Cairo, American University Press, 1990.

Journal article:
Jones A et al. One day in Tibet. *Journal of tautology*, 1993, 13(5):23–7.

Document:
Al-Itneen M, ed. *The principles of uncertainty*. Geneva, World Health Organization, 1985 (document WHO/DOC/537).

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المجلة الصحية لشرق المتوسط
دلائل إرشادية للمؤلفين

١. ينبغي أن لا تكون الورقات المقدَّمة للنشر، قد نشرت أو قبلت للنشر في أي مكان آخر. ويحتفظ المكتب الإقليمي لمنظمة الصحة العالمية لشرق المتوسط بجميع حقوق استنساخ أو إعادة نشر المواد التي تنشر في *المجلة الصحية لشرق المتوسط*.

٢. يمكن أن ترسل الورقات الأصلية، المكتوبة بالعربية، أو الإنكليزية، أو الفرنسية، للنظر فيها من قِبَل رئيس تحرير *المجلة الصحية لشرق المتوسط*، بالمكتب الإقليمي لمنظمة الصحة العالمية لشرق المتوسط، ص. ب. (٧٦٠٨)، بمدينة نصر (١١٣٧١)، بالقاهرة، في مصر. ويتم تقديم خلاصات للورقات، باللغات الثلاث.

٣. ينبغي أن يكون موضوع الورقات منتمياً لمجال الصحة العمومية، أو أي ميدان تقني وعلمي آخر، له صلة بالمجالات ذات الأهمية لمنظمة الصحة العالمية، مع الإشارة بشكل خاص إلى إقليم شرق المتوسط.

٤. ينبغي تقديم ثلاث نسخ من كل مخطوطة أو مطبوعة. كما ينبغي أن لا يتعدى النص، مع الجداول، والرسومات المرافقة، ١٥ صفحة مطبوعة على الآلة الكاتبة مع ترك فاصلين بين كل سطر، من القطع A4 (٤٥٠٠ كلمة)، وأن تكون الطباعة على وجه واحد فقط من الصفحة. وعندما يتم إعلان المؤلف بأن المطبوعة التي قدَّمها قد تم قبولها من دون شرط، أو قبولها بشروط، ينبغي أن يقدِّم قرص حاسوبي (٣,٥ بوصة)، يتضمن النص، والجداول، والرسوم البيانية والتوضيحية. وبالنسبة للورقات المقدَّمة باللغتين الإنكليزية والفرنسية، يرجى، بناءً على طلب رئيس التحرير، أن يتم تقديم النص، في كلٍّ من، صيغة معالجة الكلمات (وحبَّذا لو أمكن استخدام برنامج الكلمات اللينة الدقيقة Microsoft Word، بالنسبة للحاسوب الشخصي، غير أننا يمكن أن نترجم غالبية الصيغ الأخرى)، وفي شكل محفوظ كنص/ملف الكود الأمريكي القياسي لتبادل المعلومات ASCII (أسكي). وينبغي اتباع نفس الإرشادات في ما يتعلق بالورقات المقدمة باللغة العربية. وإذا كانت الورقة المقدمة، هي ترجمة كلية أو جزئية لعمل آخر لم ينشر، فينبغي تقديم نسخة من هذا العمل، في لغته الأصلية. وحيثما أمكن، يفضل أن تكون الرسوم البيانية في شكل رسوم هارفارد البيانية، مع استخدام برنامج النوافذ Windows أو إكسل Excel، وتقديم الرسوم التوضيحية والصور الفوتوغرافية في صيغة EPS أو TIFF. كما أنه من الضروري تقديم ثلاث مجموعات من الصور الفوتوغرافية والرسومات الأصلية، مع المعطيات الأساسية. وفي حالة وجود أي نص أو حروف مكتوبة على الصور، فينبغي تقديم نسخة إضافية خالية من أي نص مطبوع أوأي حروف مكتوبة .

٥. يتم مراجعة جميع الورقات المقدَّمة مراجعة دقيقة من قِبَل الزملاء، وفي ضوء هذه المراجعة، تحتفظ هيئة التحرير بحق قبول أو رفض أي ورقة. ومن المتفق عليه أن جميع الورقات التي يتم قبولها، تخضع للمراجعة الإحصائية والتحريرية، بحسب ما يلزم، بما في ذلك اختصار النص، أو حذف بعض الجداول أو الرسوم البيانية.

٦. ينبغي أن يكون عنوان الورقة مختصراً على قدر المستطاع، وحبَّذا لو كان حوالي ١٠ كلمات، وأن يكتب على ورقة منفصلة، مع تحديد اسم المؤلف (أو أسماء المؤلفين)، وعضويتهم في المؤسسات المختلفة، وأعلى الدرجات العلمية التي حصلوا عليها. كذلك، ينبغي ذكر العنوان البريدي، والمعلومات الأخرى اللازمة للاتصال بالمؤلف (بريد إلكتروني، فاكس، هاتف). ويجب أن لا يزيد عدد المؤلفين على خمسة. ولابد أن يكونوا قد ساهموا جميعاً في تصميم البحث أو تحليل نتائجه أو كتابته، وأن يكونوا قد وافقوا، جميعاً على النسخة النهائية المقدَّمة. وقد يطلب من المؤلفين إثبات الإسهام الذي قدَّموه. ويمكن إدراج أسماء أخرى إلى عبارات الشكر التي تكون في مقدِّمة الورقة.

٧. ومن أجل تيسير ترجمة الخلاصات وأسماء المؤلفين، على المؤلفين الذين تكون لغتهم الأم تكتب بحروف عربية، ويكتبون مؤلفاتهم بالإنكليزية أو الفرنسية، أن يزودوا رئيسي التحرير بأسمائهم كاملة، مكتوبة بالحروف العربية، ثم بالحروف اللاتينية.

٨. الورقات التي تمثّل تقارير حول نتائج البحوث الجديدة، ينبغي أن تكتب بالترتيب التالي: المقدمة؛ المواد (المواضيع) والطرق؛ النتائج؛ التحليل؛ والمناقشة. وينبغي أن تشفع هذه الورقات بخلاصة لكل منها، لا تزيد على ١٠٠ كلمة، تبيّن بوضوح، وبإيجاز، الأهداف، والسياق، والنتائج، والاستنتاجات.

٩. ينبغي أن يثبت المؤلفون، بحسب ما يلزم، أن جميع الأشخاص الذين أجري عليهم البحث، قد وافقوا موافقة واعية على ذلك، وفي حالة تعذر الحصول على موافقة المشاركين (أحياء أو أموات)، ينبغي أن يثبت المؤلفون أنه قد تم الحصول على موافقة وكلائهم أو ورثتهم.

١٠. ينبغي أن تتناول مقالات الاستعراض والمراجعة الماضية، النقاط التالية: الأهداف، المصادر، طرق الانتقاء، تجميع المعطيات وتفسيرها والاستنتاجات.

١١. ينبغي أن يقتصر الاستشهاد من أي أعمال منشورة، في النص، على المراجع الحديثة الأساسية. ولا ينصح بزيادة المراجع على ٢٥ مرجعاً على الأكثر، باستثناء المقالات النقدية. ويلزم ترقيم المراجع، كلما ظهرت في النص، وأن يليها أعداد عربية بين أقواس [أقواس مربعة]. كما ينبغي تدوين هذه المراجع في قائمة مرقمة، في صفحة منفصلة، في نهاية الورقة، وأن تتضمن المعلومات التالية، إن أمكن: اسم المؤلف أو أسماء المؤلفين، والحروف الأولى من أسمائهم، وعنوان الورقة أو الكتاب في اللغة الأصلية، إضافة إلى ترجمته؛ واسم المجلة بالكامل، مع رقم المجلد، وعدد الصفحات؛ واسم الناشر (التجاري أو المؤسسي)؛ ومكان النشر (المدينة والبلد)؛ وتاريخ النشر. وسوف يتم إعادة الورقات التي تكون فيها المراجع غير كاملة، أو غير مرتبة بحسب هذه المبادئ، إلى المؤلف، لتصحيحها. وفي ما يلي أمثلة للأسلوب الذي تفضل المجلة الصحية لشرق المتوسط أن يتبع:

كتاب:

Al Hamza B, Smith A. *The fifth sign of identity*. Cairo, American University Press, 1990.

مقالة في مجلة:

Jones A et al. One day in Tibet. *Journal Of tautology*, 1993,13(5): 23-7.

وثيقة:

Al-Itneen M, ed. *The principles of uncertainty*. Geneva, World Health Organization, 1985 (document WHO/DOC/537).

١٢. وفي ما يتعلق بالرسومات والجداول، المشفوعة بالشروح الملائمة، فإنه ينبغي أن ترد كل منها في صفحة منفصلة، ومرقمة على التوالي بالأعداد العربية، وملحقة في نهاية الورقة. كما ينبغي الإشارة إلى كل رسم وكل جدول يشار إليه في النص، وتحديد مكانه بوضوح، بحسب ما يلزم، وحبّذا لو أمكن تحديد مصدر كل رسم وكل جدول. وفي حالة نقل أي رسومات أو جداول من مواد أخرى، فإنه تقع على عاتق المؤلف، أو المؤلفين، المسؤولية الكاملة عن الحصول على الأذون اللازمة. وبُغْيَةَ تجنُّب أي مشكلات في طريقة تنسيق المنتج النهائي، فإنه ينبغي الاقتصار على قدر الإمكان في إدراج الجداول والرسومات. وحبّذا لو أمكن الاقتصار على جدول واحد أو رسم واحد لكل ١٠٠٠ كلمة. علماً بأن الرسومات المتعلقة ببعض المعطيات، ينبغي أن تصاحب هذه المعطيات، وأن يتسنّى إعادة رسمها، إذا تطلّب الأمر.

١٣. لا ترد الورقات والقريصات الأصلية، إلا بناءً على طلب من المؤلف الرئيسي.

١٤. بعد النشر، يحصل المؤلفون على نسخة من العدد الذي ترد فيه المقالة، بينما يحصل المؤلف الرئيسي على ٥٠ نسخة من البحث المنشور. وتقدَّم الطلبات للحصول على المزيد من النسخ، أو على معلومات حول الأسعار، إلى رئيس التحرير.

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