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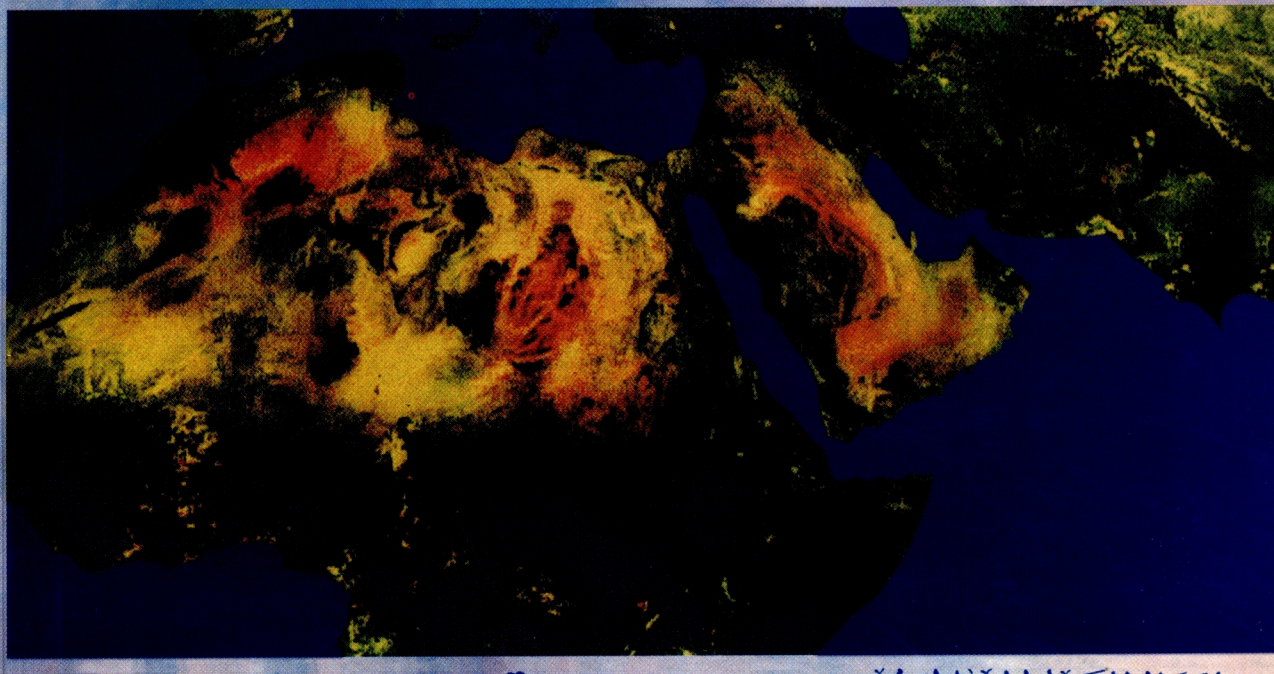

منظمة الصحة العالمية
World Health Organization
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المكتب الإقليمي لشرق المتوسط
Regional Office for the Eastern Mediterranean
Bureau régional de la Méditerranée orientale

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، وخاصةً ما يتعلق منها بإقليم شرق المتوسط. وهي موجَّهة 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

IS the official health journal published by the Eastern Mediterranean Regional Office of the World Health Organization. It is a forum for the presentation and promotion of new policies and initiatives in health services; and for the exchange of ideas, concepts, epidemiological data, research findings and other information, with special reference to the Eastern Mediterranean Region. It addresses all members of the health profession, medical and other health educational institutes, interested NGOs, WHO Collaborating Centres and individuals within and outside the Region.

LA REVUE DE SANTÉ DE LA MÉDITERRANÉE 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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ALL ARTICLES ARE PEER REVIEWED

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COVER: Remote sensing image of the area of the world that includes the Eastern Mediterranean Region. Cover image produced by the Canada Centre for Remote Sensing, Ottawa, Canada. (NOAA AVHRR Composite) Reproduced with permission

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Contents

Eastern Mediterranean Health Journal

Letter from the Editor

Each issue of the EMHJ presents papers on a wide range of topics and from a number of countries. In this issue, we are publishing submissions from 8 countries of the World Health Organization Eastern Mediterranean Region. We are also delighted to be publishing studies from 4 countries outside the Region, 3 of which are represented for the first time.

Ethiopia, one of our African neighbours, makes a first appearance with a paper on identifying strains of *Shigella* and *Salmonella* spp. We also have studies from 2 of our northern Mediterranean neighbours: Turkey, with a paper on promoting healthy behaviour, and Italy, which is also represented for the first time in a paper on hepatitis B virus (HBV) infection in immigrants. The third debut country is Australia with a paper on knowledge of and attitude toward the casemix system among Social Security Organization staff in Tehran.

One theme that is represented in almost every issue of the journal is healthy (or unhealthy) lifestyles. With the relative increase in morbidity and mortality due to noncommunicable diseases over the past few decades, and the ensuing economic and financial burden to countries, prevention is becoming an essential item on the agenda for national health services, not only in our Region, but throughout the world. Prevention and control programmes need to be based on accurate information.

In this issue we have 6 papers on this subject. Of course, smoking is a concern as it is the root cause of serious debilitating dseases, and the prevalence is increasing in the less-developed countries, and particularly in the young, especially young women, and the poorer sectors of society.

Overweight and obesity is another recurring topic in our journal. Increased prevalence has been noted in all age groups, and is of particular concern in those countries which are experiencing rapid development, perhaps reflecting the changes in lifestyle, including reduced activity levels and altered eating habits. This is particularly of concern in school-age children and adolescents as lifestyles established at an early age are often more difficult to change, a fact not unnoticed by the tobacco and fast food industries.

رسالة من المحرِّر

تقدِّم المجلة الصحية لإقليم شرق المتوسط، في كل عدد من أعدادها، دراسات بحثية تغطي نطاقاً عريضاً من الموضوعات، وتجرى في بلدان مختلفة. ونـنشر في هذا العدد ورقات بحثية مقدمة من ثمانية من بلدان هذا الإقليم، إلى جانب أربعة من البلدان الواقعة خارجه، من بينها ثلاثة تظهر أبحاثها لأول مرة على صفحات هذه المجلة.

فهذا العدد يشهد أول مساهمة لأبحاث أجريت في إثيوبيا، إحدى دول الجوار الأفريقية، حيث قدِّم بحث حول استعراف بعض ذراري الشيغيلة والسلمونيلة. ويضم العدد كذلك دراسات من بلدين من جيرانـنا المطلِّين على الساحل الشمالي للبحر المتوسط. فهناك واحدة من تـركيا حول تعزيز السلوكيات الصحية، والثانية من إيطاليا، التي تمثـّـل هي الأخرى لأول مرة على صفحات هذه المجلة، وهي حول العدوى بفيروس التهاب الكبد البائي بين المهاجرين. وتمثل أستراليا البلد الثالث الذي تظهر أبحاثه لأول مرة على صفحات هذه المجلة، حيث قُدِّمت ورقة حول معارف ومواقف موظفي هيئة الضمان الاجتماعي في طهران، بشأن نظام تصنيف الحالات.

ومن بين الموضوعات التي تكاد تكون دائمة الظهور في هذه المجلة، موضوع أنماط الحياة الصحية (أو المنافية للصحة). وفي ظل الزيادة النسبية التي شهدتها معدلات المراضة والوفيات الناتجة عن الأمراض غير السارية، على مدى العقود القليلة الماضية، وما نجم عنها من أعباء اقتصادية ومالية على البلدان، فقد أصبحت الوقاية بنداً أساسياً على جدول أعمال الخدمات الصحية الوطنية، لا في هذا الإقليم فحسب، بل في جميع أنحاء العالم، ومن ثـَـمَّ، فلابد أن تـرتكز البرامج الصحية الوقائية وبرامج المكافحة على معلومات دقيقة.

وفي هذا العدد ست ورقات تدور حول هذا الموضوع. ويمثـّـل التدخين، بطبيعة الحال، واحداً من الشواغل المهمة، بوصفه المسبب الأساسي لعدد من الأَمراض الخطيرة الموهنة. ومن أسف أن انتشاره آخذ في الازدياد في البلدان الأقل نمواً، ولاسيَّما بين الشباب، وخصوصاً الشابّات، والقطاعات الأكثر فقراً في المجتمع.

أما موضوع زيادة الوزن والسمنة فهو كالعادة موضوع يتكرَّر طرحه على صفحات هذه المجلة، حيث يلاحظ انتشارهما في جميع المراحل العمرية، وهما من الشواغل المقلقة لاسيَّما في تلك البلدان التي تشهد نمواً سريعاً، نظراً إلى أنه يمكن أن يكون معبِّراً عن التغيُّرات الحاصلة في أنماط الحياة، بما في ذلك قلة النشاط البدني، وتغيُّر عادات الأكل. كما يهم هذا الموضوع بصفة خاصة الأطفال، في سن المدرسة، والمراهقين، حيث يصعب في الغالب تغيير أنماط الحياة التي تـترسَّخ في سن مبكرة، وهذه حقيقة ليست بخافية على القائمين على صناعة التبغ والأطعمة السريعة.

Shigella and *Salmonella* serogroups and their antibiotic susceptibility patterns in Ethiopia

D. Asrat[1]

المجموعات المصلية من الشيغيلات والسالمونيلات ونماذج حساسيتها للمضادات الحيوية في إثيوبيا

دانيال أسرات

الخلاصة: استفرد الباحث في هذه الدراسة المجموعات المصلية من أنواع الشيغيلات والسالمونيلات من مزارع البراز ودرس أنماط حساسيتها للمضادات الحيوية باستخدام الإجراءات المختبرية المعيارية. ومن بين 76 مستفردة من أنواع الشيغيلات كانت المجموعة المصلية "بي" (الشيغيلة الفلكسنرية) أكثر الأنواع السائدة (54.0%). ومن بين 37 مستفردة من ذراري السالمونيلات كانت المجموعة المصلية "بي" هي الأكثر مصادفة (81.1%). وقد أظهرت مخططات الحساسية للمضادات الحيوية لأنواع الشيغيلات والسالمونيلات مقاومة مطلقة (100%) للإريثروميسين، ومقاومة مرتفعة تزيد معدلاتها على 75% للأمبيسيلين والسيفالوتين والكلورامفينيكول والتتراسكلين. وكانت أنواع السلمونيلات مرتفعة المقاومة للجنتاميسين والسلفوناميد والتريميثوبريم – سلفاميتوكسازول. وكانت الشيغيلات حساسة للجنتاميسين (100%) ولحمض الناليديكسيك (97.3%)، في حين كانت الشيغيلات والسالمونيلات حسّاسة بنسبة (100%) للنورفلوكساسين.

ABSTRACT In this study, the serogroup and susceptibility patterns of *Shigella* and *Salmonella* spp. isolated from stool cultures were determined using standard laboratory procedures. Among the 76 *Shigella* isolates serogroup B (*Sh. flexeneri*) was the most prevalent species (54.0%) and among the 37 *Salmonella* strains serogroup B was also the most prevalent (81.1%). Antibiograms of *Shigella* and *Salmonella* spp. showed 100% resistance to erythromycin and high resistance rates (≥ 75%) to ampicillin, cephalothin, chloramphenicol and tetracycline. *Salmonella* spp. also had high resistance to gentamicin, sulphonamide, and trimethoprim–sulfamethoxazole. *Shigella* were susceptible to gentamicin (100%) and nalidixic acid (97.3%) and *Shigella* and *Salmonella* were 100.0% susceptible to norfloxacin.

Les sérogroupes de *Shigella* et de *Salmonella* et leur profil de sensibilité aux antibiotiques en Éthiopie

RÉSUMÉ Dans cette étude, le sérogroupe et le profil de sensibilité de bactéries *Shigella* et de *Salmonella* spp. isolées à partir de coprocultures ont été déterminés grâce à des procédures de laboratoire normalisées. Parmi les 76 isolats de *Shigella*, le sérogroupe B (*Sh. flexeneri*) était l'espèce la plus fréquemment retrouvée (54,0 %) et parmi les 37 souches de *Salmonella*, le sérogroupe B était également le plus représenté (81,1 %). Les antibiogrammes réalisés sur les espèces *Shigella* et *Salmonella* ont montré une résistance de 100 % à l'érythromycine et des taux de résistance élevés (≥ 75 %) à l'ampicilline, à la céfalotine, au chloramphénicol et à la tétracycline. *Salmonella* spp. présentait également une résistance élevée à la gentamicine, au sulfamide et au triméthoprime-sulfaméthoxazole. *Shigella* était sensible à la gentamicine (100 %) et à l'acide nalidixique (97,3 %) et *Shigella* et *Salmonella* étaient sensibles à 100 % à la norfloxacine.

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Introduction

Gastroenteritis-causing pathogens are the second leading cause of morbidity and mortality worldwide; it is mainly children under the age of 5 years who are at risk. The organisms responsible are rotaviruses, Norwalk-like viruses, enterotoxigenic *Escherichia coli* (ETEC), *Campylobacter jejuni* and *Clostridium difficile*, *Shigella* spp., *Salmonella* spp., *Cryptosporidium* spp. and *Giardia lamblia*. These organisms are readily transmitted via food, water, environmental contacts, pets and from person to person, with morbidity rates in developing countries 3-to-6-fold higher than in developed countries [*1*].

Antimicrobial resistance has complicated the selection of antibiotics for the treatment of enteric bacterial pathogens, particularly to commonly used antimicrobial agents such as ampicillin, tetracycline and trimethoprim–sulfamethoxazole [*2*].

In Ethiopia there is a great need to establish the identity and antibiotic susceptibility patterns of different bacterial agents which cause enteric infections in order to introduce effective treatment for diarrhoeal illness. This paper reports the results of the serogroups and antimicrobial susceptibility patterns of 76 *Shigella* and 37 *Salmonella* strains isolated from the stool cultures of patients and controls, with and without diarrhoea illnesses respectively, in Addis Ababa, Ethiopia.

Methods

Source of bacterial strains

The source of *Shigella* and *Salmonella* strains were stool specimens obtained from patients with diarrhoeal disease and controls without symptoms of diarrhoeal disease who were diagnosed with other illnesses. The nature of the diarrhoeal stool specimens was watery (82.4%), bloody (6.8%), mucoid (8.4%) and mixed (2.4%). From February 1992 to January 1993, a total of 76 *Shigella* and 37 *Salmonella* strains were isolated from Tikur Anbassa and Ethio-Swedish Children's Hospital, Addis Ababa, Ethiopia. All the isolated strains were kept frozen at –20 ºC in 15% tryptone soya broth (Oxoid Ltd., Basingstoke, Hampshire, England) containing 15% (v/v) glycerol.

Culture and identification of strains

Frozen *Shigella* and *Salmonella* strains were subcultured on MacConkey agar no.2 (Oxoid) and incubated at 37 ºC for 24 hours. These bacteria were identified by their characteristic appearance on the media and further confirmed by the pattern of biochemical reactions using a standard bacterial identification system (API 20E, bioMérieux, Marcy-l'Etoile, France). From a pure culture serogrouping and antimicrobial susceptibility testing were done.

Serogrouping of *Shigella* and *Salmonella* species

Shigella strains were serogrouped by slide agglutination tests using A1, A2, A3, B, C1, C2, C3 and D antisera (National Bacteriological Laboratory, Stockholm, Sweden). For *Salmonella* strains serogrouping was done by slide agglutination tests using poly O and groups A, B, C, D, E antisera (NBL, Stockholm, Sweden). These strains were further tested against poly H antisera. Those strains identified biochemically as *Salmonella typhi* were tested against Vi antisera.

Antimicrobial susceptibility testing

All *Shigella* and *Salmonella* strains were tested for their susceptibility to different antibiotics using the agar diffusion method according the methodology described by the National Committee for Clinical Laboratory Standards [*3*]. A McFarland 0.5 standard suspension of the bacteria in 5 mL of phosphate-buffered saline (Oxoid) was then prepared and swabbed over the entire surface of Petragnani culture medium (PDM Antibiotic Sensitivity Medium II, AB Biodisk, Solna, Sweden) with a sterile cotton swab. The inoculated plates were left at room temperature to dry for 3–5 minutes. With the aid of an automatic dispenser (Oxoid) a set of 10 antibiotic disks (Oxoid) with the following concentrations were then delivered to the surface of the PDM II plate: ampicillin 10 µg; cephalothin 30 µg; chloramphenicol 30 µg; erythromycin 15 µg; gentamicin 30 µg; nalidixic acid 30µg; norfloxacin 10 µg; sulfonamide 300 µg; tetracycline 30 µg and trimethoprim–sulfamethoxazole (TMP–SXT) 25 µg. The disks were gently pressed onto the medium with sterile forceps to ensure firm contact. Following overnight incubation at 37 ºC, clear zones produced by antimicrobial inhibition of bacterial growth were measured to the nearest millimetre using metal callipers. The zone diameter was interpreted using an interpretive chart defined by the Clinical and Laboratory Standards Institute [*4*].

A reference strain of *E. coli* (ATCC 25922) was used as a quality control for culture and susceptibility testing.

The criteria used to select the antimicrobial agents tested were based on availability and frequency of prescriptions for the management of enteric bacterial infections in Ethiopia (personal communication).

Results

Serogrouping

The results of serogrouping of the 76 *Shigella* isolates are presented in Table 1. Serogroup B (*Sh. flexneri*) was the most commonly isolated species (54.0%), followed by group A (*Sh. dysenteriae*) (22.4%), group D (*Sh. sonnei*) (15.8%) and group C (*Sh. boydii*) (7.8%). Of the serogroup *Sh. dysenteriae*, 82.4% were serotypes A1 and 17.6% were type A2. Among serogroup *Sh. boydii* the prevalence of serotypes were C1 (33.3%), C2 (50.0%) and C3 (16.7%). Of the 76 *Shigella* isolates, 74 were recovered from patients and 2 from controls (1 *Sh. dysenteriae* and 1 *Sh. flexneri*).

Among the 37 *Salmonella* strains, the most commonly isolated serogroup was group B (81.1%), followed by group D (*S. typhi*) (10.8%) and group C (8.1%) (Table 2). All *S. typhi* isolates were recovered from patients. Of the 37 *Salmonella* isolates, 24 were recovered from patients and 13 from controls.

Table 1 **Serogroups of 76 *Shigella* strains isolated from patients and controls**

Serogroups	No.	%
Sh. dysenteriae (A)	17	22.4
Type A1	14[a]	18.4
Type A2	3	4.0
Type A3	0	0.0
Sh. flexneri (B)[a]	41	54.0
Sh. boydii (C)	6	7.8
Type C1	2	2.6
Type C2	3	3.9
Type C3	1	1.3
Sh. sonnei (D)	12	15.8
Total	76	100.0

[a] *1* Sh. dysenteriae *and 1* Sh. flexneri *were recovered from controls.*

Table 2 **Serogroups of 37 *Salmonella* strains isolated from patients and controls**

Serogroups	No.	%
A	0	0.0
B	30	81.1
C	3	8.1
D *(S. typhi)*	4	10.8
E	0	0.0
Total[a]	37	100.0

[a] *24 recovered from patients and 13 from controls.*

Antimicrobial susceptibility testing

The results of antimicrobial susceptibility patterns of the *Shigella* and *Salmonella* isolates are shown in Table 3. Antibiograms of *Shigella* species showed that most strains were resistant to ampicillin (78.7%), cephalothin (86.7%), chloramphenicol (74.7%), erythromycin (100.0%), sulfonamide (54.7%), tetracycline (97.3%) and TMP–SXT (45.3%), but susceptible to gentamicin (100%), nalidixic acid (97.3%) and norfloxacin (100.0%). The *Salmonella* species were resistant to ampicillin (81.2%), cephalothin (86.4%), chloramphenicol (83.7%), erythromycin (100.0%), gentamicin (75.6%), nalidixic acid (37.8%), sulfonamide (81.1%), tetracycline (94.5%) and TMP–SXT (75.7%). All strains were susceptible to norfloxacin (100.0%). Among *Salmonella* spp. a comparatively low level of resistance (20%–25%) was detected in *S. typhi* to all antimicrobial agents tested except for erythromycin. Multidrug resistance (2 or more antibiotics) was noted in 80%–90% of both isolates (data not shown).

Table 3 **Antimicrobial susceptibility patterns of *Shigella* and Salmonella isolates as a whole**

Antimicrobial agent	Resistance (%)	
	***Shigella* spp. (*n* = 76)**	***Salmonella* spp. (*n* = 37)**
Ampicillin	78.7	81.2
Cephalothin	86.7	86.4
Chloramphenicol	74.7	83.7
Erythromycin	100.0	100.0
Gentamicin	0.0	75.6
Nalidixic acid	2.7	37.8
Norfloxacin	0.0	0.0
Sulfonamide	54.7	81.1
Tetracycline	97.3	94.5
Trimethoprim–sulfamethoxazole	45.3	75.7

n = *total number of isolates.*

Discussion

In this study, serogroup B (*Sh. flexeneri*) was the dominant *Shigella* serogroup, followed by group A (*Sh. dysenteriae*), group D (*Sh. sonnei*) and group C (*Sh. boydii*). These findings are in accordance with previous Ethiopian studies, except that in those studies *Sh. boydii* was the 3rd most commonly isolated species [*5–8*]. It is not unusual for one serogroup to replace another in the community from time to time. The comparative frequencies of *Shigella* serogroups vary with time, hygienic conditions and among different populations. In the early 1900s *Sh. dysenteriae* type 1 was the most common strain, whereas *Sh. flexneri* and *Sh. sonnei* are currently isolated most often, except for certain epidemics in which *Sh. dysenteriae* has been identified as the causative organism [*9,10*]. In developed countries, higher frequencies of *Sh. sonnei* have been reported, but these frequencies are gradually decreasing [*11*]. Epidemics of dysentery with frequent passage of blood and mucus, high fever, cramps and tenesmus are mainly caused by *Sh. dysenteriae* type 1 and *Sh. flexenri*, while *Sh. boydii* and

Sh. sonnei often causing non-watery (often bloody) diarrhoea during non-epidemic episodes [*12*]. Bennish and Wojtyniak [*13*] reported most fatal cases of shigellosis occur in developing countries as a result of severe dysentery and in rare cases, bacteraemia, especially that caused by *Sh. flexneri*.

The susceptibility of *Shigella* spp. to antibiotics has changed considerably over time. In the 1940s bacillary dysentery was treated successfully with sulfa-drugs and in the 1950s with tetracycline [*14*]. In the 1970s, resistance to one or more of the antimicrobial agents then in use began to emerge [*15*], but ampicillin was available and was used successfully to treat shigellosis by that time. When *Shigella* spp. began to develop resistance to ampicillin, TMP–SXT became the drug of choice [*16*]. Since 1980, however *Shigella* spp. have demonstrated a frequent and alarming resistance to TMP–SXT [*17*]. With the usefulness of these antimicrobials curtailed by the emergence of resistant strains, investigators are challenged to find new alternative drugs.

In this study the *Shigella* isolates were more susceptible to gentamicin (100%), nalidixic acid (97.3%) and norfloxacin (100%) than to drugs commonly used to treat shigellosis including ampicillin (21.3%) and TMP–SXT (54.7%). In the early 1980s, studies done in Addis Ababa, Ethiopia, indicated that all or most *Shigella* spp. were susceptible to TMP–SXT (98.0%–100%) and ampicillin (52%–79.0%) [*5*,*6*]. Furthermore, O'Brien reported in 1987 that in many areas of the world the susceptibility of *Shigella* spp. to nalidixic acid and aminoglycosides remains constant, whereas their susceptibility to ampicillin and TMP–SXT has decreased considerably [*18*]. The present study also revealed that a high level of resistance to cephalothin (86.7%), chloramphenicol (74.7%), erythromycin (100.0%), sulfonamide (54.7%) and tetracycline (97.3%). These findings are in agreement with the previous data obtained from Ethiopia [*7,8*] and other developing countries such as Bangladesh [*19*], and eastern Africa [*20*]. Similar patterns of antimicrobial susceptibility have been observed in the United States of America [*21*], Europe and Latin America [*22*].

Among the *Salmonella* strains, the most commonly isolated serogroup was group B, followed by group D (*S. typhi*) and group C. This is an agreement with some previous studies in Ethiopia [*6,8*], but in contrast to the earlier studies which showed that *S. typhi* was the dominant species [*23,24*]. All serogroups of *Salmonella* isolated in this study are known to cause gastrointestinal infections.

Among all antibiotics tested for *Salmonella* spp., the highest resistance was observed with ampicillin (81.2%), cephalothin (86.4%), chloramphenicol (83.7%), erythromycin (100.0%), gentamicin (75.6%), sulfonamide (81.1%), tetracycline (94.5%) and TMP–SXT (75.7%). These findings are in contrast with those studies done in Ethiopia in the 1980s that showed that most *Salmonella* spp. were sensitive to the majority of drugs tested (77.8%–98.4%) [*6,23–25*], but in agreement with those studies done in the 1990s [*8,26*]. The marked resistance pattern observed in this study also agrees with reports from other parts of the world [*22,27,28*]. Reports of antimicrobial resistance trends in *Salmonella* isolates by these investigators show that *Salmonella* has developed resistance to the above antimicrobial agent over the years. It was not possible to include 3rd-generation cephalosporins for susceptibility testing in this study. In Ethiopia, these drugs are not widely used for treatment of salmonellosis/shigellosis. In the near future there is a need to determine the susceptibility pattern for cephalosporins because resistance to these

drugs has been increasing, as documented elsewhere [*22*].

Many factors have contributed to the development of resistance in gastrointestinal pathogens, including misuse, overuse, quality and potency of the antimicrobial agents [*29*]. According to Salyers and Amábile-Cuevas [*30*], acquiring resistant genes, even from distantly related genera, is what accounts for the development and spread of drug resistance in bacteria. These authors further explained that the ability of resistance genes to adapt rapidly to new hosts so that they are not readily lost even in the absence of antibiotic selection might be the reason why increases in resistance can be so hard to reverse.

In conclusion, periodic evaluation of the susceptibility pattern of *Shigella* and *Salmonella* spp. would be particularly useful. In addition, controlled clinical trial studies are needed to verify the demonstrated efficacy of alternative drugs in treating shigellosis and salmonellosis. Furthermore, developing a broadly protective vaccine may be a more effective approach to curbing morbidity and mortality against these enteric pathogens.

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Climate and health: issues of concern in the Eastern Mediterranean Region

Findings of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) indicate that the Eastern Mediterranean Region is one of those that will be worst affected. Climate change will aggravate current water scarcity to unprecedented levels that will seriously challenge water security for people and for food production. A rise in endemic morbidity and mortality due to diarrhoeal disease is expected, and malnutrition due to reduced food production will be exacerbated. A general rise in temperature and an increase in the number, intensity and duration of heatwaves and dust storms are expected, with potential for adverse health impacts. Natural disasters such as flooding and drought are projected to increase, with corresponding injuries and death. Changes in the distribution of vector-borne diseases such as malaria and dengue are also expected as a result of the changing environment.

Source: Fact sheets (http://www.emro.who.int/whd2008/factsheets.htm)

Survey of antibiogram tests in cholera patients in the 2005 epidemic in Hamadan, Islamic Republic of Iran

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تقصّي اختبارات الحساسية للمضادات الحيوية لدى مرضى الكوليرا في وباء 2005 في همدان، بجمهورية إيران الإسلامية

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الخلاصة: أجرى الباحثون دراسة مستعرضة تحليلية للتعرف على المجموعات المصلية والأنماط المصلية لضمات الكوليرا ومعدلات مقاومتها للمضادات الحيوية في وباء الكوليرا الذي ضرب همدان عام 2005. وقد شملت الدراسة 190 مريضاً لديهم زرع براز إيجابي لضمات الكوليرا من المجموعة المصلية O1، والنمط البيولوجي الطور، والنمط المصلي إينابا. ومن بين 60 حالة اختارها الباحثون عشوائياً لإجراء اختبارات الحساسية للمضادات الحيوية، لوحظ أن الحساسية للنورفلوكساسين تبلغ 97% والسيبروفلوكساسين 92% والكاناميسين 88% والأميكاسين 85% والتتراسيكلين 77% والدوكسي سيكلين 67%. وأن المقاومة للفورازوليدون تبلغ 100% وللتريميثوبريم – سلفاميثوكسازول 98% وللإريثروميسين 62%. وتدل مقارنة هذه النتائج مع نتائج وباء 1988 على ارتفاع يبعث على القلق في زيادة مقاومة ضمات الكوليرا للإريثروميسين والدوكسي سيكلين والسيبروفلوكساسين.

ABSTRACT An analytical cross-sectional study determined the serogroups and serotypes of *Vibrio cholerae*, and their antibiotic resistance rates, in the 2005 cholera epidemic in Hamadan. All 190 patients with positive stool cultures had *V. cholerae* serogroup O1, biotype El Tor and serotype Inaba positive. Of 60 cases selected randomly for antibiogram testing, sensitivity to norfloxacin, ciprofloxacin, kanamycin, amikacin, tetracycline and doxycycline was 97%, 92%, 88%, 85%, 77% and 67% respectively. Resistance to furazolidone, trimethoprim–sulfamethoxazole and erythromycin was 100%, 98% and 62% respectively. Comparison with the results of the 1998 epidemic suggests a worrying increase in the resistance of *V. cholerae* to erythromycin, doxycycline and ciprofloxacin.

Étude des antibiogrammes chez les patients atteints de choléra lors de l'épidémie de 2005 à Hamadan (République islamique d'Iran)

RÉSUMÉ Une étude transversale analytique a déterminé les sérogroupes et les sérotypes *Vibrio cholerae*, ainsi que leur taux de résistance aux antibiotiques, lors de l'épidémie de choléra de 2005 à Hamadan. On a identifié chez l'ensemble des 190 patients, dont les cultures de selles étaient positives, *V. cholerae* du sérogroupe O1, biotype El Tor, sérotype Inaba. Sur 60 cas choisis au hasard pour faire l'objet d'un antibiogramme, la sensibilité à la norfloxacine, la ciprofloxacine, la kanamycine, l'amikacine, la tétracycline et la doxycycline était respectivement de 97 %, 92 %, 88 %, 85 %, 77 % et 67 %. La résistance à la furazolidone, au triméthoprime-sulfaméthoxazole et à l'érythromycine était respectivement de 100 %, 98 % et 62 %. La comparaison avec les résultats de l'épidémie de 1998 semble indiquer une augmentation inquiétante de la résistance de *V. cholerae* à l'érythromycine, la doxycycline et la ciprofloxacine.

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Introduction

Cholera is an acute diarrhoeal disease that can, in a matter of hours, result in profound, rapidly progressive dehydration and death [*1*]. Since 1817, 7 global pandemics have occurred. The current (7th) pandemic, the first due to the El Tor biotype, began in Indonesia in 1961 and spread throughout Asia as *Vibrio cholerae* El Tor, displacing the endemic classic strain in many areas [*1–3*]. In October 1992, a large-scale outbreak of clinical cholera occurred in south-east India. This strain spread rapidly up and down the coast of the Bay of Bengal, reaching Bangladesh in December 1992. There it caused more than 100 000 cases of cholera in the first 3 months of 1993. It subsequently spread across the Indian subcontinent and to neighbouring countries, affecting Pakistan, Nepal, western China, Thailand and Malaysia by the end of 1994.

The organism has since been designated *V. cholerae* O139 Bengal [*1*]. Currently, in most regions of south-east Asia, *V. cholerae* serogroup O1 remains dominant, whereas in other regions serogroup O139 periodically re-emerges [*1,2*]. *V. cholerae* serogroup O1 is most common cause of cholera epidemics. In endemic areas, the disease is more common in the summer and autumn months [*1*]. Two biotypes of *V. cholerae* O1—classic and El Tor—are distinguished. Each biotype is further subdivided into 2 sero-types, termed Inaba and Ogawa [*1,2*]. An epidemic of cholera in Iraq was anticipated for the year 1999 and in Baghdad city 874 cases of cholera were reported during the epidemic, mostly *V. cholerae* El-Tor O1, serotypes Ogawa and Inaba [*4*].

The hallmark of cholera is the production of watery diarrhoea with varying degrees of dehydration ranging from none to severe and life-threatening diarrhoea. The goal of therapy is to restore the fluid loss caused by diarrhoea and vomiting. Antimicrobial agents play a secondary role in the treatment of cholera. When patients with severe dehydration are given antibiotics, the duration of diarrhoea is decreased and the volume of stool is reduced by nearly half [*1,2*]. The Islamic Republic of Iran is at risk of epidemics spreading from neighbouring countries. So far there have been 12 epidemics of cholera with the 1st epidemic in 1965 (Figure 1). The Center for Disease Control at the Ministry of Health and Medical Education reported 1133 cases of cholera with 12 deaths in the epidemic of 2005.

Due to increasing reports of antibiotic resistance in strains of *V. cholerae* O1 [*1,2*], our objectives were to determine the serogroups and serotypes of *V. cholerae*, and their sensitivity and resistance to antibiotics, in the epidemic of cholera in 2005 in Hamadan province and to compare the results with those from the epidemic of 1998.

Methods

This survey was carried out using an analytical cross-sectional method in the summer of 2005, following the start of the epidemic of cholera in Hamadan, western Islamic Republic of Iran.

A total of 190 isolates of *V. cholerae* were obtained from patients suspected of cholera who were referred to health centres or hospitals. The specimens were collected on sterile swabs, which were then placed in Cary–Blair transport medium. Alkaline peptone water was used for the enrichment of *V. cholerae*, which was then isolated on thiosulphate-citrate-bilesalt-sucrose (TCBS) agar [*5*]. Biochemical identification and serotyping were performed by standard procedures [*6*].

Susceptibility to antimicrobial agents was examined by an agar disk diffusion

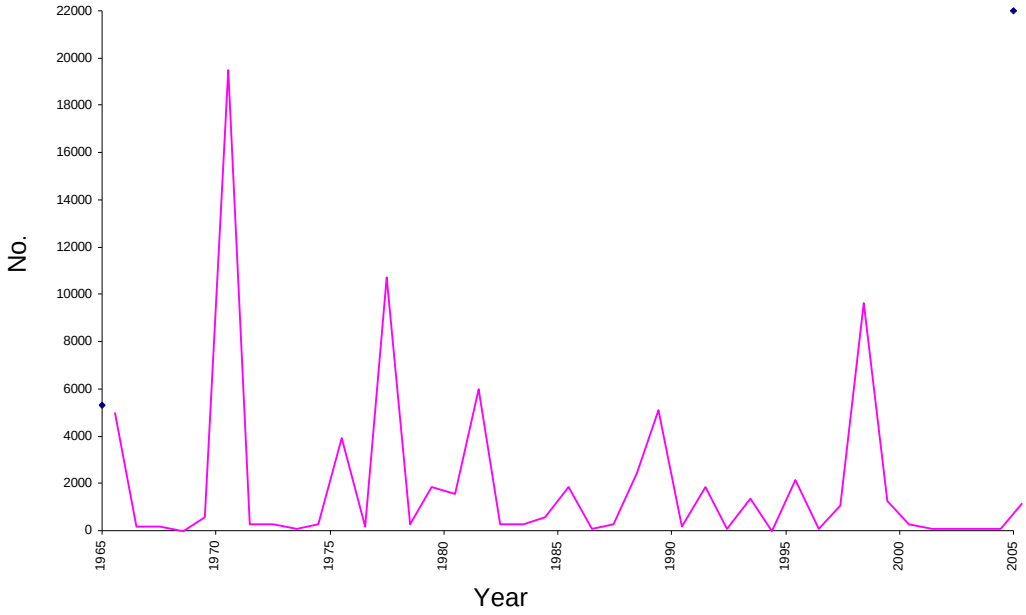

Figure 1 **Trend of cholera cases in the Islamic Republic of Iran from 1965 to 2005 [Source: Center for Disease Control, Ministry of Health and Medical Education, Islamic Republic of Iran]**

method on Mueller–Hinton agar [*7*]. The antibiotic disks were prepared by the Padtan Teb company (Tehran, Islamic Republic of Iran). The following antibiotics were used at the following concentration of drug per disk: amikacin (30 µg), tetracycline (30 µg), furazolidone (100 µg), norfloxacin (10 µg), erythromycin (15 µg), kanamycin (30 µg), doxycycline (30 µg), ciprofloxacin (5 µg), trimethoprim–sulfamethoxazole (25 µg). After 18 hours of incubation at 37 ºC on TCBS, strains were characterized as susceptible or resistant based on inhibition zone sizes [*5*].

Results

Of the 13 172 specimens collected from patients suspected of infection with cholera, 190 (1.4%) were identified as *V. cholerae* O1, biotype El Tor and serotype Inaba. Of the affected patients, 110 (58%) were males and 80 (42%) females, with 86% urban and 14% rural residence. A total of 8% of cases were admitted to hospital and the remainder were treated as outpatients. The incidence of *V. cholerae* in Hamadan province was 11 per 100 000 population. The case fatality rate was 1.1%.

From the total isolates, 60 specimens were selected randomly for further analysis: 33 (55%) from males and 27 (45%) from females. As Table 1 shows *V. cholerae* was most frequent in the age group 11–30 years (58%). The mean age of patients was 25.97 years.

The sensitivity of the *V. cholerae* strains to norfloxacin, ciprofloxacin, kanamycin, amikacin, tetracycline and doxycycline was 97%, 92%, 88%, 85%,

Table 1 **Age distribution of patients with *Vibrio cholerae* (*n* = 60) in Hamadan, Islamic Republic of Iran in 2005**

Age (years)	No.	%
0–10	9	15
11–20	19	32
21–30	16	27
31–40	7	12
41–50	2	3
51–60	3	5
61–70	1	2
71–80	3	5

77% and 67% respectively (Table 2). The resistance to furazolidone, trimethoprim–sulfamethoxazole and erythromycin was 100%, 98% and 62% respectively.

Discussion

The 7th pandemic of El Tor cholera that started in 1961 was still active in 1998 when a marked increase was recorded in the number of cases in all countries affected, with a total of 293 121 cases and 10 586 deaths reported to the World Health Organization [*8*]. This is almost double the number of reported cases in 1997 (147 425 cases and 6274 deaths) [*8–10*].

In the present study in Hamadan province in the west of the Islamic Republic of Iran in 2005, 190 isolates out of 13 172 were identified as *V. cholerae* O1, biotype El Tor and serotype Inaba. In their study of the 1998 cholera epidemic in Hamadan, Keramat et al. reported 718 isolates as *V. cholerae* O1, biotype El Tor and serotype Ogawa [*11*].

Al-Abbassi et al. reported an epidemic of cholera in Baghdad, Iraq during 1999 from which 874 strains isolated were *V. cholerae* El Tor O1, serotypes Ogawa (79.6%) and Inaba (12.1%), *V. parahaemolyticus* (2%) and non-agglutinable vibrios (6.1%). *V. cholerae* O139 was isolated from 2 cases (0. 2%) for the first time in Iraq [*4*]. Kaistha et al. reported an outbreak of cholera in and around Chandigarh, India during 2 successive years (2002 and 2003) in which 99 isolates were found to be *V. cholerae* O1 serotype Ogawa, biotype El Tor [*12*]. In the Islamic Republic of Iran *V. cholerae* O139 has not yet been isolated in any of the several epidemics.

In our study, the case fatality rate was 1.1%. In the 1998 cholera epidemic in Hamadan, the case fatality rate was 0.7%, less than the global case fatality rate of cholera of 4.3% during 1997 and 3.6% during 1998 [*8*].

We found that the antibiotic resistance to trimethoprim–sulfamethoxazole, furazolidone and erythromycin were over 60%. Table 3 (from Keramat et al.'s study) shows the results of antibiograms of 100 specimens of *V. cholerae*. Antibiotic resistance to trimethoprim–sulfa-

Table 2 **Results of antibiogram tests of *Vibrio cholerae* isolates (*n* = 60) in Hamadan, Islamic Republic of Iran in 2005**

Antibiotic	Sensitivity		Resistance	
	No.	%	No.	%
Norfloxacin	58	97	2	3
Ciprofloxacin	55	92	5	8
Kanamycin	53	88	7	12
Amikacin	51	85	9	15
Tetracycline	46	77	14	23
Doxycycline	40	67	20	33
Erythromycin	23	38	37	62
Trimethoprim–sulfamethoxazole[a]	1	2	39	98
Furazolidone	0	0	60	100

[a]n = *40 specimens only.*

Table 3 **Results of antibiogram tests of *Vibrio cholerae* isolates (*n* = 100) in Hamadan, Islamic Republic of Iran in 1998 [*11*]**

Antibiotic	Sensitivity %	Resistance %
Ciprofloxacin	92	8
Tobramycin	93	7
Doxycycline	85	15
Erythromycin	73	27
Trimethoprim–sulfamethoxazole	0	100
Furazolidone	0	100
Ampicillin	8	92
Nalidixic acid	98	2
Chloramphenicol	33	67

*Source: Keramat et al. [*11*].*

methoxazole and furazolidone was 99% and 98%, but the sensitivity to ciprofloxacin, doxycycline and erythromycin was 99%, 85% and 73% respectively [*11*]. In another study, by Pourshafie et al., 200 isolates of *V. cholerae* were obtained in 1999 and 2000 from patients suspected of having cholera in different provinces of the Islamic Republic of Iran [*13*]. The antibiotic resistance study showed significant resistance to trimethoprim–sulfamethoxazole, streptomycin and furazolidone but 100% of the strains were sensitive to ciprofloxacin and genta-mycin (Table 4). Most *V. cholerae* O1 isolates from different provinces in the Islamic Republic of Iran are characterized by resistance to multiple antibiotics. These studies show an increasing frequency of resistance. The reasons for the variation in antibiotic susceptibility patterns between different provinces are unclear.

Singh et al. reported an epidemic of cholera in Delhi in 1995 where resistance to furazolidone, streptomycin, trimethoprim–sulfamethoxazole, chloramphenicol, nalidixic acid and tetracycline was 95%, 91%, 89%, 8%, 7% and 4% respectively [*14*].

Table 4 **Results of antibiogram tests of *Vibrio cholerae* isolates in different regions of the Islamic Republic of Iran in 1999–2000 [*13*]**

Antibiotic	Resistance (%)					
	Tehran (*n* = 58)	Kashan (*n* = 29)	Khuzastan (*n* = 60)	Kerman (*n* = 44)	Kermanshah (*n* = 4)	Sistan & Baluchestan (*n* = 5)
Chloramphenicol	0	0	2	2	0	0
Ciprofloxacin	0	0	0	0	0	0
Doxycycline	0	0	0	5	0	0
Erythromycin	0	100	0	2	0	0
Tetracycline	100	0	95	2	100	0
Trimethoprim–sulfamethoxazole	100	0	97	100	100	100
Tetracycline	0	0	27	5	0	0
Gentamicin	0	0	0	0	0	0
Furazolidone	100	0	34	100	100	100
Streptomycin	100	100	100	100	100	100

n = *no. of isolates.*

Another study by Sow et al. showed that *V. cholerae* O1 strains were multiresistant to sulfonamide, trimethoprim–sulfamethoxazole and chloramphenicol but fluoroquinolone and 3rd generation cephalosporins were more effective antibiotics (100% resistant) [*15*]. Other investigators have reported *V. cholerae* O1 that is drug-resistant to tetracycline, ampicillin, erythromycin, chloramphenicol, nalidixic acid and trimethoprim–sulfamethoxazole [*16,17*]. Gabastou et al. described the outbreak of cholera in Ecuador in 1998 and reported 100% of 301 strains of *V. cholerae* were sensitive to tetracycline and quinolones, and 5.6% of the strains were resistant to erythromycin [*18*].

Antimicrobial agents play a secondary role (after rehydration) in the treatment of cholera. Clinical trials have shown that when patients are given antibiotics the duration of diarrhoea decreases and the volume of stool reduces. These benefits are critical in epidemic conditions [*2*]. Oral tetracycline and doxycycline are the agents of choice in areas of the world where sensitive strains predominate. In children younger than 7 years trimethoprim–sulfamethoxazole, erythromycin and furazolidone are preferred. Pregnant women can be treated with erythromycin or furazolidone [*2,19–21*]. New agents have been tested in endemic and epidemic areas, with quinolones (such as ciprofloxacin, norfloxacin) being the most effective. Quinolones have not been recommended for children < 18 years and pregnant women [*1,2,22*]. In the present study, ciprofloxacin resistance was 8%, the same as in the 1998 Hamadan epidemic.

However, strains resistant to quinolones have recently been reported from India [*2,23–25*]. Early planning to contain the disease may have reduced the case fatality rate, especially through proper regimens of rehydration and antibiotic therapy. Studying the antibiograms of the 2 epidemics of cholera in Hamadan and other provinces of the Islamic Republic of Iran reveals that resistance to trimethoprim–sulfamethoxazole and furazolidone has remained high, while resistance to erythromycin, doxycycline and ciprofloxacin has been increasing. This problem will cause some difficulties concerning children and pregnant women with cholera.

Our study suggests that there is a great need for the Ministry of Health and Medical Education in our country to control the utilization of antimicrobial agents in cholera, in addition to carrying out surveillance of antimicrobial resistance as a guide to the choice of antimicrobial for treatment.

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Practical guide on environmental health in emergencies and disasters

The Centre for Environmental Health Activities has just published the Arabic version of the WHO publication "Environmental health in emergencies and disasters: practical guide". This document distills what is known about environmental health (EH) during an emergency or disaster. It is intended for practitioners, as well as for policy-makers and researchers. In part I, a conceptual framework is presented for understanding EH issues in the context of disaster management. The framework covers the entire disaster-management cycle. Guidelines are also suggested for planning and reducing the effects of extreme events on public health. Part II of this book is a detailed compendium of best practices and strategies for risk reduction and response. Topics covered include: shelter and emergency settlements; water supply; sanitation; food safety; vector and pest control; prevention of epidemics; chemical incidents; radiation emergencies; and mortuary services and handling of the dead. The complete document can be accessed online at: http://www.emro.who.int/ceha/pdf/EHemerg.pdf

Résistance *d'Anopheles labranchiae* au DDT au Maroc : identification des mécanismes et choix d'un insecticide de remplacement

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مقاومة الأنوفيلة المتفرعة للد.د.ت في المغرب: التعرف على الآليات واختيار المبيدات الحشرية البديلة

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الخلاصة: أجريت هذه الدراسة للتعرف على مقاومة الأنوفيلة المتفرعة، وهي ناقلة الملاريا في المغرب، في ولايات القنيطرة، وخوريجه ولعراش والخميسات وسلا خلال عام 2005. وقد كانت الأنوفيلية المتفرعة حساسة للبروبوكسور والفينيتروثيون والبيرميثرين، ومقاومة لمختلف تركيزات الد.د.ت. أما من الناحية الجينية، فلم يكن هناك تغير في الهدف المشترك الذي يستهدفه الد.د.ت والبيريترونيدات، وهو قناة الصوديوم المعتمدة على الفولطاج. ويبدو أن المقاومة ناجمة عن آليات إزالة السمية الخاصة بالد.د.ت. فلا مانع من حيث المبدأ، من إحلال مركبات البيريترونيدات محل الد.د.ت في المغرب. ويمكن عند ذلك كشف المقاومة ومراقبتها باستخدام أدوات جزيئية موثوقة في مختبر الحشرات الطبية في المعهد الوطني للصحة.

RÉSUMÉ Une étude de la résistance *d'Anopheles labranchiae*, vecteur du paludisme au Maroc, a été réalisée au niveau des provinces de Kénitra, Khouribga, Larache, Khémisset et Salé au cours de l'année 2005. *An. labranchiae* est sensible au propoxur, au fénitrothion et à la perméthrine, et résistant à des degrés divers au DDT. L'étude génétique de cette résistance n'a pas révélé l'existence de modification de la cible commune au DDT et aux pyréthrinoïdes, qui est le canal sodium voltage dépendant. Cette résistance semble être due à des mécanismes métaboliques spécifiques au DDT. Elle ne devrait, en principe, constituer aucun obstacle à la substitution du DDT par les pyréthrinoïdes au Maroc. La résistance peut désormais être détectée et surveillée par des outils moléculaires plus fiables au niveau du Laboratoire d'Entomologie médicale (LEM) de l'Institut national d'Hygiène.

Resistance of Anopheles labranchiae to DDT in Morocco : identification of the mechanisms and choice of replacement insecticide

ABSTRACT A study of *Anopheles labranchiae* resistance in Morocco was conducted in the provinces of Kénitra, Khouribga, Larache, Khémisset and Salé during 2005. *An. labranchiae* was susceptible to propoxur, fenitrothion and permethrin and resistant to varying degrees to DDT. Genetically there was no change to the target site common to DDT and pyrethroids, the voltage gated sodium channel. The resistance seemed to be due to detoxification mechanisms specific to DDT. In principle, there should be no obstacle to the substitution of DDT by pyrethroids in Morocco. Resistance can then be detected and supervised by more reliable molecular tools in the Laboratory of Medical Entomology of the National Institute of Hygiene.

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Introduction

La lutte contre *An. labranchiae*, vecteur du paludisme au Maroc, repose essentiellement sur l'utilisation du DDT en aspersion intradomiciliaire comme adulticide et du téméphos comme larvicide. La dernière utilisation du DTT comme adulticide date de 2001 dans les foyers résiduels du Rif.

La sensibilité de l'espèce à ces insecticides est régulièrement surveillée. Les premiers tests de sensibilité au DDT réalisés en 1959 montrèrent une sensibilité normale de l'espèce à cet organochloré au Maroc [*1*]. À partir de 1971, les premiers cas de résistance furent observés [*1*, J. De Zulueta, C.D. Ramsdale, rapport inédit, 1973]. Depuis, des taux de résistance atteignant jusqu'à 30 % ont été observés dans différentes régions du pays, aussi bien dans des zones sous aspersions que dans des zones qui n'ont pas connu de traitement depuis des vingtaines d'années [L.F. Delfini, G.R. Shidrawi, rapport inédit, 1989]. Actuellement, la stratégie du Programme de Lutte antipaludique est orientée vers d'autres issues basées sur l'aménagement de l'environnement, la lutte biologique et la recherche d'insecticides de remplacement au DDT [*2*]. Toutefois, il n'y a aucune information sur l'état de sensibilité d'*An. labranchiae* aux autres insecticides : organophosphorés, carbamates et pyréthrinoïdes. Les mécanismes impliqués dans la résistance d'*An. labranchiae* au DDT ne sont pas non plus encore identifiés. Il semble primordial, avant d'envisager l'utilisation d'autres insecticides, d'identifier, d'une part, les mécanismes mis en jeu dans la résistance d'*An. labranchiae* au DDT et d'autre part, de connaître la sensibilité de ce vecteur à ces autres produits. En fait, deux mécanismes impliqués dans la résistance des anophèles au DDT sont, jusqu'à maintenant, mis en évidence : une résistance métabolique qui correspond à une dégradation de l'insecticide par des enzymes, glutathion S-transférases (GST), ou une modification de la cible, mutation du gène canal sodium voltage dépendant (*kdr*) [*3*]. Le GST est un mécanisme spécifique au DDT ; son implication n'entrave pas l'utilisation des pyréthrinoïdes comme insecticides de remplacement au DDT. Par contre, l'implication du gène *kdr* n'entraîne pas uniquement la résistance au DDT mais aussi à la majorité, sinon à la totalité des pyréthrinoïdes utilisés en santé publique [*4,5*]. En Turquie où des résistances multiples existent chez *An. sacharovi*, espèce très proche d'*An. labranchiae* puisqu'elles appartiennent au même complexe, le *kdr* a déjà été mis en évidence [*6*].

La présente étude a pour objectifs d'étudier l'état de sensibilité d'*An. labranchiae* aux différents insecticides utilisés en santé publique, d'identifier les mécanismes impliqués dans la résistance au DDT au Maroc et d'orienter le choix d'un insecticide de remplacement.

Méthodes

Zone d'étude

Les anophèles utilisés dans cette étude ont été prélevés dans des zones agricoles soumises à des traitements chimiques et où différents taux de résistance au DDT ont été enregistrés. Cinq provinces ont été ainsi retenues : Kénitra, Khémisset, Larache, Khouribga et Salé (Figure 1). Avant d'être soumis aux tests de sensibilité, les anophèles, capturés par aspirateur à bouche dans des abris animaux, ont été identifiés morphologiquement (*An. maculipennis* s.l.) [*7*]. Les survivants aux tests ont été identifiés par amplification génique (PCR) [*8*].

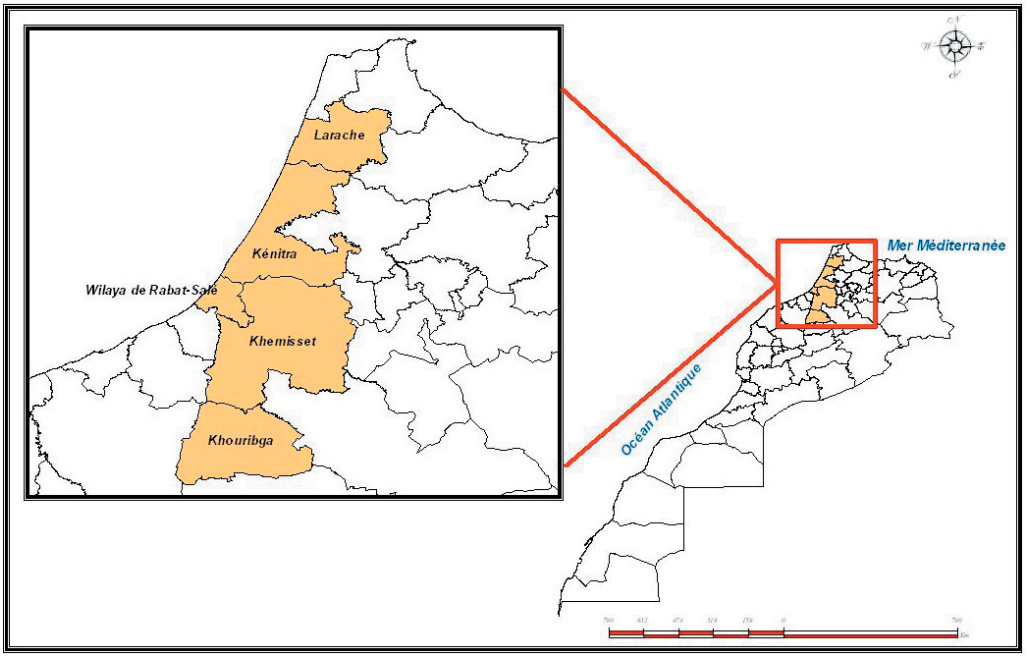

Figure 1 **Provinces retenues pour l'étude de la résistance *d'An. labranchiae***

Tests biologiques

L'état de sensibilité d'*An. maculipennis* s.l. a été déterminé vis-à-vis de quatre insecticides : DDT 4 %, fénitrothion 1 %, propoxur 0,1 % et perméthrine 0,75 %. Les tests ont été pratiqués sur des femelles sauvages du complexe *An. maculipennis* selon la méthode normalisée par l'OMS [*9*]. Cette méthode consiste à exposer les moustiques à des papiers imprégnés d'insecticides à la concentration diagnostique. Les tests ont été réalisés sur des lots de 20 à 25 femelles gorgées dans des tubes OMS avec 3 à 4 répétitions par insecticide. Pour chaque test, deux tubes tapissés de papiers imprégnés uniquement d'huile minérale ont servi de témoins. Le temps d'exposition est de 60 mn. Après exposition, les moustiques sont maintenus sous observation pendant 24 heures à une température d'environ 25 °C et une humidité relative d'environ 70 % avant de noter la mortalité. Pour les tests à la perméthrine, le pourcentage de moustiques « knock-down » a été noté au cours de l'exposition. L'évolution de ce pourcentage a été analysée selon un modèle log probit afin de déterminer les temps de « knock-down », KDT_{50} et KDT_{90}. Tous les survivants aux doses discriminatoires ont été conservés à - 80 °C avant d'être soumis à des analyses moléculaires.

Identification moléculaire des espèces

L'identification moléculaire des spécimens *An. maculipennis* s.l. a été faite selon la technique décrite par Proft et al. [*8*]. Elle est basée sur l'amplification de la région

« Second Internal Transcribed Spacer » ou ITS2 et utilise, en combinaison, un primer universel et des primers spécifiques permettant de différencier six parmi les sept espèces du complexe *An. maculipennis* s.l. : *An. atroparvus*, *An. labranchiae*, *An. maculipennis* s.s., *An. melanoon*, *An. messeae* et *An. sacharovi*.

Recherche de la mutation du gène *kdr*

Il n'existe pas encore à ce jour de test diagnostique permettant la mise en évidence d'une mutation de type *kdr* chez *An. labranchiae*, comme il en existe chez *An. gambiae* [*3*] ou *C. pipiens* [*10*]. La recherche d'une éventuelle mutation dans la zone codant pour le canal sodium voltage dépendant chez *An. labranchiae* se fait par séquençage, après amplification de cette zone. Cette recherche a été effectuée au Laboratoire de Lutte contre les Insectes nuisibles (LIN), Institut de Recherche pour le Développement (IRD), Montpellier (technique non publiée). Les séquences obtenues ont été comparées aux séquences du canal sodium voltage dépendant d'*An. sacharovi* [*6*].

Résultats

Au niveau de chaque province, les tests ont été réalisés par ordre de priorité, en fonction de la densité d'adultes d'*An. labranchiae*, au DDT (4 %), à la perméthrine (0,75 %), au propoxur (0,1 %) et au fénitrothion (1 %). Les populations testées sont totalement sensibles au propoxur et à la perméthrine avec des KDT_{50} et KDT_{90} variant respectivement autour de 15 et 35 mn (Tableau 1). Les taux de résistance au DDT sont variables selon les provinces. Dans la province de Larache, on enregistre des taux de résistance de 19 et 22 %, respectivement, pour les localités de Boucharen et Louamra. Dans la localité de Ouled Moussa, province de Kénitra, le taux de résistance au DDT est de 19 % alors que 5 % de cette même population a survécu au fénitrothion. Dans la province de Khouribga, localité de Béni Khlef, le taux de résistance au DDT est de 25 %. Dans la localité de Chougaga, province de Khémisset, 10 % de la population testée a survécu à la dose discriminatoire du DDT ; 2 % de cette même population a survécu à la dose discriminatoire du fénitrothion. Dans la localité de Ouled Bourzine, préfecture de Salé, la mortalité notée après l'exposition au DDT est de 85 %.

Les tailles des bandes de migration des produits d'amplification de la région ITS2 révélées sur gel d'agarose ont été comparées à celles du témoin du complexe *An. maculipennis* et du marqueur de taille (100-1000 pb). La taille des bandes obtenues est de 375 pb, similaire à celle du témoin *An. labranchiae*. *An. labranchiae* est donc la seule espèce du complexe *An. maculipennis* s.l. retrouvée parmi les spécimens survivants testés. Ces résultats concordent avec ce qui est déjà rapporté sur la composition du complexe *An. maculipennis* s.l. au Maroc [*11*].

Le séquençage des produits d'amplification chez les spécimens ayant survécu à l'exposition au DDT n'a pas révélé de différence au niveau du gène canal sodium voltage dépendant par rapport à des spécimens d'*An. sacharovi* sensibles. Il n'y a donc pas de mutation de type *kdr* chez les spécimens testés. Ces résultats donnent à penser que les mécanismes impliqués dans la résistance d'*An. labranchiae* au DDT sont vraisemblablement de nature biochimique.

Tableau 1 **Résultats des tests de sensibilité d'*An. labranchiae* aux différents insecticides**

Province	Localité	Insecticide	Nbre de femelles exposées	Mortalité (%)	Taux de résistance (%)	KDT_{50} (mn)	KDT_{90} (mn)
Larache	Louamra	DDT	78	78	22	14,47 (E.T. 0,14)	30,09 (E.T. 0,06)
		Perméthrine	59	100	0		
		Propoxur	60	100	0		
		Fénitrothion	60	95	5		
	Boucharen	DDT	78	81	19		
Kénitra	Ouled Moussa	DDT	81	81	19	16,07 (E.T. 0,17)	40,44 (E.T. 0,06)
		Perméthrine	65	100	0		
		Propoxur	78	100	0		
		Fénitrothion	80	95	5		
Khouribga	Béni Khlef	DDT	80	75	25	16,49 (E.T. 0,25)	39,34 (E.T. 0,1)
		Perméthrine	77	100	0		
Khémisset	Chougaga	DDT	80	90	10	12,30 (E.T. 0,59)	31,46 (E.T. 0,29)
		Perméthrine	80	100	0		
		Propoxur	76	100	0		
		Fénitrothion	60	98	2		
Salé	Ouled Bourzine	DDT	80	85	15	13,39 (E.T. 0,32)	29,59 (E.T. 0,15)
		Perméthrine	60	100	0		
		Propoxur	60	100	0		

E.T. : écart type
mn : minutes.

Discussion

D'après les résultats des tests biologiques réalisés au niveau des différentes zones étudiées, *An. labranchiae* est sensible à la perméthrine, au propoxur et au fénitrothion (Tableau 1). Il présente une résistance faible à modérée au DDT. Les taux de résistance au DDT varient de 10 à 25 % selon les régions. La souche de Khouribga semble être la plus résistante, celle de Salé la plus sensible. Cette résistance semble être maintenue malgré l'arrêt des traitements au DDT. Les premiers cas de résistance ont été détectés en 1971 dans les provinces de Kénitra, Khouribga et El Jadida [*1*], soit une dizaine d'années après les premières utilisations du DDT en santé publique. Par la suite, plusieurs enquêtes entomologiques ont montré la présence de cette résistance dans d'autres régions. En 1973, des contacts de 2 et 4 heures avec des papiers imprégnés au DDT (4 %) n'ont entraîné respectivement que 83 % et 91 % de mortalité chez *An. labranchiae* dans le secteur de Louamra (province de Larache). Ce constat a incité De Zulueta et Ramsdale à s'inquiéter quant à une éventuelle progression et généralisation de la résistance au DDT, comme c'était le cas en Turquie. Dix ans plus tard, J.L. Clarke [rapport inédit] a obtenu des taux de mortalité similaires (87 % après une exposition de 2 heures)

dans la localité de Lyadiya (province de Kénitra). Des taux comparables ont été obtenus par Delfini en 1989 dans la province de Fès qui n'a pas été traitée au DDT depuis 1971 (77 % et 86 % respectivement après 1 et 2 heures de contact). Le même auteur a observé le même taux de résistance dans la province de Meknès (89 % de mortalité après 2 heures d'exposition). Nous-mêmes avons enregistré, dans le cadre du Programme national de Lutte antipaludique, des taux de résistance semblables au cours des 10 dernières années dans différentes provinces du pays.

Les derniers traitements au DDT en santé publique dans les provinces de Salé et Kénitra ont eu lieu il y a plus de 25 années, alors qu'ils ont été interdits en agriculture dans les années 1970. Au niveau des provinces de Larache, Khémisset et Khouribga, ceux-ci ont eu lieu il y a respectivement 17, 11 et 5 ans. Le maintien d'une faible résistance apparente après l'arrêt des aspersions laisse supposer l'existence d'une pression de sélection exercée par d'autres insecticides qui sont toujours en cours d'utilisation, tels que les pyréthrinoïdes largement utilisés en agriculture.

La résistance d'*An. labranchiae* aux pyréthrinoïdes, aux carbamates, aux organochlorés et aux organophosphorés est mal documentée au Maroc. La sensibilité aux organophosphorés n'est approchée qu'à travers les tests de sensibilité des larves au téméphos. Celles-ci sont, en fait, toujours sensibles à ce produit (données non publiées du Laboratoire d'Entomologie médicale - LEM) malgré son utilisation, dans le cadre du Programme national de Lutte antipaludique, comme seul insecticide dans la lutte antilarvaire depuis les années soixante-dix. Les résultats de notre étude concernant la sensibilité au fénitrothion à 1 % concordent avec ces données. Quant à la sensibilité aux pyréthrinoïdes, le seul test concernant la lambdacyhalothrine 0,1 %, réalisé dans la province de Kénitra [*2*], montre une sensibilité normale de l'espèce à ce produit (98 % de mortalité après une heure de contact). Toutefois, il faut signaler que la dose de lambdacyhalothrine utilisée (0,1 %) est deux fois la dose diagnostique utilisée pour *An. gambiae* (0,05 %) [*5*]. Nos résultats actuels avec la perméthrine à 0,75 % peuvent être aussi discutés puisque cette dose n'a jamais été testée pour *An. labranchiae*. Chandre [*5*] a réévalué ces doses pour *An. gambiae* à 1 % pour la perméthrine et 0,05 % pour la lambdacyhalothrine. Idéalement, la dose diagnostique devrait être établie pour chaque espèce et chaque insecticide. Toutefois, en tenant compte de l'effet « knock-down » observé au cours de l'exposition des femelles à la perméthrine, et de la mortalité de 100 % après 24 heures, nous pensons pouvoir conclure à une sensibilité normale d'*An. labranchiae* aux pyréthrinoïdes. Les taux de KDT_{50} et KDT_{90} variaient respectivement autour de 15 et 35 mn. Des résultats similaires ont été obtenus chez des souches sensibles d'*An. gambiae* homozygotes et hétérozygotes pour le gène *kdr* [*5*]. D'après le même auteur, la baisse de l'effet « knock-down » peut être considérée comme un indicateur précoce de l'apparition de la résistance car elle peut être significative avant même que l'on observe une baisse de mortalité. Celle-ci n'est en fait obtenue par les tests OMS que lorsque la population est constituée d'une proportion importante d'homozygotes pour le gène de résistance. Afin de confirmer la probable non-implication d'une mutation sur le gène *kdr*, nous avons recherché une éventuelle mutation de ce gène. Le test diagnostique du gène *kdr* permettrait l'identification de la mutation de ce gène chez les individus hétérozygotes, d'où une détection précoce de l'apparition de la résistance [*5*].

Le séquençage de la région du canal sodium voltage dépendant susceptible de présenter une mutation de type *kdr* et la

comparaison avec celle d'*An. sacharovi* sensible n'a pas permis de mettre en évidence une quelconque mutation qui pourrait être impliquée dans la résistance au DDT observée chez *An. labranchiae*. Ces données indiquent que la baisse de sensibilité au DDT n'est pas due à une modification du canal sodium voltage dépendant, cible commune au DDT et aux pyréthrinoïdes.

Ces derniers constitueraient donc l'alternative idéale pour remplacer le DDT au Maroc tout en surveillant de près la sensibilité du vecteur vis-à-vis de ces produits. La détection précoce d'une mutation de ce gène contribuera sans aucun doute à la mise au point de stratégies de lutte permettant de mieux maîtriser ce phénomène de résistance. L'absence de mutation du gène *kdr* chez les individus qui ont survécu à la dose discriminatoire du DDT suppose l'implication de mécanismes de détoxication spécifiques à ce produit.

Conclusion

À travers cette étude nous avons confirmé, par l'utilisation du test OMS, la présence de la résistance d'*An. labranchiae* au DDT à des degrés divers et sa sensibilité à la perméthrine, au propoxur et au fénitrothion dans les provinces de Kénitra, Larache, Khouribga, Khémisset et Salé. Dans toutes ces provinces, les pyréthrinoïdes n'ont jamais été utilisés en santé publique tandis que le DDT l'a été depuis les années soixante et n'a pas été utilisé depuis 1980 dans les provinces de Salé et Kénitra et depuis 1988, 1994, 2000 respectivement dans les provinces de Larache, Khémisset et Khouribga.

Les tests moléculaires ont montré l'absence de mutation du gène *kdr*. L'utilisation du DDT en santé publique pendant plus de 30 ans et celle des pyréthrinoïdes agricoles depuis plusieurs années n'ont apparemment jamais sélectionné la mutation *kdr* chez *An. labranchiae* au Maroc. Les pyréthrinoïdes resteraient, pour le moment, les insecticides de choix pour la substitution du DDT dans la lutte contre le paludisme. La surveillance de la résistance par de nouveaux outils moléculaires est recommandée.

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Immigration and hepatitis B virus: epidemiological, clinical and therapeutic aspects

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الهجرة والالتهاب الكبدي "بي": الجوانب الوبائية والسريرية والعلاجية

إميليو بالومبو، جيتانو سكوتو، دوناتيلا كونتشيتا تشيبيلّي، جوزيبينا فاليو، أناليزا ساراشينو، جواكشينو أنغارانو

الخلاصة: هدفت هذه الدراسة التي أجريت في إيطاليا إلى تقييم الجوانب الوبائية والسريرية والعلاجية للعدوى بفيروس الالتهاب الكبدي "بي" بين السكان الذين لم تمض على هجرتهم أكثر من ستة أشهر. وقد أجرى الباحثون في المدة ما بين شباط/فبراير 2003 وكانون الأول/ديسمبر 2004، اختبارات على 890 مهاجراً، تبيَّن أن 83 منهم (9.3%) إيجابيون للمستضد السطحي لالتهاب الكبد "بي". وقد كان جميعهم من الرجال، وقَدِمَ 62.6% منهم من أفريقيا، و21.6% منهم من آسيا و16.8% من أوروبا الشرقية. ولاحظ الباحثون ارتفاعاً في مستويات إنزيم ناقلة أمين الألانين ALT لدى نصف المفحوصين تقريباً (54.3% منهم)، إلى جانب مقدار يمكن كشفه من دنا فيروس الالتهاب الكبدي "بي". أما توزيع الأنماط الجينية فكان على الوجه التالي: E (20 حالة)، D (14 حالة) وA (11 حالة). وتوضح هذه الدراسة أهمية التدفق الذي قد يرافق الهجرة بإدخال نمط جيني غير النمط D من فيروسات الالتهاب الكبدي "بي" إلى إيطاليا.

ABSTRACT This study in Italy aimed to evaluate the epidemiological, clinical and therapeutic aspects of hepatitis B virus (HBV) infection in a population of recent (< 6 months) immigrants. Between February 2003 and December 2004, 83 (9.3%) out of 890 immigrants tested positive for hepatitis B surface antigen. All were men and 62.6% came from Africa, 21.6% from Asia and 16.8% from Eastern Europe. About half (54.3%) of the patients had elevated alanine aminotransferase levels and detectable serum HBV DNA. Genotype distribution was as follows: E (20 cases), D (14 cases) and A (11 cases). Our study underscores the potential of migratory flow to introduce genotype non-D hepatitis B virus into our country.

Immigration et virus de l'hépatite B : aspects épidémiologiques, cliniques et thérapeutiques

RÉSUMÉ Cette étude menée en Italie avait pour but d'évaluer les aspects épidémiologiques, cliniques et thérapeutiques de l'infection par le virus de l'hépatite B (VHB) dans une population d'immigrants de fraîche date (< 6 mois). De février 2003 à décembre 2004, 83 (9,3 %) des 890 immigrants ont été testés positifs pour l'antigène de surface de l'hépatite B. Tous étaient des hommes et 62,6 % d'entre eux venaient d'Afrique, 21,6 % d'Asie et 16,8 % d'Europe de l'Est. Chez environ la moitié des patients (54,3 %), le taux d'alanine aminotransférase était élevé et l'ADN du VHB sérique était détectable. La répartition du génotype était la suivante : E (20 cas), D (14 cas) et A (11 cas). Notre étude souligne la possibilité que les flux migratoires introduisent un génotype du virus de l'hépatite B autre que D dans notre pays.

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Introduction

Hepatitis B virus (HBV) infection is an important public health problem and more than 400 million of the world's population are chronic carriers of the virus [*1,2*]. Some regions are characterized by a prevalence of infection > 8%, including the major part of sub-Saharan Africa, South-East Asia, some regions in central South America and some European countries, such as Albania and Turkey. Italy is characterized by a low prevalence of HBV (< 2%) [*3*], but immigration could be leading to the introduction into our area of people infected by HBV, with a consequent increase in prevalence.

HBV is characterized by a genetic heterogeneity and 8 genotypes (A to H) can be classified based on comparison of complete HBV genomes and according to the criterion of ≥ 8% differences in the complete nucleotide sequence of the viral genome [*4–6*]. HBV genotypes have a characteristic geographic distribution. Genotype A is widely distributed in North West Europe, North America and Central Africa, while genotypes B and C are present in Asia only; genotype D has been found worldwide with its highest prevalence in the Mediterranean area, the Middle East and South Asia, particularly India. Genotype E is found in sub-Saharan Africa and genotype F in South and Central America. Genotype G has been found in France and in the United States of America, while the newly discovered genotype H seems so far to be restricted to the northern part of Latin America, including Central America and Mexico [*5*].

Some studies have recently suggested that the genotype affects the clinical features of HBV infection and the response to antiviral treatments. In fact, with regard to genotypes B and C, which are prevalent in Asia, genotype C has been shown to be more frequently found in severe liver disease and in hepatocellular carcinoma and it has a lower response rate to interferon alpha therapy, while genotype B is associated with faster hepatitis Be antigen (HbeAg) and antibody to HbeAg (anti-HBe) seroconversion [*7–12*]. During treatment with lamivudine, YMDD variants [(Y: tyrosine; M: methionine; D: aspartic acid; D: aspartic acid] seem to appear more frequently in genotype A patients than genotype D but appear earlier in genotype D [*13*].

In Italy the prevalent genotype is D; in fact about 95% of Italian patients with HBV infection present with this genotype [*3*]. The migratory flow towards our country has increased in the last 10 years, particularly from endemic areas for HBV (prevalence > 8%) such as sub-Saharan Africa, and one consequence is the possible introduction into our country of genotype non-D HBV infections. This is important both from the epidemiological and clinical point of view, since other genotypes may have a peculiar natural history and response to antiviral treatments.

The aims of the present study were to evaluate the epidemiological, clinical and therapeutic aspects of HBV infection in a population of recent (< 6 months) immigrants and in patients affected by active chronic hepatitis HBV-related infections to determine the HBV genotype.

Methods

Data collection

Between February 2003 to December 2004 a total of 890 immigrants were tested for HBsAg. All gave written informed consent and all participants tested were temporary guests in a camp for refugees, without contact with the indigenous population. The

criteria for inclusion were: age > 14 years and presence in Italy for a period < 6 months. All subjects were tested in the medical ambulatory clinic in the camp for refugees and the blood samples were transported to the department's virology laboratory where they were tested for HBsAg.

In HBsAg-positive patients the biochemical and virological activity of infection and the eventual presence of coinfections—with hepatitis C and D virus (HCV, HDV) and human immunodeficiency virus (HIV)—were evaluated. In patients with detectable serum HBV, DNA analysis determined the HBV genotype.

All patients positive for HBsAg were invited to fill in a questionnaire regarding risk factors for HBV infection (sexual risk-taking, family history of HBV infection, etc.).

Laboratory analysis

HBsAg was assayed by commercial immunoassay (Abbott-Auszyme Mc, Abbott Laboratories, North Chicago, Illinois). Hepatitis Be antigen (HbeAg) and antibody to HbeAg (anti-HBe) were detected by radioimmunoassay (HbeAg/antiHBe immunoradiometric DiaSorin, Vercelli, Italy). IgM and IgG anti-HDV were tested with commercially available enzyme-linked immunoassay (ELISA) kits (Abbott Diagnostica, Weisbaden-Delkenheim, Germany). The presence of antibodies to HCV (anti-HCV) was determined with the use of a 3rd-generation HCV-ELISA (Ortho Diagnostic System, Raritan, New Jersey, USA) and confirmed by a 3rd-generation recombinant immunoblot assay (RIBA) (Ortho Diagnostic Systems, Raritan, New Jersey, USA). Antibodies to HIV (anti-HIV) were determined by enzyme immunoassay (HIV1/HIV2 EIA, Abbott) and positive results were confirmed by western blot. Serum HBV DNA levels were measured by polymerase chain reaction (PCR-real time) with a detection limit of 100 copies/mL. Serum alanine aminotransferase (ALT) was quantified by ultraviolet enzymatic assay (normal range 0–40 IU/L).

Determination of HBV genotypes

The serum of all patients with detectable serum HBV DNA was stored at –80 ºC then thawed for determination of HBV genotypes. First, HBV DNA was extracted as described by Stuyver et al. [*6*]. The second step was the nucleic acid amplification of the pooled HBV gene domain B and C by means of the PCR, for obtaining sequence information about codons 180, 204 and 207 in the polymerase open reading frame. The extracted DNA was amplified over 2 rounds of PCR using biotinylated PCR primers. An exact copy of the template was produced after 1 cycle of denaturation, annealing and extension.

Because the amount of amplification product is generally not sufficient, a nested (2nd round) PCR was needed. After the 2nd PCR for amplifications, HBV-genotype were determined by a line-probe assay (INNO-LiPA HBV genotyping, Innogenetics NV, Gent, Belgium) as described by Stuyver et al. [*6*].

Statistical analysis

A two-tailed Pearson χ^2 test was used to compare categorical data. Statistical significance was taken as $P < 0.05$. The software used for the statistical analysis was *Epi-info*, version 6.

Results

Table 1 shows the demographic data of the 890 studied subjects. Among the subjects tested, 83 (9.3%) were HBsAg positive. All were men, with a mean age of 23 years

Table 1 **Demographic characteristics of all immigrants tested for hepatitis B surface antigen**

Variable	Tested	Positive
Total (No.)	890	83
Male/female (No.)	758/132	83/0
Mean time in Italy [days (Range)]	72 (4–192)	
Mean age [years (Range)]	24 (15–39)	23 (16–37)
Origin [No. (%)]		
Africa	625 (70.2)	52 (62.7)
Asia	162 (18.2)	18 (21.7)
Eastern Europe	77 (8.7)	13 (15.7)
South America	26 (2.9)	0 (0)

(range 16–37), and 52 (62.7%) came from Africa (20 from Liberia, 15 Sudan, 11 Eritrea and 6 Ethiopia), 18 (21.7%) from Asia (9 from Pakistan and 9 from Bangladesh) and 13 (15.7%) from Eastern Europe (all from Albania). All patients were anti-HBe positive, with IgM and IgG anti-HDV negative.

No subject presented coinfection with HCV and HIV. Serum bilirubin, albumin and prothrombin times were normal in all subjects. No patient was aware of his positivity for HBsAg before our screening. In 27% of cases (all African) the risk factor was sexual, while in the majority of cases the risk factor for HBV infection was unknown. A total of 38/83 (45.8%) patients had normal ALT levels (< 40 IU/L) and undetectable serum HBV DNA (< 100 copies/mL), while 45 (54.2%) patients had ALT levels elevated above the laboratory normal (mean level was 167 IU/L, range 74–387) and serum HBV DNA levels detectable by PCR-real time (mean 972 866 copies/mL, range 22 933–1 697 833).

Genotype distribution was determined in patients with detectable serum HBV DNA. Distribution of HBV genotypes in these patients and correlation with biochemical and virological activity of disease are shown in Table 2. All 45 patients had been in Italy for a mean period of 30 days (range 5–55) and certainly were infected in their country of origin.

A liver biopsy was proposed to all patients affected with active chronic HBV, but written informed consent was obtained

Table 2 **Distribution of hepatitis B virus (HBV) genotypes in 45 patients with detectable serum HBV-DNA and correlation with biochemical and virological activity of disease**

HBV genotype	Immigrants tested		Origin	No.	Mean ALT (IU/L)	Mean HBV DNA (copies/mL)
	No.	%				
E	20	44.4	Liberia	12	178	1 181 900
			Sudan	8		
D	14	31.1	Eritrea	4	167	878 831
			Sudan	4		
			Albania	6		
A	11	24.4	Eritrea	7	156	776 900
			Ethiopia	4		

Statistical analysis showed no significant correlation between biochemical and virological activity of the disease and the different HBV genotypes.
ALT = alanine aminotransferase.

only by 7 patients: 3 were affected by genotype E (all from Eritrea) and 4 affected by genotype D (3 from Albania and 1 from Sudan). At the histological diagnosis the 3 patients with genotype E presented a chronic HBV-related hepatitis (grade 2, stage 2), while among the 4 patients with genotype D, 3 patients were affected by a chronic HBV-related hepatitis (grade 1, stage 1) and 1 patient by cirrhosis (grade 3, stage 4). These 7 patients were treated with lamivudine (100 mg/day, orally): actually, 3 patients (2 affected by genotype D and 1 by genotype E) after 12 months of therapy had a complete response (ALT < 40 UI/L and undetectable serum HBV DNA). Among the other 4 patients, 2 (both of whom were affected by genotype D) had a complete response after the 2nd year of treatment, while 2 patients (affected by genotype D and E) developed YMDD mutants after 14 and 16 months of therapy respectively. It was not possible to treat the other patients affected by active chronic B hepatitis because they moved to other cities in north Italy.

Discussion

Some recent studies have demonstrated that the prevalent infectious diseases in immigrants are HIV, tuberculosis and chronic viral hepatitis, more frequently caused by HBV, particularly in African people coming from sub-Saharan areas [*14–17*]. The principal aim of this study was to evaluate the prevalence of HBV infection in a population of recent immigrants living in Italy for < 6 months. We tested 890 subjects. The majority were from sub-Saharan Africa which reflects the prevalent migratory flow to Italy, characterized by migrants from Africa and, less frequently, from Eastern Europe. Among this group, 83 subjects (9.3%) tes-ted positive for HBsAg; this rate is similar to observations presented in the Italian and international literature [*14,15*]. No cases of coinfection were observed our series.

Many of our cases (about 50%) had normal ALT and undetectable serum HBV DNA. This is not surprising because many studies have shown, particularly in sub-Saharan African populations, that HBV infection in these countries is highly prevalent (> 8%), but many infected subjects (40%–65% in different studies) do not have biochemical and virological symptoms of disease (healthy carriers) [*14,18,19*]. In the majority of our cases the risk factors for HBV infection remained unknown, but in 30%, the patients reported a sexual risk factor, which is frequent in African populations due to high levels of prostitution and to cultural refusal to use condoms. Therefore, our data showed a high prevalence of HBV infection in immigrants, particularly in Africans.

An important result concerned the sex of infected patients; all HBsAg positive subjects were men. This is probably a result of the difficulty in testing females (only 82/556 of tested subjects were females). In fact, in African communities females are afraid to know their eventual diseases, in particular infectious diseases that are considered a cause of social discrimination.

The second aim of the study was to determine the clinical and therapeutic aspects with particular attention to the HBV genotype. Recently, there have been several studies reporting the influence of HBV genotypes on the clinical features and on the response to antiviral treatment (interferon and lamivudine) of patients infected with HBV [*5,7–11*]. Therefore these different genotypes, probably characterized by a different natural history and a different response to therapy, could require a dif-

ferent clinical and therapeutic approach as compared to genotype D. In our study the prevalent genotype was E, evidenced exclusively in sub-Saharan patients. This coincides with the usual geographic distribution of this genotype, which is primarily found in sub-Saharan areas. The 11 patients affected by genotype A came from central Africa (Eritrea and Ethiopia), where this genotype is prevalent.

An indirect demonstration of the potential redistribution of HBV genotypes comes from the analysis of persons infected by genotype D in our series. In fact among the 14 patients infected with genotype D, 6 came from Albania, where this genotype is diffused, while 8 patients came from Central Africa, not usually characterized by the presence of this genotype. This could demonstrate that the global migratory flow in the world can effect a partial modification of the normal geographic distribution of HBV genotype with the distribution of some genotypes in areas where they are not normally found. No case of genotypes B and C was seen because the 10 Asiatic patients who were infected with HBV had undetectable serum HBV-DNA and it was therefore not possible to obtain an HBV genotype. Concerning the biochemical and virological activity of HBV infection, while the mean ALT level was similar among the 3 different genotypes, the patients with genotype E had a mean serum HBV DNA higher than subjects with genotypes A and D, but the statistical analysis did not show a significant difference.

An important factor concerned the difficulty in treating the immigrant patients affected with active chronic HBV; in fact only 7 patients initiated antiviral therapy with lamivudine. This difficulty is connected with the continual movements of these people; the majority of immigrants pass through southern Italian regions and after a short time move to north Italy or to other European countries were work opportunities are better, without the possibility to start or continue treatment. Another important aspect is concerned with the difficulty of treating subjects for a chronic and asymptomatic disease; for many populations, particularly African people, the disease is exclusively an acute and symptomatic event, characterized by symptoms such as fever. For this reason it is very difficult to treat patients who are asymptomatic.

In conclusion, our study shows a moderate prevalence of HBV infection in immigrants to Italy, particularly in people from sub-Saharan Africa, and underscores the potential of migratory flow for the introduction of genotype non-D hepatitis B virus, as well as the difficulty in treating immigrant patients affected by active chronic B hepatitis.

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Seroprevalence of hepatitis B and C infections among young adult males in Pakistan

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معدلات الانتشار المصلي للعدوى بالالتهاب الكبدي "بي" و"سي" بين صغار الشبان في باكستان

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الخلاصة: أجرى الباحثان هذه الدراسة الوصفية المستعرضة في مستشفيَيْن عسكريَيْن في باكستان، من كانون الثاني/يناير 2004 إلى كانون الأول/ديسمبر 2005؛ وذلك بتحري صغار الشبان ممن تتراوح أعمارهم بين 16 – 22 عاماً من مختلف المقاطعات الباكستانية بحثاً عن المستضد السطحي للالتهاب الكبدي "بي" وعن الأضداد للالتهاب الكبدي "سي" وبلغ عدد الشبان المدروسين 5707، من بينهم 95 شاباً (1.70%) إيجابيون لفيروس الالتهاب الكبدي "سي" و167 شاباً (2.93%) إيجابيون للمستضد السطحي للالتهاب الكبدي "بي". ورغم التوزع المتماثل للفَيْروسَيْن "بي" و"سي" في جميع أرجاء باكستان، إلا أن معدل الانتشار المصلي كان أعلى في مقاطعات البنجاب والسند منه في مقاطعات الحدود الشمالية الغربية وبلوشستان وآزاد كشمير. ويُعَدُّ التثقيف الصحي لعامة الناس، ولاسيَّما للحلاقين، من الوسائل البالغة الأهمية في إجراءات الوقاية والمكافحة.

ABSTRACT This descriptive, cross-sectional study was conducted at 2 military hospitals in Pakistan from January 2004 to December 2005. Young adult males with age range 17–22 years from different districts of Pakistan were screened for hepatitis B surface antigens (HBsAg) and anti-hepatitis C antibodies (anti-HCV). Out of 5707 young men tested, 95 (1.70%) were positive for anti-HCV and 167 (2.93%) for HBsAg. Although both viruses were distributed evenly throughout Pakistan, seroprevalence was higher in the provinces of Punjab and Sindh than in North-West Frontier province and Baluchistan and Azad Kashmir provinces. Health education to the general public, including barbers, would be an important tool for control/preventive measures.

Séroprévalence des infections dues aux virus des hépatites B et C chez de jeunes hommes adultes au Pakistan

RÉSUMÉ Cette étude descriptive transversale a été menée dans deux hôpitaux militaires du Pakistan de janvier 2004 à décembre 2005. Une recherche de l'antigène de surface de l'hépatite B (Ag HBs) et des anticorps dirigés contre le virus de l'hépatite C (anti-VHC) a été effectuée sur de jeunes hommes adultes âgés de 17 à 22 ans et provenant de différentes régions du Pakistan. Sur les 5707 sujets soumis au dépistage, 95 (1,70 %) étaient positifs pour les anticorps anti-VHC et 167 (2,93 %) pour l'Ag HBs. Bien que les deux virus aient été uniformément répartis dans tout le Pakistan, leur séroprévalence était plus élevée dans les provinces du Pendjab et du Sindh que dans la Province frontière du Nord-Ouest et les provinces du Baloutchistan et de l'Azad Cachemire. L'éducation sanitaire de la population, notamment des coiffeurs-barbiers, pourrait être un moyen efficace de prévention et de lutte.

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Introduction

Viral hepatitis due to hepatitis B and C is widespread: 350 million people worldwide are infected with hepatitis B virus (HBV) [*1,2*] and about 170 million with hepatitis C virus (HCV) [*3*]. Both these diseases are present in the population of Pakistan, yet there are varying reports of their prevalence. HCV is one of the silent killer diseases which are spreading undetected in Pakistan. It appears to be more dangerous than HBV because there are often no clinical symptoms and, when HCV is diagnosed, considerable damage has already been done to the patient. According to an estimate there are about 9 million HBV carriers in Pakistan and over 14 million HCV carriers [*4,5*]. These figures may not be accurate, however, because in most studies, particularly in Pakistan, the population sample selected is limited to a particular area or segment or high-risk group. In different studies the prevalence has been estimated as 3%–10% for hepatitis B surface antigens (HbsAg) and 2.2%–14% for HCV antibodies [*6–9*].

There is an urgent need to assess the actual prevalence of these infections in order to adopt preventive strategies. In Pakistan young males 17–22 years of age apply for recruitment as soldiers in the armed forces from all over the country. They are usually from lower socioeconomic groups. This study was planned to estimate the prevalence of HBsAg and HCV antibodies in these young males from different districts of Pakistan.

Methods

The sample comprised 5707 young adults who reported over a period of 2 years from January 2004 to December 2005 for recruitment to different branches of the Pakistani armed forces (fighting soldiers or soldiers in services groups including the engineering branch, army medical corps, clerks, supply units and signals branch). All of them reported to the combined military hospital in Dera Ismail Khan or in Peshawar for medical examination. These individuals came from all 4 provinces of Pakistan including Azad Kashmir.

Inclusion criteria were: healthy unmarried males, 17–22 years of age, minimum height 5 feet 6 inches, with minimum educational qualification of matriculation (equivalent to GCE "O" level). Exclusion criteria were: individuals with a history of hepatitis B vaccination, prior hospital admission, blood transfusion or intravenous drug abuse and having physical body defects or systemic or local diseases/conditions such as fever, perforation of tympanic membrane, diabetes mellitus, hypertension, lymphadenopathy, hepatosplenomegaly, cardiac valvular defects or any other systemic disease.

All the individuals were given a thorough physical examination, complete blood counts, routine blood chemistry, urine examination and chest radiography. All of them were screened for HBV using an HBsAg test device (IND Diagnostic Inc., Delta, Canada) and for HCV by an anti-HCV rapid test (Maxi-test, IND Diagnostic Inc., Delta, Canada), both of which are based on immunochromatographic principles. Positive tests were confirmed by enzyme-linked immunosorbent assay (ELISA) methods using HBsAg ELISA test kits (CDC Diagnostics, Los Angeles) and HCV ELISA test kit (CDC Diagnostics).

Demographic data were collected about age, province of origin and family income and participants were asked about risk factors for HBV and HBC transmission.

SPSS for Windows, version 10 was used for data compilation and calculations and the chi-squared test was used to determine

the significance of difference between categorical variables. *P*-values < 0.05 were taken as significant.

Results

A total of 5707 males were included in the study, age range 17–22 years, with a mean age (standard deviation) of 18.72 (1.43) years. There were 2296 individuals from Punjab province, 700 from Sindh province, 2378 from North-West Frontier province and 333 from Baluchistan and Azad Kashmir province (Table 1). They all belonged to lower middle [< Rs 10 000 (US$ 167)] or poor [< Rs 4500 (US$ 75)] socioeconomic groups based on their monthly family income.

A further 1802 applicants were excluded from the study owing to over or under age, height less than 5 feet 6 inches, history of prior hospital admission or blood transfusion and having physical defects such as bow legs, flat foot, knock knee, chest deformities and systemic or local diseases/conditions such as tympanic membrane perforation, diabetes mellitus, lymphadenopathy, hepatosplenomegaly and cardiac valvular defects.

Out of 5707 cases tested, 97 (1.7%) were confirmed to be positive for anti-HCV and 167 (2.9%) for HBsAg. The distribution of positive cases for anti-HCV and HBsAg by district is depicted in Table 1. There was no case with both the infections.

None of the study sample reported a history of administration of hepatitis B vaccination or intravenous drug abuse. They all denied any sexual contact except 11 of them. These 11 males gave a history of infrequent sexual contact but all were negative for HBsAg and anti-HCV. A past history of jaundice was reported by 26 men but all of them were negative for HBsAg and anti-HCV. Some (n = 15) had received dental treatment/extraction in their village but only 1 of those was positive for HBsAg.

The prevalences of HBsAg in Punjab and Sindh provinces (3.70% and 5.00% respectively) were significantly higher than in North-West Frontier province (1.81%) and Baluchistan and Azad Kashmir (1.20%) ($P < 0.0001$). The prevalences of anti-HCV were also significantly higher in Punjab and Sindh provinces than other provinces ($P < 0.001$). However, the prevalence of anti-HCV in Punjab (1.92%) was lower than in Sindh (4.14%) ($P = 0.0012$).

In Punjab, North-West Frontier province, Baluchistan and Kashmir the prevalences were evenly distributed and there was no significant difference of prevalence for both HBsAg and anti-HCV among the population of different districts in each province (Table 1). In Sindh, however, while there was no significant difference of HBsAg prevalence among various district population ($P = 0.6773$), there was a significantly higher prevalence of anti-HCV (9.68%) among the population of Nawabshah district compared with other districts ($P = 0.0353$).

Discussion

HBV and HCV infections have significant morbidity and mortality worldwide. The global prevalence of HCV is 3% [*3*] and the carrier rate of HBsAg varies from 0.1% to 0.2% in Britain and the USA, 3% in Greece and southern Italy and up to 15% in Africa and the Asia [*10*]. In Pakistan, a prevalence of 10% has been estimated [*11*]. Different reports have estimated the prevalence of HBsAg in voluntary blood donors from 0.82% to 5% [*6–8,12,13*]. An estimated one-third of the world's population has serologic evidence of past infection, and the virus causes more than 1 million deaths annually [*14*]. In the USA, the incidence of

Table 1 **Distribution of hepatitis B surface antigen (HBsAg) carriers and anti-hepatitis C virus (anti-HCV) positive cases among young adult males of Pakistan**

Province/district	Total tested	HBsAg positive		*P* -value	Anti-HCV positive		*P* -value
	No.	No.	%		No.	%	
Punjab							
Bhakkar	367	6	1.63		5	1.36	
Chakwal	206	7	3.40		3	1.46	
Dera Ghazi Khan	71	4	5.63		1	1.41	
Gujrat	55	1	1.82		0	0.00	
Jehlem	83	3	3.61		2	2.41	
Jhang	92	8	8.70		2	2.17	
Khushab	168	4	2.38		1	0.60	
Multan	109	5	4.59		1	0.92	
Mianwali	399	13	3.26		8	2.01	
Pak Pattan	53	2	3.77		1	1.89	
Rawalpindi	120	5	4.17		5	4.17	
Sargodha	185	8	4.32		5	2.70	
Sialkot	38	2	5.26		0	0.00	
Toba Tek Singh	49	3	6.12		0	0.00	
Others[a]	301	14	4.65		10	3.32	
Total	2296	85	3.70	0.34	44	1.92	0.47
Sindh							
Karachi	111	3	2.70		1	0.90	
Khaipur Merus	158	7	4.43		7	4.43	
Larkana	76	4	5.26		3	3.95	
Nawabshah	93	4	4.30		9	9.68	
Sukhar	120	9	7.50		6	5.00	
Others[a]	142	8	5.63		3	2.11	
Total	700	35	5.00	0.68	29	4.14	0.04
North-West Frontier							
Charsadda	94	2	2.13		2	2.13	
Chitral	192	5	2.60		1	0.52	
Dera Ismail Khan	198	5	2.53		3	1.52	
Karak	101	2	1.98		0	0.00	
Kohat	102	1	0.98		1	0.98	
Mardan	274	4	1.46		2	0.73	
Nowshera	151	4	2.65		1	0.66	
Peshawar	194	5	2.58		4	2.06	
Swabi	331	5	1.51		2	0.60	
Tank	81	3	3.70		1	1.23	
Others[a]	660	7	1.06		4	0.61	
Total	2378	43	1.81	0.80	21	0.88	0.63
Baluchistan & Azad Kashmir							
Azad Kashmir	104	1	0.96		1	0.96	
Loralai	79	1	1.27		1	1.27	
Quetta	126	2	1.59		1	0.79	

Table 1 **Distribution of hepatitis B surface antigen (HBsAg) carriers and anti-hepatitis C virus (anti-HCV) positive cases among young adult males of Pakistan** *(concluded)*

Province/district	*Total tested*	*HBsAg positive*		P *-value*	*Anti-HCV positive*		P *-value*
	No.	No.	%		No.	%	
Others[a]	24	0	0.00		0	0.00	
Total	333	4	1.20	0.92	3	0.90	0.95
Total	5707	167	2.93	< 0.0001[b]	97	1.70	< 0.0001[b]

[a]*Other districts of the province.*
[b]*Indicates a significant difference between all positive cases in all the provinces.*

HBV infection declined from about 14 cases per 100 000 population in the mid-1980s to about 3 cases per 100 000 population in 1998 [*15*]. However, there are still 1.25 million adults and children in the USA with chronic HBV infection.

The World Health Organization has estimated that 170 million people worldwide are infected with HCV [*16*]. The prevalence in the USA is estimated at 3.9 million, approximately 4 times the current number of those infected with the HIV virus. Due to the latent nature of the disease (infection may precede symptoms by an average of 25 years) only 1 million of these individuals have actually been diagnosed [*17*].

HCV mortality figures are expected to triple by the year 2010, giving HCV a resultant mortality that may rival HIV. Internationally, 90% of those infected cannot afford treatment and due to the specific characteristics of the virus, a vaccine is not expected [*18*]. HCV has been estimated to be the most common cause of chronic liver disease, cirrhosis and liver cancer worldwide [*3,16,19*]. The current incubation time of HCV is 12–27 weeks, although 80%–90% of cases occur within 5–12 weeks post-transfusion [*1,16*]. Most patients with acute hepatitis C do not have demonstrable signs or symptoms at the onset of infection. Only about 25% of patients will have the appearance of jaundice [*16*]. In South-East Asia, China, and sub-Saharan Africa, HBV infection usually is acquired perinatally or in early childhood, leading to a high prevalence of chronic infection (5% to 20%). In contrast, 80% of infections in the USA, Canada and western Europe occur in adults via sexual contact or intravenous drug use, leading to a much lower baseline prevalence (0.1%). In the USA, groups at increased risk for HBV infection have been identified [*20*]

Earlier studies done in Pakistan used different methods of selection of the subjects. Khattak et al. reported a 6.2% prevalence of anti-HCV in professional blood donors [*21*] and Bhopal et al. a rate of 16.3% in admitted patients [*22*]. Farooq et al. estimated a prevalence of 3.3% and 3.0% for HCV antibodies and HBsAg respectively among young soldiers [*23*]. Qasmi et al. reported an HBsAg carrier rate of 3% among the population of Karachi [*24*]. In the present study the prevalence of both of the infections, HCV antibodies (1.70%) and HBsAg (2.93%), differed significantly ($P < 0.0001$). Similar results have been reported by Zakaria et al. with a 2.2% prevalence of HCV antibodies and 3.2% prevalence of HBsAg among naval recruits of Pakistan armed forces [*25*]. The study population mimics that of the present study, although the population in our study was younger,

belonging to the general public of rural and urban areas and moreover our study sample was larger.

HCV infection is known to have significant associations with a history of blood transfusion at least 6 months previously, direct patient care or laboratory work, intravenous drug use, multiple sexual partners and sexual or household contact with an infected person. The highest prevalence is among haemophiliacs who received factor concentrate transfusions before 1992 [*26*]. Persons with a history of intravenous drug use account for more than 50% of HCV transmission [*16*]. Perinatal spread is uncommon and, when it occurs, rarely leads to chronic infection of the child unless the mother is coinfected with HIV [*16*]. Prior hospitalization is a risk factor (prevalence in hospitalized patients is 2%–20%) [26]. All these factors appear to be excluded in the present study. Although all but 11 of the young men denied having any sexual contacts, this may be an underestimate because the social and religious taboos in Pakistan mean they may not admit to having sexual contacts. Barbers could be a source of infection in positive cases.

No specific reasons can be identified for the higher prevalence of HBsAg carrier rate and HCV antibodies in the provinces of Punjab and Sindh or the high prevalence of HCV antibodies in residents of Nawabshah district of Sindh because all the relevant factors appear to be the same throughout Pakistan. There is a need to adopt strict control/preventive measures against HBV and HCV infections. However, as the mode of transmission and risk factors are the same for both conditions, preventive and control measures should be planned to tackle them simultaneously.

Conclusions

In Pakistan, the prevalence of both HBsAg carrier rate (2.93%) and anti-HCV positive cases (1.70%) differed significantly among a sample of the young adult male population. Although both viruses are distributed evenly throughout Pakistan, the prevalence was greater in the provinces of Punjab and Sindh compared with North-West Frontier province, Baluchistan and Azad Kashmir. Health education to the general public, including barbers, would be an important tool of control/preventive measures.

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Response to hepatitis B virus vaccination in haemodialysis patients with and without hepatitis C infection

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استجابة مرضى الديال الدموي للتلقيح ضد فيروس الالتهاب الكبدي "بي" مع أو بدون العدوى بالالتهاب الكبدي "سي"

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الخلاصة: استهدفت هذه الدراسة تحديد مدى نجاعة التلقيح ضد فيروس الالتهاب الكبدي B واستجابة مرضى الديال الدموي للقاح، سواءً منهم المصابون وغير المصابين بعدوى فيروس الالتهاب الكبدي C. خلال الفترة من نيسان/إبريل 2000 إلى أيلول/سبتمبر 2003. تلقى جميع مرضى الديال الدموي الذين أحيلوا إلى مستشفى بابول، 4 كروغرامات من اللقاح على ثلاث حقن عضلية عند قدومهم وبعد شهر وبعد 6 شهور. وقد كانوا جميعاً سلبيين لواسمات العدوى بالالتهاب الكبدي B (المستضد السطحي للالتهاب الكبدي B، الضد السطحي للالتهاب الكبدي B والضد اللبي للالتهاب الكبدي B). ومن بين 62 مريضاً، استجاب 53 (85.5%) للتلقيح، منهم 26 (49.1%) استجابوا استجابة عالية. وقد استجاب جميع المصابين بعدوى فيروس الالتهاب الكبدي C للتلقيح. ولم يكن لطول مدة تلقي الديال الدموي تأثير على الاستجابة للتلقيح.

ABSTRACT The aim of this study was to determine the efficacy of hepatitis B virus (HBV) vaccination and the response to vaccine in individuals on haemodialysis with and without HCV infection. From April 2000 to September 2003 all haemodialysis patients referred to the haemodialysis department in a Babol hospital received 4 μg vaccine intramuscularly at 0, 1, and 6 months. All were negative for HBV infection markers (HBcAb, HBsAg and HBsAb). Of 62 patients, 53 (85.5%) responded to vaccination and 26 (49.1%) were high responders. All individuals with HCV infection responded to vaccination. Duration of haemodialysis had no effect on response to vaccination.

Réponse à la vaccination contre le virus de l'hépatite B chez des patients hémodialysés infectés et non infectés par le virus de l'hépatite C

RÉSUMÉ L'objectif de cette étude était de déterminer l'efficacité de la vaccination contre le virus de l'hépatite B (VHB) et la réponse vaccinale chez des sujets hémodialysés infectés et non infectés par le virus de l'hépatite C (VHC). D'avril 2000 à septembre 2003, tous les patients hémodialysés adressés au service d'hémodialyse d'un hôpital de Babol ont reçu 4 μg de vaccin intramusculaire à 0, 1 et 6 mois. Chez tous ces patients, les marqueurs de l'infection par le VHB – l'antigène (Ag) HBs, les anticorps anti-HBc et les anticorps anti-HBs – étaient négatifs. Tous les sujets infectés par le VHC ont répondu à la vaccination. La durée de l'hémodialyse était sans effet sur la réponse vaccinale.

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Introduction

Chronic hepatitis B virus (HBV) infection is one of the most important public health problems in Asia and developing countries [*1*]. More than 350 million people in the world are suffering from chronic HBV infection [*2*].

Haemodialysis patients are particularly at risk for developing of HBV infection and are unable to eliminate the virus because of their impaired immune systems. Infected individuals are predisposed to develop chronic liver disease and then renal transplantation problems may occur [*3*]. So, immunity against HBV infection is essential for all haemodialysis patients [*4–7*].

The response rates to HBV vaccine in this group of patients differ in several studies [*6,8–13*]. Haemodialysis patients have poor immunity, so the response to HBV vaccine is much lower than in healthy people [*5,14*]. After HBV vaccination, specific antibody is produced via activation of B-cells by class II (CD4 + T-helper) and class I-restricted (CD8 + CTL-cytotoxic T-cells) T-cell responses. Insufficient T- and B-cells responses can cause chronic liver disease in 30% of HBV infected haemodialysis patients [*15,16*]. Second-generation recombinant vaccine (expressing the "s" gene) is safer and more immunogenic than plasma-derived vaccines [*4,11,17*]. In addition, some studies have shown a low response rate to HBV vaccine in haemodialysis patients infected with hepatitis C virus (HCV) and some authors could not find the effective conversion rate of HCV infection on response to HBV vaccine [*14,18–22*].

The purpose of this study was to assess the efficacy of HBV vaccine in a group of haemodialysis patients and HCV-infected individuals in Babol city, Islamic Republic of Iran.

Methods

From April 2000 through September 2003, all haemodialysis patients referred to the haemodialysis department of Shahid Beheshti Hospital, Babol Medical University were enrolled in this study. The department serves all haemodialysis patients living in Babol city and the villages around it. Haemodialysis patients who were positive for hepatitis B virus surface antigen (HBsAg), antibody to hepatitis B surface antigen (anti-HBs) and antibody to hepatitis B core antigen (anti-HBc) were excluded.

All patients received 2 cm^3 Engerix-B vaccine (40 μg) HBsAg (Herberbiovac HB, Cuba) intramuscularly in the deltoid muscle in 3 doses (at 0, 1 and 6 months). One month after the last dose of vaccine, the HBsAb (anti-HBS) titre was determined using an enzyme-linked immunosorbent assay (ELISA) method, and antibody titres > 10 mIU/mL were considered as seroprotective. HCVAb, HBcAb, HBsAg and HBsAb were assayed with ELISA methods (Randox, England). Antibody levels between 10–99 mIU/mL were defined as responder and > 100 mIU/mL as high responder.

The local ethics committee approved the study and informed consent was obtained from all patients.

Statistical analysis was performed using *SPSS*, version 10. Chi-squared and Fisher exact tests were used to compare the antibody levels by age, sex, duration of haemodialysis and concurrent HCV infection. *P*-values < 0.05 were considered as significant.

Results

During this study 62 patients (28 males and 34 females) were evaluated (16 patients

were excluded due to early transplantation, elevated liver enzyme tests or death). The mean age of the patients was 50.95 (SD 17.82) years, range 10 to 79 years. Eleven (17.7%) patients were < 30 years, 14 (22.6%) were 30–49 years and 37 (59.7%) were 50+ years (Table 1). The duration of haemodialysis was 2 years in 45 (72.6%) patients, 2–4 years in 13 (21.0%) and > 5 years in 4 (6.5%).

Fifty-three (85.5%) of the patients had an antibody response to HBV vaccine: 25 (89.2%) males and 28 (82.4%) females ($P > 0.05$). Almost half of them (26, 49.1%) were high responders.

There was no significant difference in antibody response by age ($P > 0.05$). All (100%) of the 11 patients who were < 30 years old responded to HBV vaccine, 12 (85.7%) of the patients 30–49 years and 30 (81.1%) of the patients 50+ years old. There was also no significant difference in response by duration of haemodialysis ($P > 0.05$); 80.0% with duration < 2 years responded compared with 100% of those with longer durations (Table 1).

HCV infection was also detected in 19 (30.6%) patients. All of the HCV-infected individuals responded to HBV vaccine and 8 of them were high responders.

Table 1 **Response to hepatitis B virus vaccination in 62 haemodialysis patients by age and duration of haemodialysis**

Variable	Responder	Non-responder	Total
Sex			
Male	25	3	28
Female	28	6	34
Age (years)			
< 30	11	0	11
30–49	12	2	14
50+	30	7	37
Duration of dialysis (years)			
< 2	36	9	45
2–4	13	0	13
≥5	4	0	4
Total	53	9	62

P *> 0.05 for all variables.*

Discussion

Haemodialysis patients have impaired immunologic function and are predisposed to development of infections. In the United States of America (USA), complications of HBV infection are the second cause of death in these patients [*23*]. They have high risk for HBV infection, and recombinant HBV vaccine has been recommended for all patients undergoing haemodialysis since 1980. However, the success rate of vaccination is lower than in the general population [*5,14,24*].

It is noteworthy that 85.5% of our patients responded with had an anti-HBS titre > 10 mIU/mL. The reason for this high rate of response is not clear. In our study there was no significant difference in the antibody response comparing age groups < 30, 30–50 and 50+ years of old. Elderly haemodialysis patients have been found to have a lower antibody titre to HBV vaccine [*25–28*]. In Mitwalli's report the rate of seroconversion was higher in younger patients (< 30 years) than in elderly patients (> 50 years) [*13*]. Chin reported a better response rate to HBV vaccine in patients with a mean age of 51 years compared with 59 years of age [*28*]. Vlassopoulos et al. used intradermal vaccination and reported that age and sex had no influence on the immune response [*29*].

Peces et al. used 4 doses of vaccine and did not find any difference in response rate regarding sex, duration of haemodialysis, malnutrition status and haemoglobin level, but the response rate was better in patients < 40 years old [*20*]. Also, Navarro et al. did

not report any difference in the response rate with regard to age, duration of haemodialysis and serum albumin. They also showed that females had a better response than males [*22*]. In our study, sex and duration of haemodialysis had no significant effect on response to vaccination ($P > 0.05$).

Some authors have shown a decreased immune response to HBV vaccine in patients with HCV infection. They reported very low antibody titres in these patients and suggested a possible genetic basis for the low response rate to both viruses [*14,19–22*]. Navarro et al. reported a low response to HBV vaccination in HCV-infected haemodialysis patients in 2 studies. In the first study, the effective immunization rate (antibody titre ≥ 100 mIU/mL) was lower in HCV infected patients (33.3% versus 70.3%, $P < 0.05$) [*19*]. In another study they evaluated seroconversion of HBV vaccine in 56 haemodialysis patients for 1 year. They showed that HCV infection influenced the level of immunity; 27 out of 43 HCV-negative patients (62.8%) versus 3 out of 13 HCV-infected subjects (23.1%) had anti-HBs titre > 100 mIU/mL ($P < 0.01$). They suggested that HCV infection may reduce the effectiveness of HBV vaccination in haemodialysis patients [*22*].

Peces et al., however, reported 80 vaccinated seronegative haemodialysis patients. They used 4 vaccine doses (0, 1, 2 and 6 months) and 77.5% of patients had a high response. There was no difference between responder and nonresponder patients concerning HCV infection [*20*]. Cheng et al. used 5 vaccine doses and the effective conversion rates of the anti-HCV(+) and anti-HCV(–) groups were 75.0% and 77.3% respectively ($P = 0.867$) [*21*]. We also found that all cases of HCV infection had a good response to vaccination and 42% of them had a high response. So further large-scale studies are needed to confirm the response to HBV vaccination in HCV-infected haemodialysis patients.

In conclusion, sex, age, duration of haemodialysis and HCV had no association with low response to HBV vaccine, and vaccination can induce sufficient response.

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Cost–effectiveness of prescreening versus empirical vaccination for hepatitis A in Egyptian children with chronic liver disease

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مردودية تحري أضداد فيروس التهاب الكبد A قبل التلقيح ومقارنته بالتلقيح بدون التحري لدى الأطفال المصريين المصابين بمرض كبدي مزمن

هناء القراقصي، رقية السيد، منى الرازقي، نهال الكوفي، سماح منصور

الخلاصة: هدف الباحثون في هذه الدراسة إلى التعرف على معدل انتشار أضداد فيروس التهاب الكبد A في 172 طفلاً مصاباً بمرض كبدي مزمن، وإلى حساب مردودية التحري قبل التلقيح لالتهاب الكبد A. واتضح أن أضداد فيروس التهاب الكبد A إيجابية لدى 85.1٪ من الأطفال؛ ولو أن نسبة الانتشار المصلي لتلك الأضداد بلغت 62.1٪ لدى الأطفال الذين تقل أعمارهم عن 5 سنوات، و94.4٪ لدى الأطفال الذين تزيد أعمارهم على 5 سنوات. وخلص الباحثون إلى ارتفاع مردودية تحري الأضداد قبل تلقيح الأطفال المصابين بمرض كبدي مزمن ممن تزيد أعمارهم على 5 سنوات، في حين أن التحري قبل التلقيح قد لا يكون مرتفع المردودية لدى الأطفال الذين تقل أعمارهم عن 5 سنوات.

ABSTRACT The aim of the study was to determine the prevalence of anti-hepatitis A virus (anti-HAV) antibodies among 172 children with chronic liver disease, and to calculate the cost–effectiveness of prescreening prior to hepatitis A vaccination. Anti-HAV antibodies were positive in 85.1%. However, seroprevalence of anti-HAV antibodies was 62.1% in children < 5 years and 94.4% in children 5+ years. We conclude that while it is cost-effective to do prescreening before hepatitis A vaccination for children with chronic liver disease aged 5+ years, prescreening might not be cost-effective in those aged < 5 years.

Rapport coût-efficacité du prédépistage comparé à la méthode empirique de vaccination contre l'hépatite A chez des enfants égyptiens souffrant d'une affection hépatique chronique

RÉSUMÉ Les objectifs de cette étude étaient de déterminer la prévalence des anticorps anti-VHA (virus de l'hépatite A) parmi 172 enfants souffrant d'une affection hépatique chronique et de calculer le rapport coût-efficacité du dépistage préalable à la vaccination contre l'hépatite A. Les anticorps anti-VHA étaient positifs chez 85,1 % de ces enfants. Toutefois, la séroprévalence de ces anticorps était de 62,1 % chez les enfants de moins de 5 ans et de 94,4 % chez les enfants de 5 ans et plus. Nous en concluons que si un dépistage préalable à la vaccination contre l'hépatite A chez les enfants atteints d'une affection hépatique chronique qui sont âgés de 5 ans et plus est d'un bon rapport coût-efficacité, il ne l'est peut-être pas chez les enfants de moins de 5 ans.

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Introduction

During recent years many reports have discussed the outcome of acute hepatitis A in patients with chronic liver disease (CLD) [*1–4*]. Acute hepatitis A virus (HAV) superinfection causes more severe disease, acute hepatic failure and higher fatality rates in patients with underlying CLD, specifically chronic hepatitis B (HBV) and chronic hepatitis C virus (HCV) infections [*5–9*].

Two biological products, HAV vaccine and hepatitis A immunoglobulin, have been used successfully to prevent HAV [*10*]. In the mid-1990s 2 formalin-inactivated HAV vaccines were licensed by the United States Food and Drug Administration for use in preventing disease in persons 2 years and older [*11–13*].

It has been proposed that hepatitis A vaccine should be part of the routine management of patients with CLD, preferably as early as possible in the natural course of their disease [*14–16*]. Serologic testing for hepatitis A before vaccination is likely to be cost-effective only among persons who have a high likelihood of previous infection [*10*].

The aim of the present work was to determine the prevalence of previous exposure to hepatitis A in children with CLD in comparison to a group of age- and sex-matched controls; and to estimate the cost–effectiveness of prescreening versus empirical vaccination for hepatitis A in this age group.

Methods

The study was carried out over a period of 1 year from January 2004 to December 2004 at the Paediatric Hepatology Unit, Cairo University Children's Hospital, Egypt. We enrolled all children with CLD whose parents gave written consent to participate in the study. The study included 172 children: 101 with CLD and 71 healthy age- and sex-matched brothers, sisters and contacts of the patients as a control group.

Inclusion criteria for children with CLD were: willingness to participate; any CLD regardless of etiology; no previous history of vaccination against hepatitis A; and children of both sexes. Exclusion criteria were: children with uncontrolled coagulopathy; children with decompensated liver disease; children with known immunological deficiency; and infants < 2 years of age.

All children were tested for anti-HAV antibodies; 5 mL of blood were drawn aseptically by venepuncture and serum was prepared using standard techniques. Total anti-HAV antibody was detected using a competitive enzyme immunoassay (ELISA) using commercially available kits (DiaPro Diagnostic Bioprobes Srl., Milan, Italy).

The seroprevalence of hepatitis A antibodies was compared between children with CLD and their matched controls. Also children with CLD were divided according to age into 2 groups, 5+ years and < 5 years, and the seroprevalence of hepatitis A antibodies was compared between the 2 groups.

Liver function tests were done for all patients for total and direct serum bilirubin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase, gamma glutamyl transpeptidase (GGT), serum albumin and prothrombin time and concentration. Results of liver function tests were compared between the group previously exposed to hepatitis A and those negative for anti-HAV antibodies.

The costs of empirical vaccination versus prescreening were calculated according to the local costs in Egypt. The cost of a single test of anti-HAV antibodies is

approximately US$ 7 and the cost of 2 vaccine doses is approximately US$ 35.

Statistical analysis

Statistical analysis was done using the statistical package *SPSS*, version 10. Descriptive statistics were presented as means, standard deviations (SD) and number and percentage (frequency distributions). The chi-squared test was used to assess the association between groups. $P < 0.05$ was considered significant.

Results

The study included 172 children, 100 males (58.1%) and 72 females (41.9%). Their ages ranged from 2 to 18 years, with a mean of 7.8 (SD 4.0) years.

The etiological diagnoses of the 101 patients with CLD included autoimmune hepatitis (14 patients, 13.9%), cholestatic diseases of infancy (16 patients, 15.8%), viral hepatitis, 4 HBV infection and 9 HCV infection (12.9%). The remaining 58 patients (57.4%) had miscellaneous causes for their CLD.

Of the 101 patients, 86 (85.1%) with CLD were positive for anti-HAV antibodies, compared with 55 (77.5%) controls, but the difference was not statistically significant ($P = 0.197$) (Table 1). Among the anti-HAV positive group 58.2% were males compared with 41.8% females but the difference was also not statistically significant ($P = 0.993$).

The mean age of patients with CLD at the time of screening for hepatitis A was 8.6 (SD 4.4) years and the male:female ratio was 1.7:1. Comparison of the mean age at screening for hepatitis A of both seropositive and seronegative cases revealed a statistically significant difference: 9.2 (SD 4.0) years versus 5.4 (SD 4.9) years respectively ($P < 0.001$).

Among the 86 children with CLD who were positive for anti-HAV antibodies, 68 (79.1%) were 5+ years old and 18 (20.9%) were < 5 years old.

No statistically significant difference was found between CLD patients with positive or negative HAV antibodies when the results of all liver tests were compared (total and direct serum bilirubin, AST, ALT, alkaline phosphatase, GGT, serum albumin and prothrombin time and concentration).

According to age, among the 101 children with CLD, 29 were < 5 years of age: 18 were anti-HAV positive (62.1%) and 11 (37.9%) were negative. In the 72 patients who were 5+ years, 68 (94.4%) were anti-HAV positive and 4 (5.6%) were negative. This difference was statistically significant ($P < 0.01$) (Table 2).

Table 1 **Seroprevalence of anti-hepatitis A virus (anti-HAV) antibodies among patients with chronic liver disease (CLD) and controls**

Variable	Patients with CLD (*n* = 101)		Controls (*n* = 71)		Total (*n* = 172)		*P*-value
	No.	%	No.	%	No.	%	
Anti-HAV negative (*n* = 31)	15	14.9	16	22.5	31	18.0	0.197
Anti-HAV positive (*n* = 141)	86	85.1	55	77.5	141	82.0	
Total (*n* = 172)	101	100.0	71	100.0	172	100.0	

Table 2 **Seroprevalence of anti-hepatitis A virus (anti-HAV) antibodies in patients with chronic liver disease below and above 5 years of age**

Age (years)	Anti-HAV negative (*n* = 15)		Anti-HAV positive (*n* = 86)		Total (*n* = 101)		*P*-value
	No.	%	No.	%	No.	%	
< 5 (*n* = 29)	11	37.9	18	62.1	29	100.0	< 0.01
5+ (*n* = 72)	4	5.6	68	94.4	72	100.0	

Discussion

Fulminant infection may develop in patients with CLD if they are exposed to HAV [*10*]. There has been some debate about the cost–effectiveness of hepatitis A vaccination in this population [*8,17–19*]. Hepatitis A should be given to persons who have evidence of chronic liver disease and those who are awaiting or have received a liver transplant; these groups are at high risk for complications from superimposed insult to the liver [*10*]. We carried out the present study to determine the susceptibility of children with CLD to HAV infection, and evaluate the cost–effectiveness of prescreening for HAV antibodies prior to vaccination versus empirical vaccination.

Different anti-HAV antibody prevalence patterns have been described that match variations in economic development, levels of sanitation and awareness that affect food-borne infections. In areas with high endemicity, 90% of children are infected by around 10 years of age. The infections are asymptomatic, and viral hepatitis A is not a clinical problem. In areas of medium endemicity, the 90% seroprevalence level is not reached before early adulthood [*20*].

The highest seroprevalence of HAV is observed in adults in urban Africa, Asia and South America, where evidence of past infection is nearly universal [*21*]. In Egypt, a seroprevalence of HAV IgG in residents of the Nile delta of > 95% in children aged 1–3 years was reported [*22*].

In the present study the seroprevalence of anti-HAV antibodies was comparable among patients with liver disease and their contacts (85.1% versus 77.5%). The high prevalence of HAV antibodies among our patients and controls highlights the role children play in Egypt as reservoirs of infection. The virus spreads easily from asymptomatic young children to other young children and adult contacts [*10*].

Ferreira et al. in Brazil reported a 24% prevalence of anti-HAV among patients with liver disease up to 16 years of age; this difference could be attributed to the differences in socioeconomic background [*20*].

The age-stratified frequency of anti-HAV antibodies showed that the prevalence of protective antibodies increased with increasing age. This was in accordance with Acharya et al. who showed that the prevalence of anti-HAV antibodies among Indian children was 80% by 5 years of age but was 100% by the age of 16 years [*23*]. Kocak et al. from Turkey reported a seropositive rate of anti-HAV of 44% among people with liver disease between 1.5 and 20 years old, and the prevalence of antibodies increased with age [*24*].

Prescreening versus empirical immunization for hepatitis A in patients with CLD remains a controversial issue and little comparative data are available on prescreening cost–effectiveness strategy [*14*]. Serological testing for hepatitis A

before vaccination is likely to be cost-effective only among persons who have a high likelihood of previous infection.

In Egypt, the cost of testing for anti-HAV is around US$ 7 per test, and the cost of the 2 doses of hepatitis A vaccine is around US$ 35. Based on our results, in the group of children with CLD 5+ years of age, the total cost of prescreening 100 children and vaccinating 5% is approximately US$ 900, while empirical vaccination will cost US$ 3500. Expenses are reduced to 25% if prescreening is carried out in this age group. However, in children < 5 years of age, the total cost of prescreening 100 children and vaccinating 40% is approximately US$ 2100 versus US$ 3500 for empirical vaccination. Taking account also of the costs of the increased number of visits for prescreening, the possibility of drop-outs after blood testing in a group with higher susceptibility to hepatitis A and the increased number of needle-pricks per child, we can conclude that the reduction in expenses in the age group < 5 years is small compared with the age group 5+ years.

In conclusion, we recommend that all children with CLD > 2 years old be given the hepatitis A vaccine to prevent serious complications from superimposed liver insult on their diseased livers. Prescreening is cost-effective in children 5+ years of age while prescreening in children < 5 years of age may not be cost-effective.

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Evaluation of the measles–rubella mass vaccination campaign in the population covered by Tehran University of Medical Sciences

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تقييم حملة للتلقيح الجموعي ضد الحصبة والحصبة الألمانية بين السكان في دائرة خدمات جامعة طهران للعلوم الطبية

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الخلاصة: يقيِّم الباحثون في هذه الدراسة حملة للتلقيح الجموعي ضد الحصبة والحصبة الألمانية أجريت في جمهورية إيران الإسلامية في كانون الأول/ديسمبر 2003. وتناول التقييم مدى التغطية بالتلقيح والوعي المجتمعي حول الحملة وجودة خدمات التلقيح المقدمة للسكان في دائرة الخدمات التي تقدمها جامعة طهران للعلوم الطبية. وقد انتهت الحملة بتلقيح 96.4% من العينة السكانية التي يبلغ تعدادها 390 (بفاصلة ثقة 95% تتراوح بين 94.6% و98.2%). وقد ارتفع عدد من هو على علم بالحملة من 80.59% من مجمل العينة (وعددهم 190) في البدء، إلى 96.8% أثناءها، حتى وصل إلى 100% في نهايتها. ولم يتجاوز أي فريق من فرق التلقيح التي بلغ عددها 24 فريقاً عتبة الأداء غير المقبول. هذا وقد أدى الإعلام وفرق التلقيح عملاً جيداً وحققوا ما هدفوا إليه.

ABSTRACT We evaluated the measles–rubella mass vaccination campaign in the Islamic Republic of Iran in December 2003. Vaccination coverage, community awareness of the campaign and the quality of vaccination services were assessed in the population covered by Tehran University of Medical Sciences. At the end of the campaign 96.4% (95% CI: 94.6%–98.2%) of the population sample (*n* = 390) had been vaccinated. Awareness of the campaign was 80.59% of the sample (*n* = 190) at the start, rising to 96.8% during and 100.0% at the end of the campaign. None of the 24 vaccination teams sampled were over the threshold for unacceptable performance. The mass media and vaccination teams demonstrated good performance and have achieved their goals.

Évaluation de la campagne de vaccination de masse contre la rougeole et la rubéole dans la population desservie par l'Université des Sciences médicales de Téhéran

RÉSUMÉ Nous avons évalué la campagne de vaccination de masse contre la rougeole et la rubéole menée en République islamique d'Iran en décembre 2003. La couverture vaccinale, la sensibilisation du public à cette campagne et la qualité des services de vaccination ont été évaluées dans la population desservie par l'Université des Sciences médicales de Téhéran. À la fin de la campagne, 96,4 % (IC 95 % : 94,6 % - 98,2 %) de l'échantillon de la population concernée (n = 390) avaient été vaccinés. Au début de la campagne, 80,59 % de l'échantillon (n = 190) étaient sensibilisés à cette campagne, puis 96,8 % pendant, et 100 % à la fin. Les 24 équipes de vaccination échantillonnées dépassaient toutes le seuil de performance acceptable. Les médias et les équipes de vaccination ont accompli un travail de qualité et ont atteint leurs objectifs.

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Introduction

The global goals set by the World Health Assembly in 1989 [*1*] and by the World Summit for Children in 1990 [*2*] to reduce measles morbidity by 90% and measles mortality by 95% remain unachieved. In 2001, the World Health Organization (WHO) and United Nation's Children's Fund (UNICEF) presented a 5-year global strategic plan to re-energize global efforts for measles morbidity and mortality reduction [*3*]. However, for interruption of virus transmission in the community more than 95% of the population must be protected, and it is difficult to reach this level of protection by routine vaccination [*4*].

The mass campaign for rubella vaccination makes congenital rubella syndrome (CRS) a preventable disease. Live attenuated rubella vaccine is now used in most of the world. Unfortunately, in many developing countries, rubella vaccination is not part of the national vaccination programme [*5,6*], despite warnings from WHO that low levels of rubella vaccination coverage may lead to increases in maternal infection and the burden of CRS [*7*]. In January 2000, WHO held a meeting in Geneva directed at prevention of CRS, particularly in developing countries [*7*]. The recommended strategies included piggybacking rubella with measles vaccine (MR) or with measles and mumps vaccine (MMR), ensuring that the vaccination programme covered children of both sexes and adult women.

The Ministry of Health and Medical Education of the Islamic Republic of Iran launched a mass MR vaccination campaign throughout the country from 5 to 31 December 2003. More than 32 million inhabitants between 5 and 25 years old received the MR vaccine. The aim of this programme was to eliminate measles and to control CRS. The mass campaign was performed by active and passive vaccination teams. Passive teams were established in service delivery points, while active teams covered crowded places of urban areas such as schools, military garrisons, jails and dormitories as well as rural areas.

A specific characteristic of the health infrastructure in the Islamic Republic of Iran is the integration of medical universities into the administrative bodies of the government health system [*8*]. Thus each medical university in the Islamic Republic of Iran is responsible not only for research and education but also providing health services for the people of a specified region. Tehran University of Medical Sciences (TUMS) covers the southern part of the city of Tehran, plus the districts of Islam Shahr, Shahr Ray and their nearby villages. While the target population for MR vaccination was estimated as 1 245 000 people, based on data obtained from the executive teams, 1 322 489 people were reported to be vaccinated during the campaign, giving a vaccination coverage of 106.2%. This discrepancy necessitated a survey-based evaluation of vaccination coverage to investigate the validity of the executive team's data.

In this study, an external team made an assessment of the MR mass campaign within the population covered by TUMS by means of a household survey of vaccination coverage and community awareness coverage and a survey of the quality of vaccination services.

Methods

Sample

The required sample size to estimate the vaccination coverage was 390 people between 5 and 25 years old. This sample size was calculated based on possible 90% vaccination coverage, with 95% confidence

interval, 5% precision and 2.25 design effect. For the evaluation of community awareness coverage in each stage of the campaign separately, the required sample size was 190 independent members of the target population between 12 and 25 years old and/or parents (or guardians) of children between 5 and 11 years. This sample size estimate was based on a 93% awareness of the campaign, which was expected to be slightly more than the vaccination coverage, with 6% precision and similar confidence interval and design effect as for the vaccination coverage estimate.

Study participants were selected by cluster sampling for these 2 objectives. Each cluster was the set of 10 households that included at least 1 person in the target group of the campaign. Then, if there was more than 1 eligible study participant in each selected household, 1 of the intended subjects was selected by random sampling.

Lot quality assurance sampling (LQAS) was used for assessment of the quality of vaccination services. By this method, it was possible to judge the status of the sampling units (lots) regarding their expected level of performance. The number of samples was defined according to WHO guidelines for the LQAS method [*9–12*]. A total of 24 executive teams were evaluated (8 teams in each district, which comprised 3 lots for the whole of TUMS). The choice of this sample size for LQAS was based on the upper and lower thresholds of 80% and 30%. Any lot with more than 2 unqualified executive teams was considered "unacceptable".

Data collection

Figure 1 illustrates the different time periods for data collection during the evaluation of the mass campaign.

The data relating to vaccination status (the proportion of the population vaccinated) and community awareness (the proportion of the population who were aware of the mass campaign before, during and at the end of the campaign) were gathered through questionnaires in face-to-face interviews.

The quality of MR vaccination in each vaccination team was judged based on direct observation and interview with the director

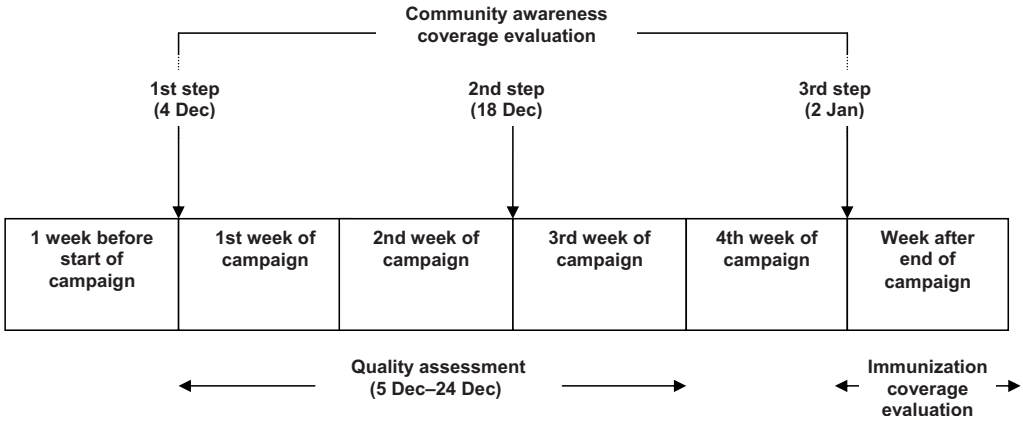

Figure 1 **Data collection phases in the evaluation of the mass measles–rubella vaccination campaign by Tehran University of Medical Sciences in 2003**

of the vaccination team. During observation 3 criteria were followed: (1) vaccination technique competence of providers; (2) information given to individuals who received the vaccination; (3) documentation of vaccination records. Data which had been gathered by interview were: (1) following correctly cold-chain supply instructions; and (2) adequacy of necessary equipment.

Analysis

Chi-squared and Fisher exact tests were used for determining the effect of independent variables on vaccination coverage and community awareness coverage. All analyses were done using STATA statistical software, version 8.0.

The protocol of this study was approved by the institutional ethics review board of TUMS.

Results

The findings of the study are presented in 3 parts: vaccination coverage, community awareness coverage and the quality of vaccination services.

Vaccination coverage

Of the total of 390 people interviewed, 376 [96.4% (95% CI: 94.6%–98.2%)] had received the MR vaccine. The reasons given for not being vaccinated were: pregnancy (4 people), fear of the side-effects of the vaccine (4), illness (3), and not having enough time (3). Exclusion of the 4 pregnant women from the denominator increased the coverage to 97.4%. Table 1 shows the vaccination coverage data according to the characteristics of the participants. The vaccination coverage in most subcategories of Table 1 was more than 95%, which was the predefined objective of the campaign. This proportion did not vary significantly according to the categories, except for family size, where coverage was significantly higher in larger families (98.4% for ≥5 members) than smaller ones (94.6% for < 5 members). Although the difference was not statistically significant (P = 0.09), the lowest vaccination coverage (92.5%) was in families where the head of household had university level of education.

Table 1 **Coverage of measles–rubella vaccination in the sample of the population covered by Tehran University of Medical Sciences according to the background characteristics of study participants**

Variable	Total no.	Vaccination coverage %	Significance
District health centre			$P = 0.05$[a]
Shouth	190	95.8	
Islam Shahr	80	96.3	
Shahr Ray	120	97.5	
Sex			$\chi^2 = 0.21$;
Male	199	96.0	$P = 0.62$
Female	191	96.8	
Age (years)			$\chi^2 = 5.3$;
5–10	55	98.2	$P = 0.37$
11–15	73	98.6	
16–20	130	98.5	
21–25	125	92.8	
≥26[b]	7	–	
Family size			$P = 0.05$[a]
< 5	202	94.6	
≥5	188	98.4	
Education of head of household			$\chi^2 = 7.94$;
Illiterate	30	96.7	$P = 0.09$
Primary	101	98.0	
Secondary	97	98.0	
High school	120	95.0	
University	40	92.5	
Unclear response	2	–	
Total	390	96.4	

[a] *Fisher exact test.*
[b] *This age group was not a target of the mass campaign.*

Of those who were vaccinated, 373 people (99.2%) had received the MR vaccination card. Just over half the sample (204) was vaccinated by passive teams in regular

Table 2 **Proportion of people surveyed in the area covered by Tehran University of Medical Sciences who were aware of the measles–rubella mass campaign, according to their background variables before, during and after the campaign in 2003**

Variable	Before (4 Dec)			During (18 Dec)			After (2 Jan)	
	Total no.	% aware	Significance	Total no.	% aware	Significance	Total no.	% aware
District health centre			$\chi^2 = 0.71$;			$\chi^2 = 0.07$;		
Shouth	90	78.9	$P = 0.31$	90	96.7	$P = 0.94$	90	100.0
Islam Shahr	40	77.5		40	97.5		40	100.0
Shahr Ray	60	85.0		60	96.7		60	100.0
Sex			$\chi^2 = 0.37$;			$P = 0.39$[a]		
Male	78	78.2	$P = 0.78$	80	97.5		77	100.0
Female	112	82.1		110	96.4		113	100.0
Age of person interviewed (years)			$\chi^2 = 16.13$;			$\chi^2 = 8.25$;		
< 25	60	81.7	$P < 0.0001$	60	98.3	$P = 0.01$	61	100.0
26–50	81	93.8		92	98.9		77	100.0
> 50	48	58.3		38	89.5		52	100.0
Family size			$\chi^2 = 8.44$;			$P = 0.49$[a]		
< 5	105	73.3	$P = 0.003$	105	96.2		103	100.0
≥5	85	89.4		83	97.6		87	100.0
Education of person interviewed			$P = 0.49$[a]			$\chi^2 = 5.73$;		
Illiterate	28	53.6		33	90.9	$P = 0.22$	30	100.0
Primary	49	67.3		32	96.9		46	100.0
Secondary	30	90.0		37	100.0		31	100.0
High school	65	93.8		66	98.5		64	100.0
University	18	94.4		22	95.5		19	100.0
Total	190	80.5		190	96.8		190	100.0

[a] *Fisher exact test.*

service delivery points and 172 by active ones, which were provided exclusively for the purpose of the campaign in crowded areas.

Community awareness coverage

At the beginning of the campaign, 80.5% (95% CI: 75.4%–86.4%) of 190 people interviewed were aware of the mass campaign; this rose to 96.8% (95% CI: 94.4%–99.3%) during the campaign and 100% at the end of the campaign. Table 2 summarizes the community awareness coverage according to the characteristics of the participants from the 1st to the 3rd steps of the study. The table shows that marketing during the campaign was successful as community awareness increased from 80.5% before the campaign to 100% at the end of the campaign in all subcategories. The difference in community awareness before the campaign was significant according to the age of the respondent ($P < 0.0001$) and family size ($P = 0.003$). The age of respondents was also significant ($P = 0.01$) in the survey in the middle of the campaign. In both surveys, i.e. before the campaign and in the middle of the campaign, older people (> 50 years old) were less aware of the mass campaign. Although educational level did not show a significant relationship with awareness of the campaign in all 3

surveys, the difference in percentage awareness before the campaign between the 2 extremes of illiterates and university educated people was notable (53.6% and 94.4% respectively).

Television was reported to be the main source of information about the mass campaign for 80% of participants (Figure 2).

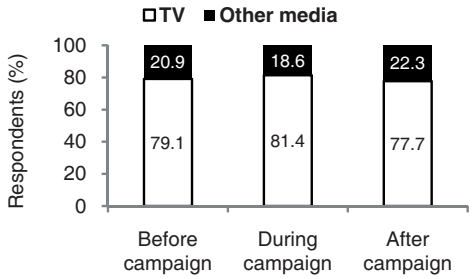

Figure 2 **Reported frequency of television and other media as the main source of information about the mass vaccination campaign in the sample (*n* = 190) covered by Tehran University of Medical Sciences**

Quality of vaccination services

Using the 30% threshold of quality, the overall quality of the vaccination services was judged to be acceptable in 19 executive teams (79.1%; 95% CI: 62.8%–95.3%). Therefore, the quality of MR vaccination was considered to be acceptable in all the district health centres covered by TUMS. Table 3 shows the quality of MR vaccination according to the district health centres.

The overall quality of the cold-chain supplies was acceptable in 23 executive teams out of 24 (95.8%). The competence of the human resources and available equipment for MR vaccination were judged to be acceptable in all the health centres studied.

Discussion

The results of this study show that the coverage of the mass campaign for MR vaccination in the target population was 96.4%. Considering the high density of the population in the region covered by TUMS and the high population mobility in the capital city of Tehran, we can say that the health system achieved the target coverage defined at 95%.

According to the reports of the Health Deputy of TUMS on the regions covered by this university, almost 1 322 489 people were vaccinated during the mass campaign. The target population covered by this university amounted to 1 245 000 people; therefore around 77 500 people were not from the target population. There may be several reasons for this overestimation. Due to the possible imprecision in data gathering and recording of the age of the vaccinated group some people may have been vaccinated who were initially not included in the age range of the target population. Also, some people from outside the region covered by TUMS might have been vaccinated, including travellers, workers, tourists, etc. who were not originally counted in the target population. These factors caused the vaccination coverage in the reports of the Deputy of Health in TUMS to go beyond 100%.

The vaccination coverage did not vary significantly according to the background variables of the population under study except for family size, where coverage was significantly higher in larger families (98.4% for ≥ 5 members) than smaller ones (94.6% for < 5 members). Family size usually has a negative correlation with socioeconomic status and hence a negative correlation with utilization of health services in different settings. However, in a vaccination campaign the effect of socioeconomic status could be different. The lowest vaccination coverage (92.5%) was in families where the

Table 3 **Quality of the measles–rubella vaccination services during the mass campaign according to the district health centre in the sample of executive teams in the area covered by Tehran University of Medical Sciences**

District health centre	Total[a]	Threshold[b]	Unacceptable lots	
			No.	%
South	8	3	2	25.0
Islam Shahr	8	3	2	25.0
Shahr Ray	8	3	1	12.5
Total	24	3	5	20.9

[a] *Total no. of sampled lots.*
[b] *Threshold no. for unacceptability.*

head of household had a university level of education. Although the difference was not statistically significant, it is noteworthy (P = 0.09). People with a higher level of education may not accept the overall benefits of free vaccination by a mass campaign in comparison to the personal risks.

The trend of community awareness coverage was favourable during the execution of the programme. According to the findings, 1 day before the beginning of the campaign, over 80% of the people under study were aware of it. This increased and at the end of the 2nd week the coverage reached more than 96%. By the end of the programme, all of the people sampled were aware of it. The difference in the awareness of people before the campaign was remarkable between the 2 extremes of educational level with 53.6% of illiterate and 94.4% of university educated people aware of the campaign. Awareness was also significantly different regarding family size and age group before the campaign, and for age during the campaign. The findings demonstrate the important influence of television programmes in the awareness of the people about health programmes and issues. Therefore, it is appropriate to give more attention to this medium in developing health programmes, especially in health education.

The quality of the performance of the health centres covered by TUMS was acceptable. The daily vaccination records and the issuance of the vaccination card were acceptable in the overall performance of the executive teams under study. On the whole, the performance of the executive teams regarding the cold-chain supplies was acceptable and all of the health centres functioned correctly in this regard. The results also show that although the human resources for the executive teams had a heavy workload during the mass campaign, none of the study teams had any difficulty in accessing the equipment and the necessary resources for MR vaccination.

We conclude that, overall, the MR mass vaccination campaign in the area covered by TUMS can be judged to be satisfactory. It is still early to estimate the overall impact of the mass campaign on the incidence of measles [*13–15*], but evaluation of the campaign by means of antibody response has been carried out nationwide.

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Prevalence and predictors of non-fatal myocardial infarction in Jordan

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معدل انتشار احتشاء عضل القلب غير المميت ونُذُر وقوعه في الأردن

مهند النسور، زياد محفوظ، منى كنعان، عادل البلبيسي

الخلاصة: أجريت هذه الدراسة في أيار/مايو 2002 كجزء من المسح المستعرض المتعدد المراحل الذي قامت به الإدارة الأردنية للإحصاء حول البطالة والعمل؛ وذلك لقياس معدل انتشار الإبلاغ الذاتي عن احتشاء عضل القلب وترافقه بعوامل اختطار يمكن تصحيحها لدى الأردنيين ممن بلغوا سن الأربعين فأكثر. وقد شملت الدراسة 3083 مشتركاً، أُخبرَ 183 (5.9٪) منهم من قِبَل طبيب ما أنه مصاب باحتشاء عضل القلب. وقد اختلف معدل الانتشار باختلاف الجنس والعمر، فقد كان 128 من المصابين (69.9٪) من الرجال. وفي كل من الرجال والنساء كان الإبلاغ الذاتي عن ارتفاع ضغط الدم وفرط كوليستيرول الدم مترابطاً بشكل يُعتَدُّ به إحصائياً مع احتشاء عضل القلب، كما كان السكري من عوامل الاختطار التي يُعْتَدُّ بها إحصائياً لإصابة النساء باحتشاء عضل القلب. وكان هناك ترابط يُعْتَدُّ به إحصائياً بين التدخين الحالي وبين الإصابة باحتشاء عضل القلب، ولكن ليس للتدخين قبل الإصابة. ولم تكن التمارين الرياضية ولا منسب كتلة الجسم MI من النذر التي يُعْتَدُّ بها إحصائياً بوقوع احتشاء عضل القلب لدى أي من الذكور أو الإناث.

ABSTRACT This study in May 2002, part of the Jordan Department of Statistics national cross-sectional, multistage employment and unemployment survey, measured the prevalence of self-reported myocardial infarction (MI) and the association with modifiable risk factors among Jordanians aged 40+ years. Of 3083 participants, 183 (5.9%) had ever been told by a doctor that they had had a MI. The prevalence varied by age and sex; 128 (69.9%) of the cases were in men. Among males and females, self-reported hypertension and hypercholesterolaemia were significantly associated with MI and diabetes was a significant risk factor for women. There was a significant relationship between current smoking and MI but not with previous smoking. Exercise and body mass index were not statistically significant predictors of MI in both males and females.

Prévalence et facteurs prédictifs de l'infarctus du myocarde non mortel en Jordanie
RÉSUMÉ Cette étude, réalisée en mai 2002 dans le cadre de l'enquête nationale transversale à plusieurs degrés sur l'emploi et le chômage menée par le Département des Statistiques jordanien, a mesuré la prévalence de l'infarctus du myocarde (IDM) autodéclaré et son association à des facteurs de risque modifiables chez des sujets jordaniens âgés de 40 ans et plus. Sur 3083 participants, 183 (5,9 %) savaient, l'ayant appris d'un médecin, qu'ils avaient eu un IDM. La prévalence variait en fonction de l'âge et du sexe ; 128 (69,9 %) de ces cas étaient des hommes. Parmi les hommes et les femmes, l'hypertension et l'hypercholestérolémie autodéclarées étaient significativement associées à l'IDM et le diabète était un facteur de risque significatif chez les femmes. Il existait une relation significative entre le tabagisme au moment de l'étude et l'IDM, mais pas avec un tabagisme antérieur. L'exercice physique et l'indice de masse corporelle n'étaient pas des facteurs prédictifs d'IDM statistiquement significatifs chez les hommes et chez les femmes.

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Introduction

Cardiovascular disease (CVD) is considered the most common cause of death for both males and females worldwide [*1,2*]. Coronary artery disease (CAD) and stroke are the major contributors [*3*]. Myocardial infarction (MI) is the most common lethal manifestation of CAD [*4*].

Jordan, a middle-income country with an estimated population of 5 million [*5*], is experiencing an epidemiological transition where infectious diseases are declining and chronic diseases are becoming more predominant. At the same time, life expectancy continues to increase, reaching 71 years for females and 69 for males according to the latest estimates [*5*]. A sedentary lifestyle, high-fat diet and smoking are becoming more common.

As in other developing countries in the Eastern Mediterranean Region (EMR) and elsewhere, [*1–3*], CVD is a major cause of death in Jordan, responsible for 35% of deaths [*6*]. Due to the tremendous impact of CVD on public health and the escalating cost of health care, strategies for prevention are becoming increasingly important and there is an urgent need to understand which risk factors to target in health prevention campaigns for MI.

In Jordan to our knowledge there have been a number of studies detailing the prevalence of risk factors for CVD but no studies looking at the importance of the association between each risk factor and nonfatal MI. Like other countries in the EMR, limited disease registries and low quality of records affect the availability of morbidity statistics in Jordan. Analysis of the data set we used for this study has shown the prevalence of different risk factors for noncommunicable diseases in Jordan and has already been published [*7*].

The aims of the present study were to examine the prevalence of self-reported nonfatal MI in Jordanian people aged 40 years and over; to determine the association between MI and various modifiable risk factors; and to determine if this association varies by sex.

Methods

Sample

The study was a cross-sectional survey of the Jordanian population at the national level. During the month of May 2002 the Ministry of Health, in cooperation with the Jordan Department of Statistics (the organization responsible of carrying out national surveys in Jordan), added 28 questions about behavioural risk factors of noncommunicable diseases to the Jordan Department of Statistics multistage employment and unemployment survey. This survey takes place quarterly and provides a comprehensive database on employment and unemployment in Jordan that serves researchers and policy-makers.

The sampling frame was representative nationally and stratified by region, governorate, major city, urban (localities with a population of 5000 or more) and rural areas. Within each stratum, sample blocks (a group of buildings that form a locality or part of it, with clear natural or man-made boundaries) were selected systematically with probability proportional to size. The sample households were selected using a systematic random procedure. The frame excluded persons living in remote areas, the majority of whom are nomads, and those living in collective dwellings (e.g. hotels, hospitals, work camps and prisons). In addition, the survey excluded the non-Jordanian population, because many non-

Jordanian workers live in small clusters and spend most of their time in work places; hence it is difficult to locate them during the daytime. From each sampled household, 1 respondent aged 18+ years was selected and interviewed directly. All reported estimates were weighted to account for the sample design and were further adjusted for the interview response rate.

The population localities in each of the 12 governorates were divided into urban and rural (except the 5 major cities, each of which formed an independent stratum), en-ding up with 29 strata. The sample size for the present survey consisted of 664 blocks, from each of which 15 households were selected using a systematic random procedure.

The results of the main fieldwork indicated that all of the 9960 sampled households were visited and 9541 interviews were successfully completed, i.e. 95.8% of the total sampled households. The main reasons for failure to complete the interview were: closed dwellings at the time of the visit (2.7%), and unavailability of an eligible respondent or refusal of the household to respond (0.6%). The response rate, based on dividing the number of completed interviews (i.e. excluding both the closed and vacant dwellings) by the number of expected completed interviews, was 99.0% and when excluding the vacant dwellings only, the response rate dropped to 96.3%.

Questionnaire

The questionnaire was designed and revised by technical staff. It was finalized on completion of the training programme. Before being fielded, the questionnaires were serially numbered at the national level. The questionnaire was divided into main topics, each containing a clear and consistent group of questions, and designed in a way that facilitated data entry and verification. Health-related questions focused on medical conditions: MI, bronchial asthma, diabetes, hypertension, hypercholesterolaemia and behaviours that related to noncommunicable diseases, e.g. obesity, smoking and physical inactivity.

Study variables

The data that were analysed for this project were from respondents aged 40+ years. Respondents were asked whether they were ever told by a health professional that they had had a MI, the main variable of interest.

The main predictors explored for MI were sociodemographic, health-related and behavioural risk factors. The sociodemographic variables were age, sex, region, urban/rural, educational level and marital status. Age and educational level (years of education) were continuous variables. The health-related variables, in addition to a subjective health evaluation, were self-reported hypertension, hypercholesterolaemia and diabetes mellitus. These 3 variables were based on whether or not the subject was told by a health professional about the presence of any of these risk factors. Gestational diabetes was excluded from the analysis. The behavioural risk factors were smoking, obesity and physical activity. Smokers were asked whether they smoked every day, some days, or not all. Those who smoked every day were asked "on average when you were smoking in the last 30 days, how many cigarettes did you smoke every day?" Smokers were classified as ever smokers (i.e. ever smoked $\geq$ 100 cigarettes during their life time) or nonsmokers (i.e. never smoked 100 cigarettes during their lifetime). For further analysis, the number of smoked cigarettes per day was transformed into number of packets per day (20 cigarettes per packet). Questions on self-reported height

and weight were included, and body mass index (BMI) (ratio of weight in kilograms to height in metres squared [kg/m^2]) was calculated. Overweight was classified as BMI 25.0–29.9 kg/m^2 and obesity as BMI ≥ 30 kg/m^2 [*7*]. Interviewees were asked whether they engaged in weekly moderate physical activity. Moderate activity was defined as any activity that caused light sweating and small increases in heart rate or breathing for 30 minutes [*7*].

Statistical analysis

All analyses were performed using *STATA-7* software. Unadjusted and adjusted odds ratios (OR) were calculated, with 95% confidence intervals for the adjusted OR (95% CI), to assess the likelihood of MI across variables related to sociodemographic, health and behavioural risk factors. Adjusted ORs were calculated using logistic regression analysis to determine the net effect of each of the different variables on the outcome variable (MI). Logistic regression analyses were also done for both males and females.

Ethical issues

The data are being used with the consent of the Director of the Health Disease Control and Prevention Unit at the Jordanian Ministry of Health.

Results

The study included 3083 participants aged 40+ years, of whom 183 (5.9%) had been ever told by a doctor that they had a MI. This paper investigates the prevalence of MI among respondents and studies its relationship with sociodemographic, behavioural and health-related characteristics both at the bivariate and multivariate levels.

Bivariate results

Sociodemographic associations

Table 1 shows the different sociodemographic, behavioural and health-related variables according to MI status. The prevalence of MI was markedly different by sex; 128 (69.9%) cases were in men compared with 55 (30.1%) in women (OR = 2.30, 95% CI: 1.65–3.15; $P < 0.0001$).

The mean age of the participants without MI was 53.3 [standard deviation (SD) 11.3] years, while for MI cases the mean was 60.3 (SD 11.0) years. However, the mean age of male cases was 59.0 (SD 11.4) years and that of female cases was 63.3 (SD 9.4) years. Without stratifying by sex, age increased the risk of having a MI; with each increase of 10 years in age, the odds of having MI among cases ratio becomes 1.63.

The distribution of MI cases across marital status showed that 86.9% of the cases were married compared with 85.1% of the non-cases. Marital status was not significantly associated with MI.

The geographical distribution of the cases showed that just over half the cases lived in the middle region of the country compared to approximately 48% of non-cases. In addition, approximately three-quarters of the cases lived in urban areas, regardless of the region. The region of residence and the rural–urban distribution were not significantly associated with MI.

Only 52 (28.4%) cases out of 183 reported their family level of income. The majority of cases and non-cases (44.0% and 40.5%) had a family income of 100–199 Jordanian dinars (JD) per month. Level of income was not significantly associated with MI.

Years of education was a significant protective predictor of MI (OR = 0.95, 95% CI: 0.91–0.99; $P = 0.037$). As the number of years of education increased, the odds of having MI decreased. With each increase

Table 1 **Sociodemographic, behavioural and health-related factors by self-reported myocardial infarction status**

Variable	Myocardial infarction[a]				OR (95% CI)	*P*-value
	Yes (*n* = 183)		No (*n* = 2900)			
	No.	%[b]	No.	%[b]		
Sex						
Female	55	30.1	1435	49.5	1	
Male	128	69.9	1465	50.5	2.30 (1.65–3.15)	< 0.0001
Mean (SD) age (years)	60.3 (11.0)		53.3 (11.3)		1.05 (1.03–1.06)	< 0.0001
Marital status						
Unmarried	24	13.1	432	14.9	1	
Married	159	86.9	2468	85.1	1.16 (0.75–1.80)	0.511
Region						
North	53	29.0	850	29.3	1	
Middle	92	50.3	1387	47.8	1.06 (0.75–1.51)	0.728
South	38	20.7	663	22.9	0.92 (0.60–1.41)	0.700
Urban–rural						
Rural	44	24.0	804	27.7	1	
Urban	139	76.0	2096	72.3	1.20 (0.86–1.71)	0.280
Mean (SD) length of education (years)	8.82 (4.12)		9.69 (4.34)		0.95 (0.91–0.99)	0.037
Income						
< 100 JD	7	13.5	94	9.6	1	
100–199 JD	22	44.0	398	40.5	0.74 (0.31–1.79)	0.507
200–299 JD	12	23.1	290	29.5	0.56 (0.21–1.45)	0.231
≥ 300 JD	11	21.1	200	20.4	0.73 (0.28–1.96)	0.537
Smoking						
No	105	57.4	1565	54.0	1	
Yes	78	42.6	1333	46.0	0.87 (0.64–1.20)	0.375
Exercise						
No	131	71.6	1679	58.2	1	
Yes	52	28.4	1279	41.8	0.55 (0.40–0.77)	< 0.0001
Mean (SD) BMI (kg/m²)	27.10 (4.59)		27.80 (4.81)		1.03 (0.99–1.07)	0.084
Hypertension						
No	43	25.9	1525	66.4	1	
Yes	123	74.1	770	33.6	5.70 (3.96–8.10)	< 0.0001
Diabetes						
No	117	63.9	2501	86.5	1	
Yes	66	36.1	391	13.5	3.60 (2.62–4.96)	< 0.0001
Cholesterol						
No	39	41.9	490	71.2	1	
Yes	54	58.1	198	28.8	3.40 (2.19–5.34)	< 0.0001

[a] *Data missing for some variables.*
[b] *Except where indicated.*
SD = standard deviation; OR = odds ratio; CI = confidence interval; BMI = body mass index.

of 10 years in education the odds ratio of having MI became 0.6.

Behavioural characteristics

After calculating the BMI according to the self-reported weight and height, the proportion of overweight people in the sample was 31%. The mean BMI was 27.3 (SD 4.7) kg/m^2 and 28.4 (SD 5.2) kg/m^2 for males and females respectively. BMI was not statistically significantly correlated with MI (OR = 1.03, 95% CI: 0.99–1.07; $P = 0.084$).

The proportion of MI cases who were smokers (ever smoked < 100 cigarettes versus ≥ 100 cigarettes) was 42.6%. This variable was not significantly associated with MI (OR = 0.87, 95% CI: 0.64–1.20; $P = 0.375$). However, if we considered the current smoking status based on the number of packets smoked, we found that the number of cigarettes smoked daily was significantly related to MI ($P < 0.0001$). With increasing number of packets, the association with MI increased. People who smoked < 1 packet were 1.4 times more likely to be have MI compared with nonsmokers. Those who smoked 1–2 packets were 1.7 times more likely to have MI than nonsmokers. A smoker of > 2 packets was 4.5 times more likely to be associated with MI compared with nonsmokers. It is worth noting that more than three-quarters of those who were current smokers were males.

Out of all the MI cases, 52 (28.4%) did at least 20 minutes of moderate physical activity in any day of the week and 131 (71.6%) did not exercise. Three-quarters of those who exercised were males (39 cases) and one-quarter (13 cases) were females. Physical activity was significantly negatively associated with MI ($P < 0.0001$). Those who did moderate exercise were 45% less likely to be associated with MI compared to those who did not (OR = 0.55, 95% CI: 0.40–0.77) ($P < 0.0001$).

Health-related characteristics

Out of all 183 MI cases, 144 (78.7%) had their blood pressure checked within the previous 6 months, irrespective of whether they were hypertensive or not (data not shown). Out of the 166 MI cases who knew their hypertension status, 123 (74.1%) reported that a health professional had told them that they had high blood pressure, and 108 (65.1%) had been told more than once that they had hypertension. Of the 123 patients who had been told they had hypertension and who reported MI, 108 (87.8%) were taking antihypertensive medication (data not shown). Participants who reported being told that they had hypertension were 5.7 times more likely to have had a MI than those who were not told this (OR = 5.70, 95% CI: 3.96–8.10; $P < 0.0001$). Among MI patients who had high blood pressure, participants who took antihypertensive medication were 71% less likely (OR = 0.29, 95% CI: 0.13–0.53; $P < 0.0001$) to have MI compared to those who were not taking medication (data not shown).

A total of 66 MI cases reported they had diabetes, defined as ever having been told by a health professional or a laboratory technician that they had high blood glucose. Self-reported diabetes was significantly associated with having had a MI, with a 3.6-fold increased risk (OR = 3.60, 95% CI: 2.62–4.96; $P < 0.0001$). Of the diabetes cases, 60 people (91.9%) had checked their glucose level. Out of all MI cases, 117 (63.9%) had never been told by a health professional that they had diabetes, of which 85 (72.6%) were males (data not shown). Among MI patients, female diabetics were 3.4 times more likely to have MI compared

with diabetic males (OR = 3.4, 95% CI: 2.58–4.83; $P < 0.0001$).

There were 54 MI cases who reported they had high cholesterol, defined as ever having been told by a health professional or a laboratory technician that they had high blood cholesterol. Self-reported hypercholesterolaemia was significantly associated with MI, with a 3.4-fold increased risk (OR = 3.40, 95% CI: 2.19–5.34; $P < 0.0001$). Of the 183 MI cases, 80 (43.7%) had had their blood cholesterol level checked within the previous year, irrespective of whether they had high blood cholesterol. Of the 96 MI cases who had their blood cholesterol checked, 54 (58.1%) had been told they had high cholesterol.

Multivariate results

Table 2 shows the results of logistic regression analysis of the associations between MI and sociodemographic, behavioural and health-related variables for the overall sample. Although BMI and previous history of smoking were not statistically significant predictors of MI, they were included in the multivariate model in order to control for their effects on the other predictors. The logistic regression results showed that years of education, self-reported hypertension diagnosis and self-reported hypercholesterolaemia diagnosis were significantly associated with MI. On the other hand, self-reported diabetes diagnosis, BMI, smoking and physical exercise were not.

The interaction between sex and age was significant ($P = 0.041$) and hence stratification by sex was done for further analysis. For males, the logistic regression results showed that length of education, self-reported hypertension and self-reported hypercholesterolaemia were statistically significant, while age, self-reported diabetes, smoking, BMI and exercise were not (Table 3). However, the results of logistic regression among females showed that age and education and self-reported hypertension, hypercholesterolaemia and diabetes were statistically significant variables (Table 4).

Discriminant analysis for the overall model showed that the sensitivity and specificity were 76.4% and 75.8% respectively, using the cut-off point 0.066. The area under the receiver operating characteristic (ROC) curve of the model

Table 2 **Logistic regression of the associations between self-reported myocardial infarction and sociodemographic, behavioral, and health-related variables**

Variable	Adjusted OR (95%CI)	*P*-value
Sex		
Female	1	
Male	0.002 (0.010–0.128)	0.011
Age	1.02 (0.98–1.06)	0.242
Length of education	0.88 (0.84–0.98)	< 0.0001
Smoking		
No	1	
Yes	0.70 (0.97–1.09)	0.225
Exercise		
No	1	
Yes	0.73 (0.40–0.77)	0.268
BMI	0.98 (0.99–1.07)	0.554
Hypertension		
No	1	
Yes	2.80 (1.86–7.21)	< 0.0001
Diabetes		
No	1	
Yes	2.4 (0.65–1.65)	0.887
Cholesterol		
No	1	
Yes	4.50 (0.28–0.64)	< 0.0001
*Age*Sex*	1.13 (1.06–1.18)	0.041

SD = standard deviation; OR = odds ratio; CI = confidence interval; BMI = body mass index.

was 83.0% (Table 5). For the male model, using the cut-off point 0.076, sensitivity and specificity were 72.1% and 77.8% respectively; the area under the ROC curve was 82.0%. For the female model, sensitivity and specificity were 76.0% and 80.0% respectively using the cut-off point of 0.056 (Table 5).

Discussion

Pooled data from different studies suggest that about 4% of men and 2% of women have had a MI at some time in their lives [*8*]. Age and sex have been demonstrated to be associated with the risk of MI risk factors [*8*] and males are more likely to suffer from MI than females [*9*]. Many hypotheses have been proposed to explain this finding but the underlying reasons are still controversial [*10*]. Biological, social, and behavioural determinants could partially explain this sex difference [*11–13*]. Many studies have shown that MI and its complications occur about 10 years later in females than males [*14,15*].

There is a causal relationship between hypertension and CVD with a relative risk of 3–4 for systolic hypertension [*16*]. The relative risk decreases to 2 with a 20% reduction in blood pressure [*17*]. Prior analysis of our data set showed that the prevalence of hypertension among Jordanians is 22.2% [*7*]. A high proportion

Table 3 **Logistic regression among males for the associations between self-reported myocardial infraction status and sociodemographic, behavioural and health related variables**

Variable	Adjusted OR (95% CI)	*P*-value
Age	1.02 (0.99–1.05)	0.207
Length of education	0.87 (0.81–0.94)	< 0.0001
Smoking		
No	1	
Yes	0.65 (0.34–1.20)	0.185
Exercise		
No	1	
Yes	0.69 (0.38–1.20)	0.216
BMI	1.04 (0.93–1.08)	0.925
Hypertension		
No	1	
Yes	3.30 (1.80–5.90)	< 0.0001
Diabetes		
No	1	
Yes	1.60 (0.47–1.59)	0.639
Cholesterol		
No	1	
Yes	3.90 (2.27–6.71)	< 0.0001

OR = odds ratio; CI = confidence interval; BMI = body mass index.

Table 4 **Logistic regression among females for the associations between self-reported myocardial infarction and sociodemographic, behavioural and health-related variables**

Variable	Adjusted OR (95% CI)	*P*-value
Age	1.15 (1.03–1.28)	0.011
Length of education	0.79 (0.63–0.98)	0.030
Smoking		
No	1	
Yes	6.90 (0.48–97.9)	0.154
Exercise		
No	1	
Yes	0.56 (0.25–9.40)	0.645
BMI	0.82 (0.66–1.13)	0.070
Hypertension		
No	1	
Yes	3.70 (2.13–6.20)	< 0.0001
Diabetes		
No	1	
Yes	5.70 (0.03–0.98)	0.047
Cholesterol		
No	1	
Yes	21.0 (3.6–123.7)	0.010

OR = odds ratio; CI = confidence interval; BMI = body mass index.

Table 5 **Discriminant analysis for the overall, female and male models for self-reported myocardial infarction**

Variable	Overall model		Male model		Female model	
Cut-off point	0.066	0.500	0.076	0.500	0.056	0.500
Sensitivity (%)	76.4	5.2	72.1	4.9	76.0	1.0
Specificity (%)	75.8	99.5	77.8	98.8	80.0	99.0
ROC curve area	83.0		82.0		86.0	

ROC = receiver operating characteristic.

of MI cases in our study (around 79%) had checked their blood pressure within the previous 6 months. In addition, the high percentage (around 88%) of hypertensive patients who were taking medication are less likely to develop complications due to hypertension control. It should be noted that screening for hypertension is obligatory in health facilities in Jordan; each patient who visits a health facility should have his/her blood pressure measured, irrespective of the reason of visit. Moreover, we have to take into consideration the high coverage rate of public health insurance that supplies patients with medication almost free of charge.

Our study showed a significant relation between self-reported diagnosis of high cholesterol and MI. A causal relationship between diet and blood cholesterol level and CVD has been demonstrated. The relative risk of high cholesterol for ischaemic heart disease is 2.5–3.5, satisfying most criteria for causation. A 10% reduction of blood cholesterol produces a 20%–30% decline in CHD deaths. In addition every 1% reduction in mean LDL cholesterol level has a 1%–2% reduction in CHD morbidity and mortality [*18*]. In Jordan the prevalence of hypercholesterolaemia as reported by the prior analysis of the data collected in this survey is 20.9% [*7*].

A self-reported diagnosis of diabetes was not a risk factor for MI in our regression analysis. The prevalence of diabetes is increasing as a result of sedentary lifestyles and increasing prevalence of obesity. Furthermore, this study agrees with numerous studies that have shown that MI is more common among diabetic people than non-diabetics [*19–21*]. A self-reported study among elderly Mexicans has shown that 15.2% of MI cases were diabetic patients [*22*]. Diabetes is a gradual process and patients go through different phases without expressing any symptoms, and cross-sectional studies severely underestimate the number of diabetic patients. Its worth noting that silent (painless) MI is much more prevalent among diabetic patients [*23,24*].

Our study showed a significant relationship between years of education and self-reported MI in the regression analysis. The most common measures that have been used to evaluate socioeconomic status are level of income, occupation and level of education; however, these measures are difficult to standardize in developing countries, particularly for females [*25*]. Education is more strongly associated with CAD than any other indicator of socioeconomic status [*26*]. Although there has been a sharp increase in the level of

education in Jordan in recent decades, education status was relatively low 5 to 6 decades ago. In addition, no information could be derived from the level of income variable since 66.5% (2049 of 3082) of the information was missing. No statistical test is robust enough to compensate for this shortcoming. The reason behind the incompleteness of the data may well be the reluctance of Jordanians to answer a question that relates to dignity and social standing.

Using a classification based on current smoking status, our study found a relationship between current smoking and self-reported MI. Cigarette smoking has been identified as the single most important source of preventable morbidity and premature mortality [*27*]. In Jordan, 29.8% of the population are defined as current smokers, of whom 8.3% are females [*7*]. Results of a large case–control study showed the adjusted odds ratio for MI in smokers in the Middle East region was 2.27 (95% CI 2.11–2.44) [*28*]. Other data have shown, however, that there is no safe limit for smoking, since smoking as few as 5 cigarettes a day increases the likelihood of a MI [*29*]. In contrast, our study did not find a relationship between previous history of smoking and MI. This could be due to people misclassifying themselves because of the specific number of cigarettes (100) in the question asked. Also, recall bias could be a factor. Some differences exist in the patterns of smoking between women and men, for example women tend to smoke fewer cigarettes than males and for a shorter duration [*30*]. Furthermore, the difference could be partially explained by reporting bias, since smoking among females is generally considered socially unacceptable in Jordan.

BMI was not a significant risk factor for MI in our regression analysis. However, our questionnaire asked about height and weight at the present time, and many people lose weight after being diagnosed with a MI. Some studies in industrialized countries have shown differences between measured and self-reported BMI [*31*]. In addition, self-reported height is a controversial measure [*32*]. From the EMR, particularly in Lebanon, a study has shown a bigger difference in self-reported height than studies in the industrialized world [*33*]. Furthermore, many people in Jordan do not have regular medical checkups and there are often no height and weight measures in our health facilities. As a result of rapid modernization and urbanization, a new lifestyle has emerged in Jordan, characterized by physical inactivity. The percentage of those who exercise among MI cases is low (27%) [*7*]. This low prevalence of physical activity is particularly important since it negatively impacts the health status and also increases the economic burden for society [*34*]. It is worth mentioning that the majority of MI patients who exercised (75%) were males. This low prevalence of Jordanian women who exercise is most likely due to cultural norms that restrict women's outdoor physical activities. The lack of facilities where people can exercise should also be taken into consideration.

Strengths and limitations

Although our study is based on self-reported variables, the self-report approach has been demonstrated to provide reasonable information on sociodemographic and health-related problems including MI [*35,36*]. Results from a study of 107 patients aged $\geq$ 65 years showed that agreement between self-reported results compared to medical records for the diagnosis of MI was 94% with a kappa statistic of 0.7 [*35*].

To our knowledge, this is the first study in Jordan that assessed the relationship

between the prevalence of different risk factors and MI morbidity. Our study was population-based which allowed us to represent all localities and subgroups among the Jordanian population. Moreover, the questionnaire had different aspects which permitted us to explore the relationship of demographic, socioeconomic, behavioural and medical aspects. The relatively large sample size of the study provided the high power and precision of estimates. The high response rate (96.3%) is also considered a major strength of our study.

We are also aware of some other limitations. In general, surveys explore prevalence rates of diseases rather than incidence. Such an approach leads to under-reporting of the magnitude of the outcome of the study. In our study, this effect could be explained by 2 factors; first, there may be subclinical cases of MI which were not reported, and secondly, the severe cases of MI may have already led to death. Since our data were collected directly from respondents, without confirmation of any diagnosis from health care providers, misclassification of MI status may have occurred [*37*].

Recommendations

This study was the first step in establishing MI morbidity information in a community-based survey in Jordan. Since this survey will be conducted continuously we recommend monitoring the prevalence of nonfatal MI, the mortality and morbidity trends of MI among the Jordanian population, and the changes in the prevalence of the behavioural risk factors and their effects on the prevalence of MI. Furthermore, like many other countries in the EMR, Jordan suffers from underutilization of data sets. Therefore maximizing the usefulness of the data by secondary analysis is the strategy to follow.

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Hair lead concentration in the Lebanese population: phase 1 results

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تركيز الرصاص في شعر السكان اللبنانيِّين: نتائج المرحلة الأولى

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الخلاصة: هدفت المرحلة الأولى من هذه الدراسة المستعرضة إلى مقارنة تراكيز الرصاص في الشعر ووضع محددات لمستوياته لدى 149 من المتعرضين للرصاص لأسباب مهنية، ومقارنة ذلك مع 177 من الشواهد ممن لم يتعرضوا للرصاص لأسباب مهنية من السكان اللبنانيِّين. وقد استخدم الباحثون استبياناً معيارياً وقاسوا تركيز الرصاص بمقياس الطيف الضوئي، ووجدوا فرقاً يصل إلى 5–6 أضعاف لدى المتعرضين مما هو عليه لدى غير المتعرضين (23.60 مقابل 4.33 جزء بالمليون) وقد أبدى المتعرّضون بسبب المهنة ولاسيما العاملين في تكرير البترول ومحطات الوقود الحد الأقصى من الترابط مع التعرض للرصاص. أما لدى غير المتعرضين فإن الترابط الأعلى كان بين التراكيز المرتفعة من الرصاص وبين الذكورة والجنسية غير اللبنانية والعمل في مواقع حضرية.

ABSTRACT Phase 1 of this cross-sectional study aimed to compare hair lead concentrations and establish the determinants of hair lead levels in 149 occupationally exposed individuals versus 177 non-occupationally exposed controls in the Lebanese population. In addition to a standardized questionnaire, lead concentration was measured by atomic spectrophotometry. A 5–6-fold difference in hair lead concentration was found between occupationally exposed and non-exposed individuals (23.60 ppm versus 4.33 ppm). Professional exposure, particularly working in petrol refining and gasoline stations, had the highest correlation with lead exposure. In non-exposed individuals, male sex, non-Lebanese nationality and urban worksite correlated with higher hair lead concentration.

Contrentration de plomb dans les cheveux : résultats de la première phase d'une étude menée dans la population libasnaise

RÉSUMÉ La première phase de cette étude transversale visait à comparer la concentration de plomb dans les cheveux de 149 sujets exposés sur leur lieu de travail à celle de 177 témoins non exposés sur leur lieu de travail, choisis dans la population libanaise, et à établir les déterminants de ces concentrations. Un questionnaire standard a été utilisé et la concentration en plomb a été mesurée par spectrophotométrie atomique. La concentration de plomb dans les cheveux des sujets exposés sur leur lieu de travail était 5 à 6 fois plus élevée que dans ceux des sujets non exposés (23,60 ppm contre 4,33 ppm). L'exposition professionnelle, notamment dans les raffineries de pétrole et les stations-service, présentait la corrélation la plus élevée avec l'exposition au plomb. Chez les sujets non exposés, le sexe masculin, la nationalité non libanaise et le lieu de travail urbain étaient corrélés avec une concentration de plomb dans les cheveux plus élevée.

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Introduction

Lead poisoning is a global health problem, particularly in developing countries that persist with leaded fuel [*1,2*]. However, even in developed countries with stricter controls, sources of lead are still numerous [*1,2*]. In fact, lead remains an important problem for poor, inner-city, ethnic minority children, with a particular emphasis on lead paint and dust [*3*]. In houses built before 1980, paint crumbles and mixes into house dust and soil, where it may be unwittingly ingested by young children. Airborne lead can also be generated during renovation work, when paint is often sanded or burned into fine inhalable particles [*4*].

Careful longitudinal cohort studies have shown that children with elevated lead exposure are at risk for deficits in IQ, balance, hearing and growth [*5*]. In adults, chronic lead exposure has led to kidney, gastrointestinal, haematological, nervous system and rheumatologic problems. Women have an increased risk of stillbirths, miscarriages and decreased birth weights, and men often develop abnormal sperm counts and morphology leading to sterility [*6,7*]. Occupational lead exposure can also cause a decline in cognitive function over the course of time [*8*].

The Centers for Disease Control and Prevention guidelines define elevated blood lead levels as ≥ 10 µg/dL for children [*9*]. However, evidence is now emerging that even levels < 10 µg/dL can cause neurological damage [*1*]. The effects of lead may thus be more deleterious than currently thought. For occupationally exposed adults, the maximum allowable blood lead that requires medical removal remains the existing Occupational Safety and Health Act standard of 50 µg/dL. Below these levels, however, nervous, gastrointestinal, and musculoskeletal symptoms begin to be increased in individuals with blood leads between 30 and 39 µg/dL and possibly at levels as low as 25–30 µg/dL for nervous system symptoms [*10*].

In Lebanon, close to 90% of vehicles were operating on leaded gasoline until early 2002 when leaded gasoline was banned [*11*]. In addition to ambient air lead and passive and active smoking, the population in Lebanon may be exposed to lead through other sources, such as tap water delivered by lead-soldered pipes, paint and kohl (traditional eyeliner rich in lead) [*12*]. Despite the presence of a national study on all groundwater sources used in Lebanon that reported non-detectable lead content, or lead concentrations that were within international standards [*13*], lead content has not been assessed in households, or within the old water distribution network, which has been maintained or replaced only recently [*12*].

A study has been performed on working men in Lebanon at low occupational hazard for lead toxicity in Beirut [*14*], and another on children aged 1–3 years old [*12*]. However, to our knowledge, no study has been carried out across all Lebanese regions, particularly using hair concentration as an indicator of lead exposure, nor has a study been performed in Lebanon to compare occupational and non-occupational exposures to lead from gasoline and other sources and its determinants. The objective of the first phase of our study, which was carried out before lead was banned from fuel in Lebanon, was to compare hair lead concentrations in occupationally exposed individuals versus non-occupationally exposed controls in the population across Lebanon, and to look at determinants of hair lead levels in both occupationally exposed and non-exposed individuals. With the announcement of the new law, a

second phase was designed to compare its results with those of phase 1, allowing us to confirm whether there had been a decrease in exposure, to find out the new determinants of lead exposure in Lebanon, and to come up with new recommendations for further decreases in lead exposure. Phase 2 of our study is expected to finish by the end of 2008. In this article, the results of phase 1 are presented.

Methods

This was a cross-sectional comparative study that compared hair lead concentration from individuals occupationally exposed to lead versus individuals not occupationally exposed in the Lebanese population.

Sample

The study took place between January and September 2001, before lead was banned from Lebanese gasoline in 2002. Occupationally exposed individuals were selected by convenience non-random quota sampling from individuals working in sectors known to be exposed to lead, with equivalent distribution of residence in all Lebanese regions. The sectors involved were: traffic flow controllers, taxi drivers, gasoline station staff, pipe soldering workers, glass industry workers, battery recycling workers, oil refinery workers and lead-containing pigments industry workers.

Non-exposed individuals were workers who had never worked in these sectors, selected by non-random quota sampling, distributed by sex and region of residence according to the Central Administration of Statistics in Lebanon [*15*]. Furthermore, the numbers were weighted to take account of the distribution of the general Lebanese population by region, sex, nationality and age group [*15*].

Data collection

In every region, people were approached at their worksite. Previously trained, independent interviewers briefly explained that they were carrying out a health study. Individuals gave oral consent to give a hair sample and answer a questionnaire.

Questionnaire

A standardized questionnaire was used, where the dependent variable was hair lead concentration and the independent variables were professional exposure to lead, age, sex, nationality, region of residence, region of work, smoking and frequency of fish consumption. Occupational exposure to lead was determined according to the description of the actual job (for employment of 6 months and over). Regions were determined according to the official distribution of Lebanese governorates, and primary residence was considered as the region of residence. Smoking details included frequency of cigarette smoking during the last 6 months. Fish eating was introduced because of the proven accumulation of heavy metals in seafood; however, no studies were available concerning the lead levels in Lebanese coastal fish.

Lead analysis

Results from other studies support the hypothesis that hair lead levels can be considered an indicator of relative exposure of populations to lead pollution [*16–18*]. It is in the occipital region that hair growth is least affected by age and sex. In order to limit variable factors, a standardized technique was used: 50–100 mg of hair (about 30–50 hairs) were cut at 1 cm from the base of the occipital region. This proximal hair sampling is expected to maximize the correlation with blood levels, with a correlation coefficient $r = 0.70$, and a correlation equation being

log(blood Pb in µg/L) = 0.3445 log(hair Pb in ng/g) + 0.7385 [*19*]. Hair samples were preserved in plastic bags and transported to the laboratory.

A 1100B model Perkin Elmer spectrophotometer was used, equipped with a deuterium lamp for correction of basic signal, a hollow cathode lamp and a HG-400 graphite oven. The experimental conditions were as follows: cathode lamp λ = 283.3 nm, bandwidth 0.7 nm, intensity 10 mA; argon vector gas; atomization conditions as shown in Table 1. Controls at 0, 10, 20 and 30 µg/L of lead were analysed according to the same atomization procedure. Detection limit of the method is 0.05 µg/L.

Sweat, sebum and other environmental organic pollutants were removed to decrease false positive results. Hair samples were washed with distilled water 3 times, then with acetone 3 times, then again with distilled water 3 times, followed by desiccation at 60 °C for 2 hours.

Hair solubilization was performed with 5 mL of 65% supra-pure nitric acid and 1 mL of 110 V hydrogen peroxide for every 50–100 mg of washed and dried hair. Digestion was done in an incubator at 50 °C for 2 hours. The final volume was adjusted to 10 mL with distilled water. Analysis was then done by spectrometry. Concentrations are expressed in parts per million (ppm) or µg of lead/kg of dry hair.

Table 1 **Atomization conditions for hair lead analysis**

Step	Temp (°C)	Ramp (s)	Hold time (min)	Argon flow (mL)
Desiccation	150	15	20	300
Combustion	1100	15	10	300
Atomization (reading)	1600	0	3	0
Cleaning	2500	1	3	300

Temp = temperature.

Data analysis

Data entry and analysis was performed using SPSS, version 12.0. Statistical tests used included chi-squared test for bivariate analysis of categorical data and Student or Mann–Whitney rank sum test for continuous variables when applicable. A *P*-value of 5% was taken as significant. Multivariate analysis was also performed using a step-by-step backwards linear regression procedure, with the independent variables: professional exposure, age, sex, nationality, region of residence, region of work, fish consumption and smoking. The dependent variable was lead concentration.

Results

The sample size was 326. There were 177 (54.3%) non-occupationally exposed individuals versus 149 (45.7%) individuals occupationally exposed to lead.

Background characteristics

The mean age of the whole group was 34.15 [standard deviation (SD) 15.40] years; for non-exposed individuals it was 35.47 (SD 17.49) years and for exposed individuals 32.58 (SD 2.35) years (not significant; $P < 0.09$).

There were some significant differences in the baseline characteristics of the 2 groups. The exposed group was composed of a higher proportion of males (99.3%), aged between 19 and 40 years (71.1%), residing almost equally in all Lebanese regions, and working mainly in Beirut (40.9%) (Table 2). They also included a majority of smokers (61.7%), with a higher percentage of non-Lebanese (29.5%) and those working on urban sites (77.9%). The

Table 2 **Sociodemographic characteristics of individuals occupationally exposed to lead sources and individuals not exposed**

Characteristic	Non-exposed (n = 177)[a]		Exposed (n = 149)[a]		*P*-value	Total (n = 326)[a]	
	No.	%	No.	%		No.	%
Sex					< 0.001		
Male	88	50.0	148	99.3		236	72.6
Female	88	50.0	1	0.7		89	27.4
Age (years)							
≤ 18	19	10.8	8	5.4	0.001	27	8.3
19–40	88	50.0	106	71.1		194	59.7
> 40	69	39.2	35	23.5		104	32.0
Residence region					0.01		
Beirut	19	10.7	30	20.1		49	15.0
Mount Lebanon	71	40.1	41	27.5		112	34.4
North Lebanon	36	20.3	21	14.1		57	17.5
Bekaa	22	12.4	29	19.5		51	15.6
South Lebanon	29	16.4	28	18.8		57	17.5
Work region					< 0.001		
Beirut	15	8.5	61	40.9		76	23.4
Mount Lebanon	81	45.8	39	26.2		120	36.9
North Lebanon	33	18.6	20	13.4		53	16.3
Bekaa	18	10.2	7	4.7		25	7.7
South Lebanon	29	16.4	22	14.8		51	15.7
Smoking (packs/day)					0.001		
Non-smoker	104	58.8	57	38.3		161	49.4
< 1	54	30.5	59	39.6		113	34.7
1–2	15	8.5	24	16.1		39	12.0
> 2	4	2.3	9	6.0		13	4.0
Fish consumption (times/month)					0.10		
1	55	31.1	33	22.1		88	27.0
2	54	30.5	39	26.2		93	28.5
3	32	18.1	39	26.2		71	21.8
> 3	36	20.3	38	25.5		74	22.7
Nationality					< 0.001		
Non-Lebanese	12	6.8	44	29.5		56	17.2
Lebanese	165	93.2	105	70.5		270	82.8
Residence					0.82		
Urban	64	36.4	56	37.6		120	36.9
Rural	112	63.6	93	62.4		205	63.1
Worksite					0.002		
Rural	68	38.4	33	22.1		101	31.0
Urban	109	61.6	116	77.9		225	69.0

[a] *Data missing for some items.*

non-occupationally exposed group had 50% females, 50% of 19–40 years, mainly residents and workers of Mount Lebanon (40.1% and 46% respectively), 58.8% non-smokers, 6.8% non-Lebanese, and 61.6% with urban worksite. Fish consumption and urban residence were similar between the 2 groups ($P = 0.10$) (Table 2).

Hair lead concentration

There was a 5–6-fold difference in hair lead concentration between occupationally exposed and non-exposed individuals: 23.60 ppm versus 4.33 ppm ($P < 0.001$). In non-exposed individuals male sex, older age, North Lebanon, Beirut and Bekaa residence and working regions, smoking, non-Lebanese nationality, urban residence and urban worksite were all associated with higher lead concentrations (Table 3).

Of the occupationally exposed workers, 9 (6%) were petrol refinery workers, 40 (27%) gasoline station staff, 42 (28%) traffic flow controllers, 31 (21%) taxi drivers, 12 (8%) pipe soldering workers, 3 (2%) glass industry workers, 11 (7%) battery recycling workers and 1 (1%) lead pigments industry workers. Petrol refining workers had the highest concentrations (30.92 ppm), along with gasoline station attendants (28.29 ppm), followed by traffic flow controllers (22.73 ppm), taxi drivers (21.76 ppm) and pipe soldering workers (21.08 ppm). Workers in the glass industry, battery recycling and lead-containing pigments industry had lead levels of 15.17, 14.61 and 14.10 ppm respectively. These differences were statistically significant ($P < 0.001$).

In Table 4, we present a multivariate analysis of lead concentrations. In non-exposed individuals, age, male sex, non-Lebanese nationality and urban worksite were correlated with higher hair lead concentration (adjusted $R^2 = 0.44$). In the total population, professional exposure was the factor with the highest correlation with lead concentration, along with the same other factors (male sex, non-Lebanese nationality and urban worksite), except that age that was not retained in the model (adjusted $R^2 = 0.79$).

Discussion

In this study, we found a 5–6 fold difference in hair lead concentrations between occupationally exposed and non-exposed individuals. Occupational exposure to lead sources, particularly working in petrol refining and gasoline stations, was the most strongly correlated with lead exposure. In non-exposed individuals, male sex, non-Lebanese nationality and urban work-site were correlated with higher lead concentrations. Individuals with higher lead exposure are expected to present all kinds of symptoms and diseases associated with high lead exposure, such as neurological, nephrological and gastrointestinal health effects [*5–8*]. Again, the banning of lead from fuel in our country is expected to affect those individuals beneficially because lead in engine fuel is the most important source of lead exposure in urban regions, despite the fact that this utilization constitutes only 2.2% of its global utilization [*20*]. This is expected to decrease the exposure level of all individuals, and thus their lead-associated health risks.

Gasoline exposure constituted the most important source of lead in our study, and other exposed professions had lower lead concentrations although still higher than the general population. This is in line with the results of other studies, where the hair lead concentration of workers occupationally exposed to lead was significantly higher than that in persons not exposed to the metal (7.6 µg/g for exposed workers versus

Table 3 **Mean hair lead concentrations of occupationally exposed and non-exposed individuals in parts per million (ppm)**

Characteristic	Non-exposed		*P*-value	Exposed		*P*-value	*P*-value[a]
	Mean lead level (ppm)	SD		Mean lead level (ppm)	SD		
Sex			< 0.001			0.34	
Male	5.85	2.90		23.62	7.16		< 0.001
Female	2.80	1.84		16.70	0		< 0.001
Age (years)			< 0.001			0.25	
≤ 18	1.52	0.91		21.80	8.12		< 0.001
19–40	3.91	2.52		24.24	7.59		< 0.001
> 40	5.65	2.93		21.96	5.16		< 0.001
Residence region			< 0.001			0.05	
Beirut	5.29	2.40		23.73	7.46		< 0.001
Mount Lebanon	3.28	1.92		26.32	8.26		< 0.001
North Lebanon	6.31	3.65		23.22	6.05		< 0.001
Bekaa	5.17	3.19		22.37	5.98		< 0.001
South Lebanon	3.16	1.98		20.90	5.92		< 0.001
Work region			< 0.001			0.08	
Beirut	6.52	0.57		23.97	6.48		< 0.001
Mount Lebanon	3.52	2.30		25.37	8.80		< 0.001
North Lebanon	6.09	3.65		23.44	6.12		< 0.001
Bekaa	4.82	3.45		21.89	6.80		< 0.001
South Lebanon	3.16	1.98		19.94	5.69		< 0.001
Smoking (packs/day)			0.001			0.45	
Non-smoker	3.66	2.90		23.69	7.21		< 0.001
< 1	5.32	2.34		24.22	7.10		< 0.001
1–2	5.64	3.35		21.57	6.74		< 0.001
> 2	3.21	1.39		23.92	8.46		< 0.001
Fish consumption (times/month)			0.07			< 0.001	
1	4.72	2.48		20.67	6.58		< 0.001
2	4.18	2.96		23.72	6.74		< 0.001
3	3.26	3.02		28.08	7.59		< 0.001
> 3	4.90	2.97		21.31	5.24		< 0.001
Nationality			< 0.001			0.02	
Non-Lebanese	7.25	2.58		25.64	7.79		< 0.001
Lebanese	4.12	2.78		22.71	6.72		< 0.001
Residence			< 0.001			0.15	
Urban	4.95	2.91		24.23	7.51		< 0.001
Rural	3.23	2.46		22.48	6.44		< 0.001
Worksite			< 0.001			0.20	
Urban	5.08	2.87		23.97	7.08		< 0.001
Rural	3.12	2.43		22.16	7.33		< 0.001
Total	4.33	2.87		23.60	7.15		< 0.001

[a]*Exposed vs non-exposed.*
SD = standard deviation.

3.2 µg/g for non-exposed workers and 2.6 µg/g for randomly selected controls, $P < 0.05$) [*17*]. The results we obtained for non-occupationally exposed individuals are below the threshold for hair lead (5 µg/g) suggested by Maimulov et al., especially for individuals below 18 years of age [*21*]; higher allowable limits of 9 µg/g were even suggested by Revich [*22*] and by Esteban [*23*]. However, lead may still be a problem for selected individuals. Nuwayhid et al. found for children 1–3 years old that those whose fathers worked in occupations with potential exposure to lead, and whose families used kohl, glazed pottery for food preparation or hot tap water for milk preparation, might be at a higher risk for lead exposure [*12*]. In the study performed in Moscow, by Revich the highest lead concentrations among urban children were found among those who lived near a copper smelter (18.2 µg/g), a lead–cadmium plant (31.1 µg/g) and a storage battery factory (48.3 µg/g), exceeding the control group values by up to 5 times [*22*]. Our phase 2 study is expected to provide further insight regarding high-risk subgroups.

In our study, smoking was found to be a factor that affected hair lead level in the bivariate analysis; however, when tested as an independent factor, it was not retained in the final multivariate model as a source of lead. In fact, the quantity of lead absorbed from 1 pack of cigarettes is estimated to be 0.68 µg to 1.35 µg [*24*], which is a relatively small quantity compared to occupational exposure. Even in non-occupationally exposed individuals, smoking was not found to correlate with hair lead level. One explanation for this finding is that there may be sources of exposure to lead in these populations that are more important than smoking; another explanation would be an information bias. This contrasts with Nuwayhid et al.'s findings that smoking was related to higher blood lead levels in workers of Beirut, whether or not they were occupationally exposed to lead [*14*]. Further studies are necessary to clarify this issue. Fish consumption also did not show any correlation to lead exposure in our study. In fact, it has been demonstrated that seafood contains less lead than other heavy metals such as mercury [*25*].

Given that lead poisoning is a preventable condition, these findings add urgency to the call for effective implementation of governmental policies that help to prevent lead poisoning [*3*]. The results we found could be extrapolated to neighbouring developing countries where lead is still used in gasoline, demonstrating the urgency of acting to solve this issue by public health decision-makers in these countries. However, this is not sufficient to prevent all health risks of lead in the population. Vigilance in countries where leaded fuel has been banned should also be applied; it could be assisted by broadening community awareness, by enforcing stricter controls over use of products known to contain lead, as well as stricter surveillance and testing of goods [*2*]. In Lebanon, further research is needed to assess the decrease in lead exposure and its determinants, with the ultimate aim of acting to diminish lead concentrations to no-effect levels.

In this study, the following systematic errors are possible: residual confounding may persist despite the fact that potential confounding variables were taken into account in the multivariate analysis. A selection bias is also possible since sampling was non-random, particularly for non-exposed individuals. However, we do not expect these possible biases to affect our results except towards the null.

Table 4 **Multivariate linear regression analysis of hair lead levels in the total sample and in non-exposed individuals**

Variable	Non-exposed		Total	
	β (95% CI)	*P*-value	β (95% CI)	*P*-value
Professional exposure	n/a	–	17.17 (15.82 to 18.53)	< 0.001
Male sex	2.15 (1.03 to 4.07)	< 0.001	2.60 (1.10 to 4.11)	0.001
Lebanese	–2.02 (–3.37 to –0.66)	0.04	–2.41 (–3.97 to –0.85)	0.003
Urban worksite	1.37 (0.70 to 2.04)	< 0.001	1.44 (0.22 to 2.66)	0.02
Age	0.05 (0.03 to 0.07)	< 0.001	n/r	–
Adjusted R^2	0.44		0.79	

Adjustment was made for smoking status, fish consumption, age, sex, nationality, work region, urban worksite, residence region and urban residence.
CI = confidence interval; n/a = not applicable; n/r = not retained in the model.

Conclusion

In conclusion, high levels of lead were found in the hair of occupationally exposed people. In addition, non-occupationally exposed individuals also had measurable lead concentrations in their hair, and are thus exposed to its harmful effects. The resolution of the problem has begun by banning lead-containing fuel from the Lebanese market. This is expected to decrease hair lead levels, and comparison with the current results will be performed in phase 2 of the current study. Future results are expected to inform decision-makers about the appropriateness of the policy they applied and further steps to be taken to promote the health of at-risk populations.

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Clinical evaluation of Graves ophthalmopathy in north-east Islamic Republic of Iran

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التقييم السريري لاعتلال العين في داء غريفز في شمال شرق جمهورية إيران الإسلامية

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الخلاصة: تقيِّم هذه الدراسة معدل انتشار ووخامة التظاهرات العينية في داء غريفز لدى 68 مريضاً ممن راجعوا عيادات الغدد الصماء في جامعة مشهد للعلوم الطبية في المدة من كانون الأول/ديسمبر 2002 إلى أيلول/سبتمبر 2005. وقد كان العمر الوسطي للمرضى 38 عاماً (الانحراف المعياري: 14.0 عاماً والمجال: 15–71 عاماً). وكانت الشكوى الأكثر شيوعاً هي الإحساس بوجود جسم غريب (54.0%) وانتفاخ الأجفان (48.4%) أما الاضطراب الأكثر شيوعاً ووضوحاً فكان انكماش الجفن لدى 64.2% من المرضى (ثنائي الجانب في 95.3% منهم). وقد كان لدى المرضى درجات أحراز متوسطة وفق تصنيف ويرنر لاعتلال العين في داء غريفز (NOSPECS) وقد بلغت 3.00 (بانحراف معياري 1.46). وقد كانت الدرجات المحرزة لدى الذكور [3.58 (بانحراف معياري 1.44)] أعلى بشكل يعتد به إحصائياً مما هو عليه لدى الإناث [2.63 (بانحراف معياري مقداره 1.35)]، وكانت مترابطة ترابطاً إيجابياً مع العمر.

ABSTRACT This study evaluated the prevalence and severity of ophthalmic manifestations in all Graves disease patients (*n* = 68) presenting to endocrine clinics at Mashad University of Medical Sciences between December 2002 and September 2005. The mean age of patients was 38.0 (SD 14.0) years, range 15 to 71 years. The most common complaints were foreign body sensation (54.0%) and puffy eyelids (48.4%). The most common apparent abnormality was lid retraction in 64.2% of patients (bilateral in 95.3% of cases). The patients had a mean modified Werner's NO SPECS classification score of 3.00 (SD 1.46). The score was significantly higher in males than females [3.58 (SD 1.44) versus 2.63 (SD 1.35)] and was positively correlated with age.

Évaluation clinique de l'ophtalmopathie basedowienne dans le nord-est de la République islamique d'Iran

RÉSUMÉ Cette étude a évalué la prévalence et la gravité des manifestations ophtalmologiques chez les patients atteints de la maladie de Graves-Basedow (n = 68) qui se sont présentés au service de consultations externes d'endocrinologie de l'Université des Sciences médicales de Mashad entre décembre 2002 et septembre 2005. L'âge moyen de ces patients était de 38,0 (écart type 14,0) ans, avec des extrêmes de 15 et 71 ans. Les sujets se plaignaient le plus souvent de sensation de corps étranger (54,0 %) et de gonflement des paupières (48,4 %). L'anomalie apparente la plus courante était la rétraction palpébrale chez 64,2 % des patients (bilatérale dans 95,3 % des cas). Les patients avaient un score moyen de 3,00 selon la classification NOSPECS de Werner modifiée (écart type 1,46). Ce score était significativement plus élevé chez les hommes que chez les femmes (3,58 [écart type 1,44] contre 2,63 [écart type 1,35]) et positivement corrélé à l'âge.

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Introduction

The relationship between exophthalmos and thyroid disease was first recognized by the Iranian scientist Sayyid Ismail Al-Jurjani in the 12th century [*1,2*]. Graves ophthalmopathy (GO) is a chronic, debilitating infiltrative eye and orbital disease that is often associated with Graves disease. About 50% of patients with Graves disease will develop GO and severe forms affect 3% to 5% of patients. The onset of the ophthalmopathy is in most cases concomitant with the onset of hyperthyroidism, but eye disease may precede or follow hyperthyroidism [*3*]. GO was found to affect females 6 times more frequently than males (86% versus 14% of cases, respectively), but the female:male ratio was reduced to 4:1 in severe forms of eye disease [*4*]. The age-adjusted incidence was 16 cases per 100 000 population per year for females and 2.9 cases per 100 000 population per year for males. The peak incidence rates were bimodal, occurring in age groups 40–44 years and 60–64 years in females and 45–49 years and 65–69 years in males [*5*].

The ocular changes associated with thyroid dysfunction have been recognized for many years, yet controversy remains regarding the pathogenesis, pathophysiology, and management of this disease [*6,7*]. Newer studies have brought possible significant insights to the understanding of the pathogenesis of GO. It has been found that thyroid-stimulating hormone (TSH)-receptors are also present in retrobulbar tissue [*8,9*], which is why it is suspected that TSH-receptor antibodies contribute to the development of GO by the stimulation of these retro-orbital tissue TSH-receptors.

General health-related quality of life is markedly impaired in patients with GO, and could be even worse than in patients with other chronic conditions such as diabetes, emphysema or heart failure [*10*]. In addition, severe forms of GO can lead to sight-threatening complications. Evaluation of the epide-miologic characteristics and severity of GO in each region can help to inform better decisions about increased quality of life and adequacy of education and counselling in patients with GO.

There have been few studies to evaluate the prevalence and severity of GO in Iranian patients [*11*]. Due to this lack of data, we aimed to investigate the prevalence and severity of ophthalmopathy in Graves patients in our area (north-east of the Islamic Republic of Iran). We therefore examined a large number of patients with Graves disease for the prevalence of GO, as well as the influence of various factors, such as age, sex and thyroid status, on the severity of ophthalmopathy. In addition, the clinical presentation of our patients was compared and contrasted with that of previously reported studies.

Methods

This was a multi-centre, prospective, descriptive study between December 2002 and September 2005. All patients with confirmed diagnosis of Graves disease attending the endocrine clinics of the Mashad University of Medical Sciences during the study period were recruited to the study. The diagnosis of Graves disease was based on clinical and laboratory findings of diffuse enlargement of thyroid gland, free triiodothyronine (T_3) and thyroxine (T_4) levels, T_3 resin uptake, raised free T_4 or T_3 levels, suppressed TSH levels. The study had no exclusion criteria and all patients with documented history of hyperthyroidism with any age, onset or type of intervention were included.

Information about age, occupation, family history, ocular symptoms and associated systemic diseases was obtained. The records of patients were reviewed to evaluate the recent thyroid disease status and the treatment regimen.

A comprehensive ophthalmic examination was performed in a standardized way for all patients. Best corrected visual acuity was documented by Snellen chart. A visual field test was requested in any case suspected of optic nerve dysfunction.

Intraocular pressure (IOP) was measured by applanation tonometer in the primary position and with upward gaze. Eyelid, conjunctiva and ocular motility status were assessed. Tear status was evaluated with Shirmer test and tear break-up time. We considered Schirmer < 10 mm and tear break-up time < 10 seconds as tear film dysfunction. Retraction of either upper or lower eyelid was defined by any exposed superior or inferior sclera beyond the limbus in the primary gaze. The degree of proptosis was measured by the Hertel exophthalmometer. Proptosis was defined as the measurement of protrusion of the globe > 20 mm from the lateral orbital rim in either eye or any discrepancy in the degree of protrusion of the 2 eyes by > 2 mm. Corneal involvement was assessed with fluorescein staining under slit lamp biomicroscopy. Fundus examination was done for evaluation of disc and retina. Also computed tomography (CT) or magnetic resonance imaging (MRI) was taken when required.

The classification of GO was based on Werner's classification, as endorsed by the American Thyroid Association [*12*] (Table 1). The relation of the thyroid functions and ocular manifestations were also evaluated.

Table 1 **Modified Werner's NO SPECS classification score**

Score	Sign
0	No signs or symptoms
1	Only signs
2	Soft tissue involvement with symptoms and signs
3	Proptosis (≥ 20 mm)
4	Extraocular muscle involvement
5	Corneal involvement
6	Sight loss (visual acuity ≤ 0.67)

Results

A total of 68 patients were studied during the period December 2002 to September 2005: 24 men (36%) and 43 women (64%) (data missing for 1 patient). The mean age of the patients was 38.0 [standard deviation (SD) 14.0] years (range 15 to 71 years). The mean age for females was 34.8 (SD 13.3) years and for males 44.3 (SD 13.4) years.

The mean duration of systemic thyroid disease was 2.5 (SD 2.4) years (range 6 months to 11 years). The majority of patients had hyperthyroidism at the initial presentation to the ophthalmologist (86.2%); only 3% of patients were hypothyroid and the remainder were euthyroid. While 76.7% of patients were receiving methimazole, 11.7% of patients were under treatment with levothyroxine. A history of radioactive iodine treatment was present in 23.3% of patients.

The most common presenting complaints of patients were foreign body sensation (54.0%) and puffy eyelids (48.4%). Ocular and periocular pain was the complaint in 45.2% of patients and the eyeball was the most prominent site of pain

in the majority (78.5%). Other symptoms included: tearing (40.3%), photophobia (35.5%), staring (31.7%), blurred vision (29.0%) and diplopia (17.7%).

Mean Snellen visual acuity was 0.90 (SD 0.17). The most prevalent sign was increased intraocular pressure on upgaze (88.2%), which was clinically significant (≥ 5 mmHg) in 13.2% of patients. The mean intraocular pressure in the primary position was 15.90 (SD 3.56) mmHg, which increased to 18.76 (SD 4.57) mmHg on upgaze. The increment in intraocular pressure on upgaze was statistically significant ($P < 0.0001$).

Figure 1 **Bilateral upper and lower lid retraction and injection over medial rectus muscles**

Table 2 **Common physical findings in thyroid related immunological orbitopathy in 68 patients with Graves disease**

Finding	%
IOP rise	88.2
Lid retraction	64.2
Periorbital swelling	50.0
Staring	48.6
Injection over horizontal recti insertion	48.5
Exophthalmos	53.0
Lagophthalmos	28.1
Punctate corneal epithelial erosion	25.0
Peripapillary venous tortuosity	20.9
Diffuse injection	20.9
Dry eye	20.6
Restricted eye movements	19.1
High IOP, upgaze	19.1
Eye deviation	13.3
Significant IOP rise	13.2
Caruncle swelling	7.4
High IOP, primary position	4.4
Decreased levator function	4.4
Chemosis	4.4
Disc swelling	1.5
Corneal ulcer	1.5
Corneal opacity	1.5
Relative afferent pupillary defect	0.0

IOP = intraocular pressure.

The most common apparent abnormality was lid retraction, which was noticed in 64.2% of patients (Table 2). Lid retraction was bilateral in 95.3% of cases. Exophthalmos was present in 53.0% of patients and was bilateral in the majority of cases (85.6%). Injection over the insertion of horizontal recti was noticed in 48.5% of patients, which was more prominent over the insertion of medial rectus (Figure 1). Limited ocular movements were present in 19.1% of patients. Most of the patients had limitation on upgaze and abduction (16.2%), and unexpectedly the downgaze was the least limited gaze (5.9%).

Tear break-up time had a mean of 11.61 (3.46) seconds (range 4–20 seconds). It was abnormal in 55.9% of patients (< 5 seconds in 1.5% and 5–10 seconds in 54.4% of patients). With a mean of 17.76 (SD 6.18) mm (range 4–30 mm), the Schirmer test was abnormal in 10.3% of patients. Increased IOP on upgaze had a statistically significant correlation with limitation of extraocular movements (4.57 mmHg versus 2.56 mmHg in the presence and absence of gaze limitation, respectively; $P = 0.03$). Also, a clinically significant increase in IOP

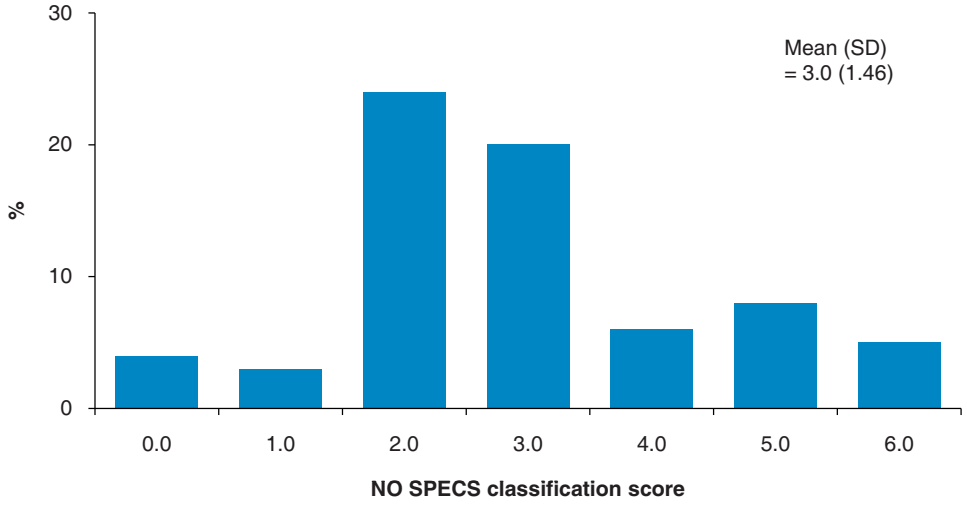


Figure 2 **Modified Werner's NO SPECS classification of 68 patients with Graves disease**

was more common in patients with limited gaze ($P = 0.01$).

The patients had a mean modified Werner's NO SPECS classification score of 3.00 (SD 1.46) (Figure 2). The mean score was significantly higher in males [3.58 (SD 1.44)] than females [2.63 (SD 1.35)] ($P < 0.01$). The score was positively correlated with the age of the patient ($r = 0.298$, $P = 0.016$) (Figure 3). A correlation between the score and disease duration or TSH level could not be shown.

Clinically detectable optic neuropathy was found in 1 of our patients (Figure 4). This patient had the complete constellation of classic findings at the same time: eyelid retraction, exophthalmos, optic nerve dysfunction, extraocular muscle involvement, and hyperthyroidism. Visual impairment (visual acuity and visual field changes) was the main symptom of optic neuropathy.

Discussion

Our study, conducted with a relatively large number of patients, can be compared with other similar studies. GO was found to be more common among women. However, in other studies the female:male ratio was between 4:1 and 6:1 [*5,13,14*], whereas in our sample it was less than 2:1 (64% of cases were females versus 36% males). On average, females presented 10 years earlier than males; the mean age of females in our study was 34.8 years and for males 44.3 years. As the majority of affected patients were middle-aged women, the importance of the functional and cosmetic consequences should be considered in the context of early diagnosis and treatment.

The most common complaints of our patients were foreign body sensation (54.0%) and puffy eyelids (48.4%), followed by ocular and periocular pain (45.2%), tearing

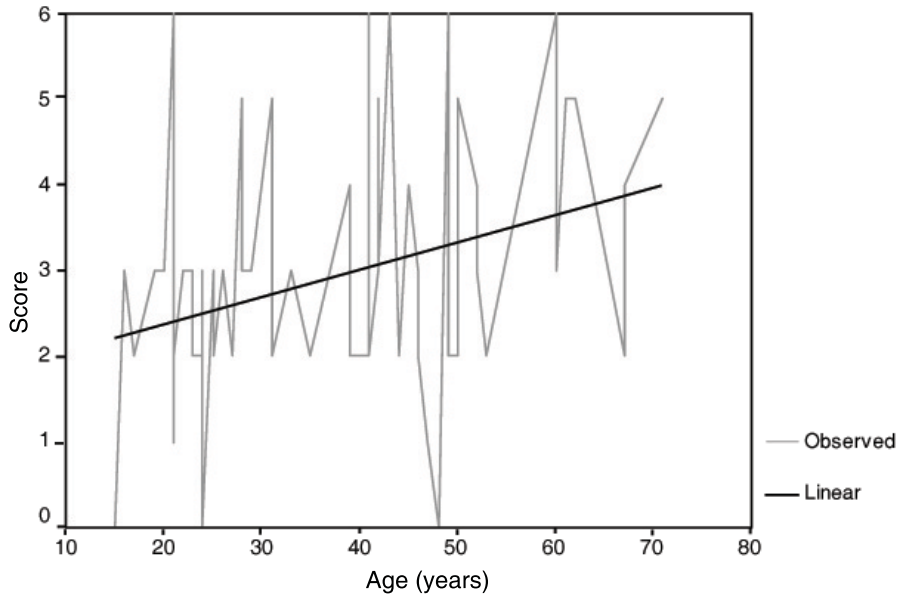


Figure 3 **Correlation of modified Werner's NO SPECS classification score and age in 68 patients with Graves disease (*r* = 0.298, *P* = 0.016)**

(40.3%), photophobia (35.5%), staring (31.7%), blurred vision (29.0%) and diplopia (17.7%).

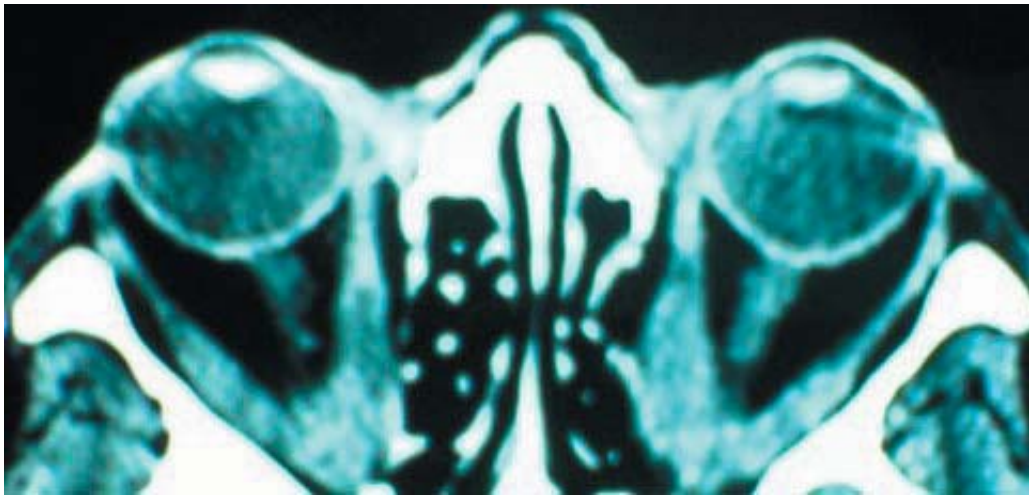
The most common ocular signs among patients with thyroid ophthalmopathy in this study were increased IOP on upgaze (88.2%), lid retraction (64.2%), exophthalmos (53%) and periorbital swelling (50.0%). The rate of lid retraction in our study was lower than the rates reported by Bartley et al. [*5*] (90.0%), Vangheluwe et al. [*15*] (90.0%), and Teshome and Seyoum [*16*] (83.8%).

Strabismus is common in GO and usually presents in the hypotropic or esotropic forms. In our study, 13.3% of patients had strabismus, the majority of whom had hypotropia or esotropia.

The prevalence of restrictive myopathy in the studies by Vangheluwe et al. [*15*] and Bartley et al. [*5*] were 40% and 43% respectively. In our study, the prevalence of extraocular muscle involvement with limited gaze was 19.1%, whereas frank strabismus was noted in only 13.3%.

Clinically detectable optic neuropathy was found in 1 of our patients. Visual impairment (visual acuity and visual field changes) was the main symptom. However, other methods used to detect optic neuropathy are more sensitive than vision tests alone and also take into consideration early forms of optic nerve damage [*17*]. Using visual evoked cortical potentials, Salvi et al. found signs indicative of optic

Figure 4
(a) Patient with bilateral lid retraction, proptosis, restricted ocular motility. His best corrected visual acuity reduced to 4 m finger-counting due to optic neuropathy (left: patient looking left; centre: patient looking straight; right: patient looking right)



(b) Axial CT scan showed horizontal muscles enlargement and bilateral proptosis

neuropathy in 21 out of 88 patients (23.8%) [*18*]. Considering the high prevalence of optic neuropathy found by these authors, it is surprising that clinically significant optic neuropathy (with visual deterioration) was much rarer in our patients. However, the diagnosis of optic neuropathy in our patients was by clinical examination only, based on visual deterioration and visual field defects. More sensitive methods were not available and therefore the actual occurrence of optic neuropathy is probably underestimated.

GO is frequently associated with elevated IOP on upgaze. In this study, 88.2% of patients had abnormal IOP on upgaze which was ≥ a 5 mmHg rise in 13.2%. This finding is similar to those of Gamblin et al. [*19*]. Increased IOP on upgaze had a significant correlation with limitation of extraocular movements (4.57 mmHg versus 2.56 mmHg in the presence and absence of gaze limitation respectively; $P = 0.03$).

However, the usefulness of measuring IOP change on upgaze in clinical practice remains controversial. In Reader's study on 100 healthy eyes, the mean increase in IOP at 20 degree upgaze was 1.75 (SD 1.49) mmHg [*20*]. A total of 5 patients had an increase in IOP of 4 mmHg and 1 patient had a 6 mmHg increase. Therefore, the pressure elevation has to be interpreted very carefully.

Similar to Perros et al.'s study [*13*], age and sex influenced the severity of thyroid-associated ophthalmopathy. In our cases the score was significantly higher in males than females (3.58 versus 2.63 respectively; $P < 0.01$) and was positively correlated with the patients' age ($r = 0.298$, $P = 0.016$). Although we included the patients' smoking history in our study, the number of smokers was small and a definitive conclusion regarding the relation between smoking and thyroid eye disease could not be made from this study.

Marcocci et al. showed no clear relationship between treatment of hyperthyroidism and the course of ophthalmopathy [*21*]. Antithyroid drugs may improve ocular manifestations, whereas prescription of radioactive iodine and thyroidectomy cause worsening of ophthalmopathy. In our cases while 76.7% were receiving methimazole, 11.7% of patients were under treatment with levothyroxine. A history of radioactive iodine treatment was present in 23.3% of patients. The majority of patients had hyperthyroidism at the time of first presentation (86.2%), 3% of patients had a hypothyroidic state and the remainder were euthyroid. These interventions may change the course of ophthalmopathy in our patients.

Conclusion

The epidemiological characteristics and clinical course of ophthalmopathy in Graves disease has been the subject of many studies. Our study of a relatively large patient sample revealed the known epidemiological facts regarding Graves ophthalmopathy in north-east of Islamic Republic of Iran. Our results correspond with numerous other studies with slight epidemiological variations. The prevalence of most of the ocular complications increased with increasing age. The incidence of higher severity score of ophthalmopathy was significantly greater among older patients.

Acknowledgements

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Retinal examination of diabetic patients: knowledge, attitudes and practices of physicians in Oman

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فحص الشبكية لدى السكريين: معارف ومواقف وممارسات الأطباء في سلطنة عُمان

راجيف خانديكار، سمير شاه، جواد اللواتي

الخلاصة: أجرى الباحثون تقييماً للمعارف والمواقف والممارسات لدى 40 طبيباً تم اختيارهم عشوائياً في المنطقة الشرقية من سلطنة عُمان عام 2003؛ وشمل التقييم معارف الأطباء غير المتخصصين بطب العيون حول أساليب فحص العيون لدى السكريين، ومواقفهم تجاه فحص قعر العين وممارساتهم تجاه الفحص العيني التفصيلي. وقد كانت معارفهم حول مختلف أجزاء العين مقبولة لدى 58٪ فقط من الأطباء، وكانت معارفهم عن طريقة فحص قعر العين لتحري اعتلال الشبكية السكري ضعيفة لدى 40٪ منهم. أما مواقفهم تجاه فحص العين من قِبَل طبيب غير متخصص بأمراض العيون في المستوى الأول فكانت إيجابية. وفي حيِّز الممارسة، حاول عشرون طبيباً مِنهم استخدام منظار فحص العين فلم يستطع أكثر من تسعة منهم رؤية تفاصيل الشبكية. وعلى هذا فإن الأطباء الممارسين العامِّين بحاجة لتدريب تفصيلي إذا أريد لهم أن يشاركوا في الكشف المبكر عن اعتلال الشبكية السكري.

ABSTRACT Knowledge, attitudes and practices of 40 randomly selected physicians was assessed in the North Sharqiya region of Oman in 2003. We evaluated non-ophthalmologist physicians' knowledge of techniques of eye examination of diabetic patients, attitudes towards fundus examination and practices of detailed eye examination. Knowledge about different parts of the eye was satisfactory in only 58% of physicians and knowledge about method of fundus examination for diabetic retinopathy was poor in 40%. Attitudes towards eye examination by non-ophthalmologists at primary level were positive. In practice 20 physicians had attempted to use an ophthalmoscope and only 9 could see details of the retina. Our general physicians would need detailed training if they are to be involved in early detection of diabetic retinopathy.

L'examen de la rétine chez les patients diabétiques : connaissances, attitudes et pratiques des médecins d'Oman

RÉSUMÉ Les connaissances, les attitudes et les pratiques de 40 médecins choisis au hasard ont été évaluées dans la région septentrionale de Sharqiya à Oman en 2003. Nous avons évalué les connaissances des médecins non ophtalmologistes relatives aux techniques d'examen ophtalmologique chez les patients diabétiques, leurs attitudes à l'égard de l'examen du fond d'œil et leurs pratiques en matière d'examen ophtalmologique complet. Les connaissances relatives aux différentes parties de l'œil n'étaient satisfaisantes que chez 58 % des médecins et celles relatives à la méthode d'examen du fond d'œil en cas de rétinopathie diabétique étaient faibles chez 40 % d'entre eux. Les attitudes à l'égard de l'examen des yeux par des médecins non ophtalmologistes au niveau des soins de santé primaires étaient positives. Dans la pratique, 20 médecins avaient essayé d'utiliser un ophtalmoscope et seuls 9 d'entre eux avaient réussi à voir les détails de la rétine. Nos médecins généralistes auront besoin de suivre une formation poussée s'ils doivent participer au dépistage précoce de la rétinopathie diabétique.

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Introduction

Visual disability due to diabetes is a major global health concern [*1*]. The eye health care programme in Oman aims to reduce blindness due to diabetes through early detection of eye complications among people with diabetes [*2*]. However, there are nearly 35 000 people diagnosed with diabetes in the 1.9 million Omani population who would need frequent eye check-ups to rule out complications, mainly diabetic retinopathy [*3*]. The existing ophthalmic services may not be able to cope with this increased demand. In many countries, non-ophthalmologist physicians conduct 1st level screening by performing retinal examination using an ophthalmoscope [*4–7*]. It was proposed that Oman should also adopt this strategy. To study the feasibility of such an endeavour, the capacity of the current cadre of physicians in retinal examination of people with diabetes needed to be assessed. The information about the existing skills of physicians could also be used to develop a training module.

We selected one region of Oman, North Sharqiya, as considerable progress has been done here in early detection of people with diabetes. North Sharqiya is a land-locked region of Oman with a population of 123 085; health services are provided free of charge through 9 primary health centres, 5 local hospitals and 1 regional hospital [*8*]. Two (2) ophthalmologists give eye care at 2 institutions.

Most of the physicians of the region are trained in primary eye care. Under the guidance of an epidemiologist and with the technical assistance of a senior ophthalmologist, the regional eye health care programme periodically conducts 2-day training workshops. Information on common eye diseases, especially diabetes, is provided to the participants. These trained staff subsequently treat common eye diseases. The primary health centres are equipped to diagnose and manage common eye ailments. Direct ophthalmoscopes are available at all health institutions.

We conducted this study to determine the level of knowledge, attitudes and practices (KAP) regarding eye examination for diabetic retinopathy among non-ophthalmologist physicians of North Sharqiya region of Oman and to propose a public health policy to improve the eye care of diabetics.

Methods

We conducted this cross-sectional descriptive study between September and December 2003. The study group were physicians involved in care of patients with diabetes (family physicians, hospital physicians, diabetologists and other types of doctors) in health institutions of the North Sharqiya region. These were primary health care centres, *wilayat* hospitals and policlinics. Primary eye care is provided by trained physicians (non-ophthalmologist) in all these institutions

To calculate the sample size for our study we assumed that 70% of the staff will have poor knowledge about retinal changes in diabetes. To achieve this, at 95% confidence level with acceptable error of 10%, at least 37 physicians were needed. To compensate for refusal we enrolled 10% more subjects. Thus the final sample size for our study was 41.

A list of Ministry of Health institutions was drawn up and, using random number tables, 6 out of 14 institutions were selected for the study. In each of these institutions, the list of all primary care physicians was obtained and physicians were randomly selected for interview. The field investigators—an ophthalmologist and public health physician in charge

of the region—visited the study sites, explained the purpose of the study to the selected participants and gave them the questionnaire. The participants were assured that the outcome would not be used for performance appraisal of individuals. To maintain confidentiality from the health centre administrators, physicians sent the competed questionnaire directly to the principal investigator. One physician refused to participate and was excluded from the study.

The questionnaire had a covering letter explaining the objectives of the study and assuring them about the confidentiality of the responses. The participants were requested to complete the forms without consulting any manuals, textbooks or fellow staff. The questionnaire included personal details, such as type of work, name, year and country of achieving medical qualification. There were 11 KAP questions about fundus examination of patients with diabetes. The questions for knowledge were open-ended and included the part of the eye to be examined for noting diabetic changes, a list of the structures of the eye and the major changes in the eye due to diabetes that could be seen with the ophthalmoscope. Attitude was assessed using close-ended questions about the logistics and capacity of fundus examination at the primary care level. Information about the current practice of fundoscopy and intensity of training needed to build capacity of a physician for retina examination was also collected using close-ended questions.

The questionnaire was prepared with the help of an epidemiologist and social scientist in English, which all participants understood. It was piloted on 4 health staff working in the department and amended for clarity of the contents. The responses during the pilot study were validated by comparing their results to a physician who was recently trained in the United Kingdom and now during his family practice in Oman routinely examines the ocular fundus of diabetics to determine diabetic retinopathy. The response of 5 subjects who were tested in the presence of investigators was compared with that collected by post. This suggested that the social acceptance bias had a minimal effect on the study outcome.

The forms were audited after completion and then were handed over to the data manager. The data was computed using *SPSS*, version 9. A codebook was maintained for the responses. Univariate analysis was used to review the frequencies and percentages of the level of KAP of the participants. Attitudes and practices were graded as positive, negative or equivocal. For each correct knowledge answer 5 points were awarded and for a wrong answer 5 points were deducted. The sum of points for the 3 questions on knowledge was then divided into 3 equal proportions and graded into very good, good and poor knowledge. For the question about parts of the eye to examine for diabetes, if 4 or 5 parts of eye were correctly mentioned and if the retina was one of them, the grade was very good. If the retina was not mentioned and only 1 or 2 correct eye parts were mentioned, the grade was considered to be poor. Other participants with a score of 3, including the retina, were grouped as average. The score for individual question's response was summed up and grouped in 3 grades to determine participants' overall knowledge about the eye in diabetes.

Results

Profile of the study participants

Of the 40 participants, 14 (35%) were family physicians, 9 (23%) were physicians at hospitals, 1 was a diabetologist and 12 (30%) were other types of doctors

Table 1 **Physicians' knowledge about parts of the eye to be examined for diabetes (*n* = 40 respondents)**

Eye part	No.	%
Retina[a]	15	38
Cornea[a]	6	15
Optic nerve/disc[a]	9	23
Lens[a]	17	43
Blood vessels	3	8
Other	23	58

[a]*Correct answers.*

(information about 4 staff was missing). There were 15 participants with < 10 years of experience after obtaining their medical degree and 25 with ≥ 10 years of experience after graduation. The mean interval between physician's graduation and the present study was 12.8 years (standard deviation 6.4 years).

Knowledge about eye examination for diabetes

The response to the question regarding the part of the eye that should be examined to review the eyes of a diabetic patient is given in Table 1. The knowledge of eye parts involved in diabetes and components that could be examined by ophthalmoscope was limited. Just over half the participants (23, 58%) correctly gave the name of one eye part that is usually affected by diabetes. Only 43% of staff knew that the lens could be affected in diabetes.

The response to the questions to evaluate the knowledge about fundus examination is given in Table 2. The knowledge of the main parts of the eye to be examined with the help of an ophthalmoscope to determine changes of diabetes was graded poor in 40% of the participants. Most physicians (88%) knew the importance of dilating pupils for retinal examination.

Attitudes

The responses to questions about attitudes to performing retinal examination is given in Table 3. A majority of respondents (74%) had a positive attitude to the role of non-ophthalmologists in retinal examination in general. However, when considering the specific situation in their institute, the regulations preventing the practice of pupil dilation in primary health centres and clients' preferences, 45% were of the opinion that this should be left to the ophthalmologists. Only 5% believed that physicians can successfully conduct fundus examination in outpatients departments.

Table 2 **Physicians' knowledge of eye changes in diabetic patients (*n* = 40 respondents)**

Item	Knowledge score					
	Very good		Average		Poor	
	No.	%	No.	%	No.	%
Which parts of the eyes should be examined to review eye changes of diabetes?	22	55	13	33	5	13
Which structures of eye can be seen by ophthalmoscope?	12	30	19	48	9	23
What are the main changes due to diabetes that can be seen on fundus examination?	10	25	14	35	16	40
Do you think dilatation of pupil is required for noting diabetic changes?	35	88	3	8	2	5

Table 3 **Physicians' attitudes towards retinal examination of diabetic patients**

Item	Positive		Negative		Equivocal	
	No.	%	No.	%	No.	%
Do you think fundus examination by a non-ophthalmologist would benefit diabetics in your area? (*n* = 38)	28	74	9	24	1	3
Do you think fundus examination should be done by an ophthalmologist and not by a physician? (*n* = 40)	18	45	22	55	0	0
Do you think that it is feasible for a physician to successfully conduct fundus examination in outpatients departments? (*n* = 40)	2	5	14	35	24	60

n = *number of respondents.*

Practices of retinal examination of diabetics

The responses concerning practices of retinal examination showed that only 20 physicians were working in institutions where ophthalmoscopes were in working order and hence had had an opportunity to perform fundus examination of diabetes mellitus cases (Table 4). However, only 9 of them said they could see some details of the retina. In the last 5 years of their working in Oman, only 10 physicians had specifically tried to use the ophthalmoscope for retinal examination of their patients.

Training of physicians for retinal examination

The responses of the participants regarding modalities of training suggested that 27% of physicians felt that a training of 1 week duration was sufficient, while 70% of participants suggested 15 days to 1 month duration of training was essential. Only 1 participant suggested that training should be of more than 1 month duration. Most physicians (70%) believed that regional ophthalmologists could successfully train the primary staff in this screening.

Discussion

A rapid decline in communicable diseases and increasing trend of noncommunicable diseases in Oman during the last decade has prompted the health planners to change strategy [*9*]. However, screening more than 35 000 people with diabetes in the Omani population aged more than 20 years of age and a similar number with impaired glucose

Table 4 **Physicians' use of the ophthalmoscope in their practice and their success in fundus examination of diabetic patients**

Item	Positive		Negative		Equivocal	
	No.	%	No.	%	No.	%
Did you have the opportunity to use the existing equipment in your institution? (*n* = 40)	20	50	18	45	2	5
(If so, could you see the details of the retina?)	(9)		(9)		(2)	
Did you attempt fundus examination of a diabetic in Oman in the last 5 years? (*n* = 38)	2	5	14	35	24	60

n = *number of respondents.*

tolerance would demand large resources [*3*]. An organized approach for screening and management of eye complications of registered diabetes patients was laid down in all regions of Oman in 2001 [*10*]. In the initial period, the prevalence of diabetic retinopathy was found to be 14.4% [*11*] and 9% of people with diabetes had glaucoma as comorbidity [*12*]. The risk of visual disability in the registered diabetics was 25 times more than the general population [*13*]. Thus regular and periodic eye check-ups of diabetic patients is crucial to reduce blindness and to improve the quality of life of these people.

The present strength of 85 ophthalmologists in Oman is able to screen and manage eye complications of diabetic patients [*10*]. However, in view of the intense advocacy campaign for proactive screening of the diabetic population, referrals for eye examination of diabetics will increase [*2*]. Hence developing a non-ophthalmic cadre to initiate the first level of eye screening of diabetics could be helpful. General physicians could be first-level screeners but the risk of missing retinopathy changes by physicians is reported to be high [*14*]. This could lead to presentation of retinopathy cases in advanced stages when limited intervention can be offered to save the eyesight.

Digital documentation and use of telemedicine for detection of retinopathy changes in diabetes is adopted as an alternative strategy in many countries but the high cost is the main barrier [*15–17*]. The use of technological advances in combination with screening of diabetics by trained physicians using ophthalmoscopy has also been found to be a useful method [*18*]. Hence building the capacity of existing non-ophthalmic staff in retinal examination would be ideal. Evaluation of knowledge, attitudes and practices of the health staff would thus help in formulating the training modules and plan the implementation of such initiatives.

Limited experience of using the ophthalmoscope during undergraduate training and professional practice in Oman was evident in our study. It should be noted that most of the primary health staff come not only from Oman but also from India, Pakistan, Sudan, Egypt and Iraq. This inevitably means that there are disparities in training in eye care. Attempts were made in the past to standardize the eye care in Oman through training workshops, but attention to diabetic eye care was not comprehensive in these workshops.

A KAP survey of eye care among primary health staff in Oman was conducted in 2000 and was found to be very satisfactory [*19*]. However, the primary focus in that study was on cataract, trachoma, blindness and the preventive practices, and so the outcomes of the present study differ from the previous KAP study. Our study showed poor KAP among primary health care staff. Dilatation of pupils in primary health care centres is not allowed in Oman due to the risk of precipitating glaucoma among persons with narrow angle. This could explain the poor practice of retinal examination at primary health centres. The health staff not included in the study but working in the primary health care centres were mainly resident doctors and medical officers that deal with patients in the gynaecology department. They have a limited role in the care of diabetics in the region. Thus, caution is needed in extrapolating the information of our study should to all doctors of the region.

The low KAP scores suggest that a stress on screening eye changes in diabetes and its care is needed in future training workshops for non-ophthamologists. Better advocacy [*20*] and coordination between physicians and ophthalmologists is also recommended in the literature to improve the care of

patients with diabetes [*21*]. Variations in knowledge of eye changes in diabetes suggest that all components—anatomy, pathology, clinical examination and current modalities of management and prevention—should be included in the training. Different types of physicians, such as diabetologists, physicians with postgraduate qualifications and family practitioners exist in Oman. A training approach to develop the capacity of the first 2 categories could be different from that of family physicians.

The suggestions of participating physicians about duration of training should be considered when the policy for such training is formulated. However, shortages of staff both at ophthalmic units and at primary health care centres in the regions could pose logistic problems for holding such long training sessions (15 days to 1 month).

In summary, this study demonstrated limited knowledge and practice of eye care in diabetes among physicians of North Sharqiya region. To build their capacity, intense, exhaustive and well-planned training programmes are needed.

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Unhealthy lifestyles and ischaemic electrocardiographic abnormalities: the Persian Gulf Healthy Heart Study

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أنماط الحياة المنافية للصحة والاضطرابات الإقفارية على تخطيط كهربية القلب: دراسة القلب الصحي للخليج الفارسي

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الخلاصـة: درس الباحثون 3727 شخصاً تبلغ أعمارهم 25 عاماً فأكثر في منطقة شمال الخليج في إيران لتقيـيم معدل انتشار عوامل الاختطار القلبية الوعائية ومرض القلب الإقفاري وأنماط الحياة المنافية للصحة، فلاحظوا وجود عامل اختطار قلبي وعائي واحد أو أكثر لدى 96.0%، وأن ما يزيد على 60% من المشتـركين في الدراسة لديهم وزن غير صحي، وأن 8.3% منهم فقط يتناول المقادير الموصى بها من الفواكه والخضراوات، وأن 70.6% منهم غير نشيطين بدنياً، وأن 19.0% كانوا يدخنون في ذلك الوقت. أما معدل انتشار علامات مرض القلب الإقفاري على مخطط كهربية القلب فكانت 12.7%. ولوحظ تـرابط مستقل بين التدخين في وقت الدراسة أو في وقت سابق لها، وكذلك بين البدانة الجذعية، وبين هذه التغيرات التخططية لدى الرجال، وكما لوحظ ترابُط مع التدخين وقت الدراسة أو في وقت سابق لها ومع البدانة لدى النساء. كما يرتبط ارتفاع ضغط الدم والسكري ارتباطاً مستقلاً مع ازدياد اختطار تلك التغيرات.

ABSTRACT We assessed prevalence of cardiovascular risk factors, ischaemic heart disease (IHD) and unhealthy lifestyles in 3723 participants aged ≥ 25 years in the northern Persian Gulf region; 96.0% had ≥ 1 cardiovascular risk factor. Over 60% had unhealthy body weight, only 8.3% ate the recommended amount of fruits and vegetables, 70.6% were physically inactive and 19.0% were current smokers. Prevalence of electrocardiogram (ECG) with evidence of IHD was 12.7%. Present or past smoking and truncal obesity were independently associated with IHD ECGs in men, and past or present smoking and obesity in women. Hypertension and diabetes were independently associated with increased risk of IHD ECG.

Modes de vie malsains et anomalies électrocardiographiques évocatrices d'une ischémie : *Persian Gulf Healthy Heart Study* [étude sur la santé cardiaque dans le Golfe persique]

RÉSUMÉ Nous avons évalué la prévalence des facteurs de risque cardio-vasculaire, de la cardiopathie ischémique et des modes de vie malsains chez 3723 participants âgés de 25 ans ou plus dans la région du nord du Golfe persique ; 96,0 % présentaient au moins un facteur de risque cardio-vasculaire. Plus de 60 % avaient un poids corporel préjudiciable à la santé, seuls 8,3 % consommaient la quantité de fruits et légumes recommandée, 70,6 % étaient sédentaires et 19,0 % étaient des fumeurs au moment de l'étude. La prévalence de l'électrocardiogramme (ECG) mettant en évidence une cardiopathie ischémique était de 12,7 %. Le tabagisme actuel ou passé et l'obésité tronculaire étaient indépendamment associés à des ECG révélant une cardiopathie ischémique chez les hommes, et le tabagisme passé ou actuel et l'obésité chez les femmes. L'hypertension et le diabète étaient indépendamment associés à un risque augmenté d'ECG révélant une cardiopathie ischémique.

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Introduction

Mortality for cardiovascular disease (CVD) is decreasing in developed countries as a result of long-term promotion of healthy lifestyles and community prevention measures. However, with ageing populations and rapidly changing lifestyles (in particular tobacco smoking, unhealthy diets and physical inactivity), the burden of CVDs is increasing in almost all developing countries [*1,2*]. This poses a threat to the economies of the less-developed world [*3*].

Results of large, prospective cohort studies have shown that a healthy diet and lifestyle, along with low levels of serum cholesterol and blood pressure and not smoking, are associated with a low risk of coronary artery disease [*4–5*]. Lifestyle therapies which include a combination of diet and exercise modifications have been recommended in place of drug treatment for patients who fall into an intermediate range for coronary heart disease risk [*6*].

The Islamic Republic of Iran is an example of countries in the Eastern Mediterranean Region of the World Health Organization (WHO) which are undergoing a nutritional transition. Preliminary reports indicate that CVD is the leading cause of death in those over the age of 35 years [*7*]. The prevalence of CVD risk factors among the urban population in Tehran is high, particularly high total cholesterol, low high density lipoprotein (HDL)-cholesterol and high waist–hip ratio [*8*]. However, unhealthy lifestyles and CVD have not yet been studied and documented in the south of the Islamic Republic of Iran, in the region bordering the Persian Gulf and this places a major limitation on developing healthy lifestyle policies, strategic plans and programmes.

The main aim of this study was to characterize the prevalence of 4 unhealthy lifestyle patterns (unhealthy weight, inadequate fruit and vegetable consumption, lack of regular leisure-time physical activity and smoking) in the northern Persian Gulf region, and to determine the association between these lifestyles and electrocardiographic ischaemic abnormalities using the Minnesota coding criteria [*9*].

Methods

The Persian Gulf Healthy Heart Study (PGHHS), of which this study is a part, was designed to determine CVD risk factors among the population of the northern Persian Gulf area, to develop community-based projects to change the lifestyles of the population and to publicize the rising threat of CVD in the region. The PGHHS comprises 2 major components: Phase I is a cross-sectional prevalence study of unhealthy lifestyles and ischaemic heart disease (IHD) and associated risk factors. Phase II comprises a multiple intervention project to reduce CVD in the region. The study is being carried out by the Persian Gulf Health Research Centre in Bushehr University of Medical Sciences and Health Services. More details of the PGHHS are discussed on the Canadian Heart Health Database (http://www.med.mun.ca/g8hearthealth), project ID Number 168.

Community sampling

In the PGHHS, the protocol and guidelines of the WHO Countrywide Integrated Noncommunicable Diseases Intervention Programme for sample size in health behaviour surveys were used. The recommended minimum sample size to meet statistical requirements for detectable changes in risk factors in the population is 3000 [*10*]. In Phase I of the study, a multi-stage stratified

cluster random sampling technique was used to select 3000 people aged 25–64 years from major ports of Bushehr province (Iranian province with the greatest border with the Persian Gulf). The ports studied were Bushehr (the provincial capital, population 150 000, and annual coronary events of 481.05 per 100 000 for men and 156.61 per 100 000 for women, 2003 [*11*]), Genaveh and Deilam.

Almost all the households of the 3 ports were under the coverage of local health centres of Bushehr University of Medical Sciences and Health Services. A multi-stage stratified cluster random sampling technique was used to select households in the coverage area of each local health centre. The specifications dictated that approximately 2 persons per selected household could be included in Phase I. The total number of households selected in the area of each local health centre was proportional to the total number of households in that area.

Publicity concerning the study appeared in the local newspapers and on TV. The participants were informed about the study through a letter delivered by hand. After a primary educational input about CVD and its associated risk factors, they were invited to participate in the screening programme in a 12–14-hour fasting state the following morning at one of the local health service centres belonging to Bushehr University of Medical Sciences.

Survey procedure

Phase I was a cross-sectional survey in which each participant was examined only once. Examinations were conducted in 2003–04. All participants were asked to fast 12–14 hours and to present at the survey centre at 07.30–09.30. On arrival, information on age, sex, marital status, education, smoking, estrogen and/or progesterone usage or hormone replacement therapy, and drugs for angina, hypertension, diabetes and dyslipidaemia were recorded by trained interviewers using the WHO MONICA questionnaire [*12*]. A 6-item food frequency questionnaire of the Behavioral Risk Factor Surveillance System was used to assess fruit and vegetable consumption [*13*]. Physical activity was evaluated through a questionnaire based on the Countrywide Integrated Noncommunicable Diseases Intervention Programme and the Behavioral Risk Factor Surveillance System documents [*10,13*]. Blood pressure was assessed twice on the right arm after a 15-minute rest in a sitting position using a standard mercury sphygmomanometer. Height and weight were measured using a stadiometer. Heavy outer garments and shoes were removed before measuring height and weight. Body mass index (BMI) was calculated. Waist circumference was measured at the midway level between the costal margins and the iliac crests. Hip circumference was measured at the level of the greater trochanters. A resting 12-lead electrocardiogram was performed.

A fasting blood sample was taken and all samples were promptly centrifuged and separated. Analyses were carried out at the Persian Gulf Health Research Centre on the day of collection using a Selectra 2 autoanalyser (Vital Scientific, Spankeren, Netherlands). Glucose was assayed by an enzymatic (glucose oxidase) colorimetric method using a commercial kit (Pars Azmun Inc., Tehran). Serum total cholesterol and HDL-cholesterol were measured using a cholesterol oxidase phenol aminoantipyrine and triglycerides using a glycerol-3 phosphate oxidase phenol aminoantipyrine enzymatic method. Serum low density lipoprotein (LDL)-cholesterol was calculated using the Friedewald formula.

Definitions

Fasting serum glucose of ≥ 126 mg/dL or use of antidiabetic measures was defined as diabetes [*14*]. Hypertension was defined according to WHO criteria (systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg, or use of antihypertensive medication) [*15*].

Smoking was considered to be present when the participant smoked cigarettes or used a *shisha* (water pipe) daily. Healthy weight was defined as having BMI 18.5–24.9 kg/m^2. Overweight and obesity were defined as BMI 25.0–29.9 kg/m^2 and ≥ 30 kg/m^2 respectively. Truncal obesity was defined as waist–hip ratio ≥ 0.95 for males and ≥ 0.80 for females. Adequate fruit and vegetable consumption was defined as eating fruits or vegetables ≥ 5 times per day [*16*]. Respondents were classified as active at the recommended level if they reported sufficient physical activity of moderate intensity (≥ 30 minutes per day ≥ 5 days per week) or of vigorous intensity (≥ 20 minutes per day ≥ 3 days per week) [*17*].

The cut-off points for serum total cholesterol, HDL-cholesterol, LDL-cholesterol and serum triglycerides distributions used to assign subjects at different levels of risk were those derived from the National Cholesterol Education Program guidelines in the United States of America (Adult Treatment Panel III), September 2002 [*18*].

Electrocardiograms (ECGs) were coded on the basis of the Minnesota coding criteria [*19*]. Codes 1.1 and 1.2 were classified as myocardial infarction and codes 1.3, 4.1–4.4, 5.1–5.3 and 7.1 were classified as ischaemia. ECG with evidence of ischaemic heart disease (IHD ECG) was defined as myocardial infarction and ischaemia together.

Statistical methods

Statistical significance of any difference in the results for any 2 groups was determined by chi-squared analysis using 2 × 2 contingency tables. A 2-tailed *t*-test was used to compare mean values across groups. $P < 0.05$ was considered statistically significant.

Multiple logistic regression analysis was used to ascertain the associations between IHD ECG and unhealthy lifestyles and CVD risk factors.

For analysis of data, the sample population was divided into 4 age groups: 25–34, 35–44, 45–54, and 55–64 years. Statistical analysis was performed using the *SPSS* statistical software package, version 9.05.

Results

We approached a total of 5475 people and 3723 (46.9% males, 53.1% females) agreed to participate, a response rate of 68%. Of the studied population, 36.1% were 25–34 years, 29.1% 35–44 years, 22% 45–54 years and 12.7% 55–64 years.

Women had statistically significantly higher mean serum total cholesterol, LDL-cholesterol and HDL-cholesterol levels and significantly higher mean BMI but men had significantly higher mean triglyceride levels and diastolic and systolic blood pressure (Table 1).

Unhealthy lifestyle characteristics

An estimated 60.5% of the participants had an unhealthy body weight, only 8.3% ate the recommended amount of fruits and vegetables, 70.6% were physically inactive and 19.0% were smokers (Table 2).

Table 1 **Lipid profile, blood pressure and anthropometric measurements for adults from the northern Persian Gulf region**

Variable	Males Mean (SD)	Females Mean (SD)
Total cholesterol (mg/dL)	201.53 (52.17)	210.05 (51.52)[b]
LDL-cholesterol (mg/dL)	122.93 (51.42)	129.46 (63.53)[a]
HDL-cholesterol (mg/dL)	42.14 (44.53)	48.11 (47.60)[b]
Triglycerides (mg/dL)	182.20 (113.97)[b]	162.33 (97.85)
Diastolic blood pressure (mmHg)	82.56 (42.73)[b]	77.21 (20.64)
Systolic blood pressure (mmHg)	129.35 (43.40)[b]	121.38 (25.33)
Body mass index (kg/m^2)	25.93 (4.65)	28.44 (5.62)[b]
Waist to hip ratio	0.91 (0.12)	0.91 (0.14)
Fasting blood sugar (mg/dL)	92.09 (41.39)	93.08 (47.46)

[a]P = *0.001;* [b]P < *0.0001.*
SD = standard deviation.

Table 2 **Prevalence of unhealthy lifestyle among adults from the northern Persian Gulf region**

Variable	Males (*n* = 1746)		Females (*n* = 1977)		Total (*n* = 2723)	
	No.	%	No.	%	No.	%
Inadequate fruit & vegetable consumption	1624[a]	93.0	1790	90.5	3414	91.7
Unhealthy body weight	946	54.2	1308[b]	66.2	2254	60.5
Current smoking	436[b]	25.09	267	13.5	703	19.0
Physical inactivity	1169	67.0	1460[b]	73.8	2629	70.6

[a]P = *0.005;* [b]P < *0.0001.*

Overall, 8.1% (9.0% of males and 7.3% of females; $P > 0.05$) of adults engaged in none of these unhealthy lifestyle practices, 38.6% in 1, 40.7% in 2, 12.0% in 3, and 0.7% in all 4 (0.6% of males and 0.8% of females; $P > 0.05$).

Risk factors for CVD

Overall, 96.0% of the participants had ≥ 1 cardiovascular risk factor and 79.5% (81.9% of men and 77.6% of women) had ≥ 2 risk factors ($P < 0.0001$).

Prevalence of hypertension and cigarette smoking were statistically signi-ficantly higher among men ($P < 0.0001$), but the prevalence of obesity (including truncal obesity) was significantly higher in women ($P < 0.0001$) (Table 3).

A total of 181 (4.8%; 9.8% of men and 0.5% of women, $P < 0.0001$) were ex-cigarette smokers, and 316 (8.5%; 7.1% of men and 9.6% of women, $P < 0.0001$) were ex-shisha smokers. Only 29.6% engaged in regular physical activity. Men engaged in vigorous physical activity more than women (21.9% versus 8.9%; $P < 0.0001$); however there was no statistically significant difference for moderate intensity physical activity (20.4% for men and 21.8% for women).

Table 3 **Prevalence of cardiovascular risk factors among adults from the northern Persian Gulf region**

Variable	Males (*n* = 1746)		Females (*n* = 1977)		Total (*n* = 2723)	
	No.	%	No.	%	No.	%
Physical inactivity	1169	67.0	1460[a]	73.8	2629	70.4
Overweight	424	24.3	418	21.1	842	22.6
Obesity	158	9.0	398[a]	20.1	556	14.9
Truncal obesity	516	29.6	1780[a]	90.0	2296	61.5
Diabetes	136	7.8	174	8.8	310	8.3
Hypertension	491[a]	28.1	404	20.4	895	24.0
Smoking (cigarette)	346[a]	19.7	7	0.4	353	9.5
Smoking (shisha)	101	5.8	261[a]	13.2	362	9.7

[a]P *< 0.0001.*

Table 4 shows the distribution of serum total cholesterol and triglycerides; 51.0% had triglyceride levels < 150 mg/dL while 1.5% had ≥ 500 mg/dL. The prevalence of borderline high and high total cholesterol was 30.2% and 22.0%, respectively. High serum triglyceride was more prevalent in men than women, but high serum total cholesterol level was more prevalent in women ($P < 0.0001$ for both).

Table 4 also shows the distribution of serum LDL-cholesterol and HDL-cholesterol by sex over different levels of risk. For LDL cholesterol, 25.9% of the population were in the moderate risk range, 130–159 mg/dL; 12.6% had levels of 160–189 mg/dL; and 7.2% had levels > 190 mg/dL. High serum LDL-cholesterol was more prevalent in women than men ($P < 0.0001$). Overall, 47.9% of the participants had HDL-cholesterol levels in the high-risk range, < 40 mg/dL. This differed markedly between men, 58.5% at risk, and women, 38.5% at risk ($P < 0.001$).

Prevalence of ischaemic heart disease end points

Table 5 shows prevalence of ischaemic heart disease end points among the study participants. Myocardial infarction was determined in 53 cases (1.4%); ischaemia in 421 cases (11.3%). Prevalence of ECG with evidence of ischaemic heart disease (IHD ECG) was 12.7% (10.4% for men and 14.7% for women; $P < 0.0001$).

Association between IHD ECG and lifestyle patterns

In multiple logistic regression analysis for association between IHD ECG and lifestyle characteristics, past or present smoking [odds ratio (OR) = 1.37; 95% CI: 1.00–1.87, $P = 0.04$] and truncal obesity (OR = 1.78; 95% CI: 1.30–2.45; $P < 0.0001$) were independently associated with IHD ECGs in men, past or present smoking (OR = 1.66; 95% CI: 1.26 –2.19; $P < 0.0001$) and obesity (OR = 1.37; 95% CI: 1.04–1.81; $P = 0.02$) were also independently associated with IHD ECG in women (Table 6).

Association between IHD ECG and coronary artery risk factors

In multiple logistic regression analysis to ascertain the association between IHD ECG and coronary artery risk factors, hypertension (OR = 2.39; 95% CI: 1.73 –3.30; $P < 0.0001$) and diabetes (OR = 1.82; 95%

Table 4 **Serum levels of lipids and lipoproteins over different categories of risk for cardiovascular disease among adults from the northern Persian Gulf region**

Risk factor (mg/dL)	Males (*n* = 1746)		Females (*n* = 1977)	
	No.	%	No.	%
Triglycerides				
< 150 (normal)	818	46.8	1082	54.7
150–199 (borderline high)	355	20.3	367	18.6
200–499 (high)	534	30.6[a]	510	25.8
≥ 500 (very high)	40	2.3[a]	17	0.9
Total cholesterol				
< 200 (desirable)	899	51.5	880	44.5
200–239 (borderline high)	521	29.8	605	30.6[a]
≥ 240 (high)	327	18.7	491	24.8[a]
LDL-cholesterol				
< 100 (optimal)	486	27.9	433	21.9
100–129 (near optimal)	505	29.0	579	29.3
130–159 (borderline high)	446	25.6	517	26.2
160–189 (high)	210	12.0	258	13.1[a]
≥ 190 (very high)	92	5.3	176	8.9[a]
HDL-cholesterol (mg/dL)				
< 40 (low)	1021	58.5[a]	761	38.5
40–59 (borderline)	656	37.6	984	49.8
≥ 60 (high)	65	3.7	214	10.8

[a] *P* < 0.0001

LDL = low density lipoprotein; HDL = high density lipoprotein.

Table 5 **Prevalence of myocardial infarction, ischaemia and ischaemic electrocardiogram (ECG) in different age groups using Minnesota coding criteria among adults from the northern Persian Gulf region**

Age (years)	Males (*n* = 1746)						Females (*n* = 1977)					
	Myocardial infarction		Ischaemia		Ischaemic ECG		Myocardial Infarction		Ischaemia		Ischaemic ECG	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
25–34	7	1.1	35	5.6	42	6.7	2	0.3	67	9.3	69	9.5
35–44	6	1.2	28	5.6	34	6.8	1	0.2	71	12.2	72	12.3
45–54	7	1.9	41	11.0	48	12.9	11	2.5	75	16.9	86	19.3
55–64	14	5.5	44	17.3	58	23.3	5	2.2	60	25.9	64	28.4
Total	34	1.9	148	8.5	182	10.4	19	1.0	273	13.8[a]	291	14.7[a]

[a] P *< 0.0001 females in comparison to males.*

Table 6 **Multivariately adjusted odds ratios relating ischaemic heart disease electrocardiogram (dependent factor) with unhealthy lifestyle characteristics and cardiovascular disease (CVD) risk factors among adults from the northern Persian Gulf region**

CVD risk factor	Males (*n* = 1746)			Females (*n* = 1977)		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Past or present smoking	1.37	1.00–1.87	0.04	1.66	1.26–2.19	0.0001
Obesity	1.25	0.91–1.71	NS	1.37	1.04–1.81	0.02
Truncal obesity	1.78	1.30–2.45	< 0.0001	0.90	0.60–1.36	NS
Physical inactivity	1.00	0.72–1.38	NS	1.25	0.95–1.65	NS
Inadequate fruit & vegetable consumption	0.83	0.44–1.59	NS	1.24	0.82–1.86	NS
Low serum HDL-C	1.06	0.76–1.47	NS	1.55	1.17–2.05	0.002
Hypertension	2.39	1.73–3.30	< 0.0001	2.13	1.61–2.80	< 0.0001
Diabetes	1.82	1.16–2.84	0.009	2.23	1.57–3.17	< 0.0001

OR = adjusted odds ratio; CI = confidence interval; NS = not significant.
HDL-C = high density lipoprotein cholesterol.

CI: 1.16–2.84; $P = 0.009$) were associated with an independently increased risk of IHD ECG findings in men, and independent effect of diabetes (OR = 2.23; 95% CI: 1.57 –3.17; $P < 0.0001$), hypertension (OR = 2.13; 95% CI: 1.61–2.80; $P < 0.0001$) and low HDL cholesterol (OR = 1.55; 95% CI: 1.17–2.05; $P = 0.002$) on IHD ECG in women (Table 6).

Discussion

The prevalence of engaging in all 4 healthy lifestyle characteristics (healthy weight, adequate fruit and vegetable consumption, regular leisure-time physical activity and not smoking) was 0.7% in the Northern Persian Gulf. The findings in this report document the low prevalence of healthy lifestyles in this region, which is even lower than the overall American 2000 BRFSS data (only 3% of adults engaged in all 4 healthy lifestyle characteristics in Michigan) [*19*].

Only 8% of participants in our study ate the recommended amount of fruits and vegetables compared to about 25% among adults in the United States of America [*16*]. Compared with multiple 24-hour recalls or records that include fruit and vegetable intakes from mixed foods and condiments, the module that we used underestimates the proportion of adults consuming 5 or more servings of fruits and vegetables each day [*20*], however our findings of low consumption of fruits and vegetables underscore the need to develop cost-effective dietary approaches in the Persian Gulf region.

In an American report, adults aged ≥ 18 were recommended to participate in a minimum of 30 minutes of moderate-intensity physical activity on most days of the week [*21*]. The majority of people in the United States of America do not comply with this recommendation: in 2001 and 2003, more than half the adults did not participate in physical activity at the recommended level [*22*]. In comparison, only around 29% of our participants from the northern Persian Gulf reported physical activity that met or exceeded recommended levels of physical activity, using the 2002

questionnaire. This was based on self-reported data and is subject to recall bias, but the low prevalence of physical activity is consistent with the reported 70%–80% physical inactivity in a previous national study [*23*].

In the mid-1980s, the WHO MONICA Project sampled 48 populations for cardiovascular risk factors. In all but one male population (China) and in most of the female populations, 50%–75% of adults aged 35–64 years were overweight or obese [*24*]. This can lead to metabolic changes and raise the risk of noncommunicable diseases, including heart disease and type 2 diabetes [*25*]. Even in developing countries, the adverse health consequences of overweight and obesity have begun to replace undernutrition and infection as the main causes of early death and disability. In our study of adults ≥ 25 years in the northern Persian Gulf, prevalence of overweight/obesity was 37.6%.

Since the introduction of the Minnesota code, several epidemiological studies have concentrated on estimating prevalence of ECG abnormalities in a standardized way. A high prevalence of ECG-based possible ischaemia (IHD ECG) (12.3% for women and 7.5% for men) was reported from an urban population in Isfahan, central Islamic Republic of Iran [26]. We also found a high prevalence of IHD ECG in 10.4% of male and 14.7% of female participants. These rates are higher than other countries in Asia [*27–31*] and are comparable with those reported from industrialized countries [*31*]. These findings indicate that there is a high prevalence of coronary artery disease among the Northern Persian Gulf population.

A small number of population-based studies have reported the association of ischaemic findings in ECG and CVD risk factors [*30,32*]. In the Belgian study, regarding the influence of lifestyle characteristics on prevalence of ischaemia-like ECG changes, significant associations were observed for obesity and diabetes [*32*]. Electrocardiographic IHD evidences in the Japanese study were predominantly associated with blood pressure level in both sexes [30]. One of the strengths of both the present study in the northern Persian Gulf and the Belgian study was the ability to relate association of ischaemia-like ECGs with lifestyle characteristics. Our study showed that IHD ECGs evidence was predominantly associated with current and/or past smoking in both sexes, and truncal obesity in men and obesity in women. In multiple logistic regression analysis, hypertension and diabetes were independently associated with IHD ECGs in both sexes and low HDL cholesterol in women.

Our findings indicate that unhealthy lifestyle patterns for CVDs which occurs very frequently among the northern Persian Gulf population have a significant association with nonfatal ischaemic heart disease by electrocardiogram criteria.

Overall, the results of Phase 1 of the PGHHS, provide regional and province-wide prevalence data on behavioural risk factors which could be used for strategic planning in prevention of atherosclerosis at local, regional and national levels to combat the epidemic of CVD in the northern Persian Gulf region.

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An identity-based model for adolescent health in the Islamic Republic of Iran: a qualitative study

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نموذج مستند إلى الشخصية لصحة المراهقين في جمهورية إيران الإسلامية: دراسة كيفية

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الخلاصة: أجرى الباحثون هذه الدراسة على 52 مراهقاً في طهران للتعرُّف على وجهات نظرهم حول الصحة، واستخدموا الأسلوب المرتكز على النظرية مع طريقة تحليلية للمقارنة الثابتة. واتضح أن الشخصية متغير أساسي شأنها في ذلك شأن المودَّة، والتعليم، والانتماء إلى أسرة، وغياب الحواجز والمجتمع. وأن لها تأثيرها على صحة المراهقين في ما يتعلق بالمفاهيم المستجدة. ويعتقد المشاركون في الدراسة أن العوامل النفسية الاجتماعية المتعلقة بالصحة أكثر أهمية من العوامل الصحية الجسدية والفردية. ومن هنا، فإن الرعاية الاجتماعية والأسر التي يتمتع أفرادها بالصحة، والمودَّة، ورعاية السمات الفردية لدى المراهقين، هي عوامل ذات أهمية كبيرة في صحة المراهقين.

ABSTRACT We conducted this study on 52 adolescents from Tehran to investigate their perspectives on health. We used the grounded theory approach and the constant comparison analysis method. Identity emerged as a core variable along with the concepts of friendship and relationships, education, family, lack of limitation and community. Identity affects adolescents' health regarding the emerged concepts. Participants believed that psychosocial health-related factors were more important than physical and individual health factors. Therefore, social welfare, healthy family/friendship, and caring for adolescents' individuality are important for healthy adolescence.

Modèle fondé sur l'identité appliqué à la santé de l'adolescent en République islamique d'Iran : étude qualitative

RÉSUMÉ Nous avons conduit cette étude auprès de 52 adolescents de Téhéran afin d'analyser leur conception de la santé. Nous avons utilisé le principe de la théorie enracinée (*grounded theory*) et la méthode de l'analyse comparative constante. L'identité est apparue comme une variable fondamentale, de même que les concepts d'amitié et de relations, d'éducation, de famille, d'absence de limites et de communauté. Elle a une incidence sur la santé des adolescents du point de vue des concepts identifiés. Les participants estimaient que les facteurs psychosociaux liés à la santé étaient plus importants que les facteurs sanitaires physiques et individuels. Par conséquent, la protection sociale, une famille/des amis bien portants et l'attention accordée à l'individualité des adolescents sont essentiels pour garantir une adolescence en bonne santé.

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Introduction

Adolescence plays a fundamental role in both human and community development. The main health risk factors for adolescents are unsafe sexual behaviour, addiction, motor vehicle accidents, mental health problems, suicide [*1*] and increasing unemployment, which they may encounter in their future [*2*].

In a study of Finnish adolescents' subjective well-being and realized values, most of the respondents were satisfied with life. However, 25% worried about money and 17% were unusually tired [*3*]. The effective role of community health centres in providing preventive care to adolescents has been reported in an analytical study [*4*]. There has also been research in other areas of adolescent health such as violence [*5*]. Regarding physical health, it has been shown that overweight and obese adolescents had worse self-reported health than those of normal weight [*6*].

Reproductive health is a further area of importance. A Taiwanese study employed qualitative research to find strategies for resolving adolescent pregnancy. The researchers suggested enhancing the understanding and participation of parents, church and schools on sex education [*7*]. An investigation on sexually transmitted diseases (STD) among adolescents found higher risk in females, black teenagers whose mothers had a lower level of education, and those with prior STD infection [*8*].

A significant amount of research has been carried out on different aspects of adolescent addictive behaviour and the effect of advertising, taxes and peer pressure [*9–12*].

The Islamic Republic of Iran, with 15 million adolescents, is one of the youngest countries in the world. The National Youth Organization studied the situation of 75 000 Iranian youth in a national survey. Good educational improvement and social commitment were reported, however, 51% of the sample did not have appropriate life skills. Thinking of the possibility of unemployment in the future and the difficult university entrance examination also increased their problems [*13*]. In a study conducted in Shiraz in the south-east of the country, 25.4% of high-school students smoked, 9.6% drank alcohol and 3.5% used opium [*14*]. Adolescents, therefore, are an important group in the country, with significant problems which need to be studied. So far, however, few studies have been carried out on their health and even fewer on their perspectives on health using qualitative methodology.

The aims of this study were to gain an understanding of adolescents' perspectives on health and to develop a categorical model for adolescent health.

Methods

A qualitative approach was employed to allow the researchers to explain adolescents' perspectives on health. Data were analysed using the grounded theory method: this has been important in developing nursing knowledge and explaining nursing phenomena [*15*]. The primary purpose of using this approach is to generate a comprehensive explanation of phenomena that are grounded in reality [*16*]. It was selected as our research method because health is an interdisciplinary and multidimensional concept within the social context in different individuals, groups and societies. Health has emotional, political, cultural, economic, educational and biological dimensions [*17*].

Adolescents aged 11–19 years were approached in a number of different places

such as schools, sport clubs, the home and parks in randomly selected areas of Tehran, which covered neighbourhoods of a variety of socioeconomic levels. The researcher explained to each participant the research goals and the interview guide questions, and an appointment was made for the time and place of interview. There were no refusals to participate in the study.

The guided questions were: How do you view your health as an adolescent? What factors affect adolescents' health? Who is a healthy adolescent? Additional points raised by the participants helped researchers to develop the interview guide over time. The semi-structured, focused interviews were conducted in 1–3 sessions taking an average of 70 minutes. They were audio-taped and transcribed as fully as possible. Data were collected and analysed during an 11-month period from mid-2003 until data saturation, i.e. until no additional data were found for development of the properties category. When one category is saturated, nothing remains but to go on to a new group for data on other categories [*18*]. The categories became saturated after the 52nd subject was interviewed and the codes added to the analysis.

The analysis process included open coding, axial coding, and selective coding. Constant comparison analysis and theoretical sampling were also used in the data analysis process. Open coding is a process that requires line-by-line scrutiny of the data to identify key words, phrases or themes. In this stage, 840 key words, which reduced to 96 themes, were refined after several readings of the transcripts. The last 96 themes were categorised and labelled in 5 categories.

In selective coding (the third phase), categories and subcategories were systematically linked with the core. Through the in-depth data collection and constant comparative analysis, identity emerged as the core category through the process of linking among categories. This concept came up repeatedly in the interviews and was therefore a referral category. It can also be generalized to other categories and create linkages among categories [*19*].

Identity, as core variable, had multiple linkages among the concepts. The process of data collection is controlled by the emerging theory. The core becomes a theoretical guide to the further collection and analysis of data. Therefore, emerging categories and the main category (identity) led the researcher toward interviewing several key informants in late adolescence who provided rich data about identity (theoretical sampling).

Rigour

Credibility and consistency were confirmed through several methods. First, the evolving results were discussed continuously among the authors. A second review of the transcripts, codes and grouped codes, concepts and designed relationships was carried out by a number of colleagues as a peer check and some of the participants as a member check. This was then also checked by 5 adolescents who had not participated in the survey to verify the fitness of the results. Through the variation in sampling, the opportunity was offered to adolescents from different socioeconomic backgrounds to describe the factors that affect their health. Quotations were used to illustrate participants' key points. Finally, prolonged engagement with the adolescents and their circumstances enabled the investigator to gain the participants' trust and obtain deeper and more reliable data.

Ethical considerations

Ethical approval was obtained from the Nursing Faculty Research Committee at

Tehran University of Medical Sciences. Permission for interviews and recording was obtained from both the Area School Organization Chief Executive Officers and school principals when required. All of the adolescents were informed of the purpose and design of the study and that participation was voluntary with concern for confidentiality and anonymity. Verbal consent was given and also audio-taped. To protect privacy, interviews were conducted with the participation of only the interviewer and the interviewee.

Results

The participants consisted of 52 adolescents aged 11–19 years, with equal numbers of males and females. Thirty (58%) were 17–19 years old, 14 (27%) were 14–16, and 8 (15%) were 11–13 years. In terms of education, 5 (10%) were university students; 47 were in school, 26 (50%) in high school and 21 (40%) in guidance school (years 6–8 in the Iranian education system). On average, participants had completed 9 years of schooling. Four participants (8%) (all males) were employed, 2 (both females) were married.

Five concepts and the core variable, with 2 dimensions each, emerged through constant comparison analysis. These are presented in Table 1. The following section explains these dimensions.

Table 1 **Main concept, core variable and their dimensions emerging from analysis of adolescents' perspectives on health**

Concept	Dimension
Community	Contrast Obedience
Friendship and relationships	To be accepted To be dependent
Education	Worries Hopes
Family	Individuation Nurture
Lack of limitation	Trial Error
Identity (core variable)	Identity formation Emergence of identity

Community: contrast and/or obedience

The importance of community was emphasized by all the participants. Furthermore, according to the their views, despite all their useful applications, the Internet, satellite television, films and CDs teach a variety of behavioural patterns that are contradictory to Iranian culture and religion. Unemployment and the availability of cigarettes, alcohol and narcotics in society were challenges to adolescent health. Feeling healthy in a caring community means that people can attain their goals and adolescents are able to develop their identity.

"Contrast" (the opposite of obedience) is found in an unhealthy community and this means "protest by doing wrong in order to find oneself". On the other hand, "obedience" is another dimension reflected in an unhealthy community. This was another dilemma for adolescents: "ignore oneself, one's identity, and obey wrong norms".

Friendship and relationships: to be accepted or to be dependent

Friendship/relationships is one of the main concepts in relation to adolescent health, and almost all our participants mentioned it one in way or another. To be accepted, based on the participants' perspectives, meant "join peers", "independence from the family", "to gain personhood" and "to

be identified as an adult". In contrast, being dependent (on the family) equates with not being accepted by friends or "being counted as a kid".

Friends were considered more influential than parents although the participants talked about some of their experiences of undesirable behaviours (smoking, drinking, playing hookey, and exchanging inappropriate, forbidden films) and seldom mentioned the positive effects of friendship. Being accepted by their peers was extremely important for adolescents; in other words it was independence from the family. Therefore, they sometimes started smoking and drinking and continued doing so to be identified as a member of the group and pretend independence. As 1 participant said "we usually start smoking after friends offer and are forced to continue because of our friends' persistence".

Education: worries and hopes

Education, with the dimensions of worry and hope, has been emphasized in relation to adolescent health. Worry could also affect their identity. Examples given of adolescents' worries acting against the development of their identity were "school authorities and repeated dos and don'ts" and "being fed up with school regulations". They also experienced "anxiety", "nothingness", "disappointment through the difficult and exhausting university entrance exam" and the enforced major subjects. Participants revealed that sometimes they chose their majors based on their parents' wishes, social preferences or job markets, and not their own talents and interests.

In contrast, their hopes included planning and provision of educational facilities with regard to students' talents, expert teachers as role models, higher education as a job prerequisite, and education that prepared them to be ready for real life. Informing adolescents about the dangers of smoking and addiction was considered one of the responsibilities of educational media, "The most important thing is being aware about smoking. The schools teach us lots of useless things but not the useful and necessary points."

Family: individuation or nurture

The participants emphasized effective familial factors on health. Individuation could be a result of some familial factors which helped adolescents' identity. Family induces a sense of being understood, being respected and personhood; thus the "adolescent child could be identified as a perfect man". In contrast, some parents who are excessively nurturing may inhibit adolescent health. These parents "highly protected adolescents as if they were little kids" and "cared too much about clothes, food and education but not adolescents' emotional needs." The participants complained about parents' repeated dos and don'ts. These were challenging for adolescents with normal independence-seeking behaviours. The family can have a negative effect on the health of adolescents by not regarding them as independent individuals.

Communication problems between adolescents and their parents were important challenges in the individuation and nurture dimensions. This is caused by a widening gap between the generations. Communication problems create feelings such as "a sense of loneliness", "not having been guided by parents", and "less participation in family activities". Adolescents expected of their parents such things as good communication, learning life skills and growth of self-esteem: "If parents trust their children, the trust will grow both ways and the children will also talk to their parents and won't hide things so much."

Lack of limitation: trial and error

Lack of limitation was important to the participants; trial and error helps them to find themselves as complete individuals. Not being limited had a vital role in the formation of identity in adolescents. Owing to the emergence of independence-seeking characteristics among adolescents, they believed that they could achieve a more perfect self through freedom, even if this meant making errors which they would later regret. Many of the participants, especially females, who had experienced more restrictions, could recall when they sensed limitation. They revealed a sense of not being respected through limitations at home, in the school and the community because of differences in viewpoint and the generation gap. One of the participants said, "Adolescents know that such shackles as religion, tradition, morality, and social norms could guarantee adolescents' health relatively, but we want to try everything."

Core variable: identity formation and emergence of identity

Identity became apparent as a major avenue through which adolescents maintained their health through living in a healthy community, accepting friendships, effective education, living in a family respecting individuation, not being limited, and developing their identity.

Identity was a special concept which was revealed by the participants in different ways, e.g. goal attainment through social facilities, materialization of wishes, enjoyment and satisfaction with activities. They considered social problems such as poverty and availability of drugs detrimental to both their health and their identity, and factors such as the following could develop their identity: affecting instead of being affected, performing important tasks, being the centre of attention, smoking and having girl-friends (for boys), taking risks and having a tendency towards wrong-doing. The importance of identity in adolescents is such that it causes them to be identified with these very features: "I felt perfectly healthy when I was so important and could have a determining role for others".

Discussion

Different methods were used to increase the credibility and the conformity of the results. Through maximum variation of sampling and constant comparison analysis, a variety of different adolescents were interviewed, and the categorical model that arose seemed consistent across adolescents. Peer check and member check showed more than 90% of the codes in common. We also tried to interview adolescents of different socioeconomic status regarding pluralistic diversity. However, the findings may not be generalizeable to other adolescents.

More in-depth data and a better-fitting model may have emerged using a same sex interviewer and narrowing the participants into special age groups (early, middle or late adolescence). In this study a female investigator carried out all of the interviews regardless of the participants' sex and the period of adolescence which they were in. Furthermore, the data were generated from adolescents who participated voluntarily; this may not reflect those who refused to participate—neither their characteristics nor their health perspectives were known.

We found that adolescents' health factors were undergoing changes to identity-oriented factors through main concepts. Identity as the core variable of this study interacts with adolescents' health and also with the 5 concepts mentioned. Community was the most important field for the participants. It also had a wider

range, superior position and interactional connections with the main concepts of identity and adolescents' health.

The community

Our findings indicated that a healthy community is related to adolescents' health. This seems congruent with studies on the health of elderly Iranian emigrants. It was found that cultural meaning and practices are not static or monolithic. Life context also influences health-and-illness-related perceptions and experiences. Furthermore, Cowley in a grounded theory study on nurse health visiting perspectives suggested that positive health is promoted within a broad, acceptable sociocultural context [*20*]. Community heath was important in our participants' view. Drug availability, because of the geographical situation and being in the drug transition path, and the unemployment problem were the main reasons for their panic. This, combined with unemployment, could threaten both adolescents' health and adolescents' identity. Having a job in the future was a prerequisite for health in our participants' viewpoints. However, to have money [*21*] to be well paid and to have a respected job [*3*] were valued for adolescence health in other studies.

Friendship and relationships

Friendship, with the dimensions of acceptance or dependency, was another concept. The participants stated that their health was affected by their friends in different ways. In contrast, in a 2000 study, a mutual relationship with friends was not found to be a predictor of adolescents' global well-being [*3*]. Accordingly, recreation, music, clothing and expenses will be affected by peers. Moreover, adolescents' psychological liveliness helps them acquire a better identity in peer groups [*22*]. Although there are some public education programmes in the media and schools, neither adolescents nor parents have enough experience to manage a healthy transition using the positive role of friendship. As a result, some parents continue protecting their adolescent children from undesired consequences of friendships. However, some social changes such as changing families from extended to nuclear families, mothers' employment, modernity and urbanization, could increase the role of peers, thereby decreasing the role of the family.

Education

Education forms the bulk of participants' worries and hopes. Our findings indicated that school was among the factors affecting adolescents' self-esteem and their identity. These findings are similar to those of the McFeely study [*23*], which found that there was a positive relationship between school satisfactions on the one hand, and total life satisfaction, self-esteem and better healthy behaviours on the other hand. In contrast, examination stress, competition, excessive homework and school regulations may cause adolescent depression and anxiety [*24*]. Adolescents have said that they are afraid of facing daily problems, and are dependent on and even addicted to their families' advice and encouragement. This is caused by the teacher-centred education, which ignores problem-based learning. Therefore, health education in different areas, education regarding knowledge and prevention of addiction, say-no skills, teaching and the other fields considered necessary and important in adolescents' health tasks were all emphasized by the participants. Similarly, schools are expected to educate regarding globalization, increasing use of satellite and the Internet, and social situations such as the transition from tradition to modernity.

Family

Family also had a strong influence on adolescent' behaviour and reducing risky behaviour in this age group. Independence is one of the developmental changes seen in adolescence. In contrast, "becoming depressed" and "feeling unhealthy" were revealed as consequences of limitation. Adolescents complained about their parents in relation to limiting them and ignoring their ability to make decisions and choices. The sense of limitation and intergenerational differences to establishing identity were also reported by Canadian adolescents [*21*]. These challenges between adolescents and parents are common in adolescent research literature [*25,26*]. It has been reported that the respondents who perceived the parental relationship in the family to be moderate or poor felt lower satisfaction, lower self-esteem and a more depressive mood than those who reported a good parental relationship [*2*]. Parents need more knowledge and skills regarding adolescent health in a changing world. The appropriate parent–child relationship and parents' expectations should be reviewed through the notion of the modern changing world.

Lack of limitation

Lack of limitation was a common concept of trial and error. These limitations need more awareness and tolerance with regard adolescents instead of restricting them as the simplest method of discipline. This was revealed as a prerequisite for healthy adolescence. The link between a sense of not being limited and being healthy has also been shown in a phenomenological study by Haggman-Laitila using other words. Health was defined as an individual way of existence, an independent coping, a control of lives fully and autonomously, and a right to disclose oneself as one wants [*27*]. Senderowitz also considered that limitations could affect adolescents' identity formation. To acquire a new and independent identity and gain more freedom are among the reasons why adolescents start risky behaviour [*25*]. Unlike Rosenbaum and Carty's study that found religion was only occasionally mentioned as an important value by Western adolescents, this was highly valued by many of our participants. There is a great difference between adolescents' views and those of parents and school authorities. The gap, which is due to the characteristics of this transitional period and to their access to such media as computers, the Internet, and satellite TV, has made adolescents feel limited [*21*].

According to our participants, the rejection of these religious and cultural shackles, a negative outcome of globalization and the price of modernity, can be challenging for adolescents' families and societies. Similar to our finding in this area about the effect of modernity changes on adolescents' health, Tsai and Wong found the same phenomenon in their qualitative study. They reported that a fast rising society, widening gap between generations, insufficient communications, weakening family bonds and cultural changes were the cause behind adolescent pregnancies in Taiwan [*7*].

Identity

Identity was the core variable in this study and was related to other variables and adolescent health. Adolescents have different understandings of identity, freedom and democracy at different stages of development. The most important aspects of decision-making and the right to choose in this period are the right to choose one's friends, school, and field of study. As they grow up, adolescents are inclined towards their right to choose social variables such as voting [*28*]. Clothes, hair and music were

metamorphoses for adolescents gaining identity [*21*].

There are some useful considerations in adolescents' health. Firstly, informing parents of adolescents' developmental process and of behaviours appropriate for this process can bring about the desired identity. Secondly, adolescent participation in social affairs can also help stabilize their identity. The symbolic move of the Ministry of Education to establish a students' parliament, and school mayors who encourage participation in school affairs are but 2 examples [*29*]. Thirdly, the availability of satellite television and the Internet can play a role in destroying national identity. Of course, it is not limited to our country. The opponents of globalization criticize this phenomenon more than others, i.e. subcultures which lack information technology (IT) are gradually dissolved into cultures having IT. The participants' comments showed the importance of being fashionable, with their patterns taken from the satellites and/or the Internet.

Conclusion

Understanding the views of adolescents can enhance their health during this period. Different understandings of the concept and process of health and their related needs have been shown this study. The participants emphasized the importance of identity and its role in their health. Cultural factors, globalization and social changes were also important for understanding, and to maintain and enhance adolescent health.

As a result, the interdisciplinary efforts among families, health, industry, education, and economics could be directed towards the following areas:

- concern about adolescents' participation which can enhance their personhood,
- strengthening religious beliefs, and also the holy basis of the family,
- preparing safe and healthy friendship through adolescence period,
- improving the economic conditions and increasing the job opportunities, social welfare services for more recreational facilities,
- creating the appropriate culture for making use of international media and the Internet,
- enhancing public knowledge, especially that of parents about changes and risk factors in adolescents.

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Effect of a health promotion course on health promoting behaviours of university students

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أثر دورات تعزيز الصحة على السلوكيات المعزِّزة للصحة لدى طلاب الجامعات

إنصاف ألتون

الخلاصة: كان الهدف من هذه الدراسة الارتيادية التي جرت في تركيا التعرف على أثر دورة تدريبية حول تعزيز الصحة، في تقوية أنشطة الرعاية الذاتية والسلوكيات المعزِّزة للصحة لدى طلاب جامعة كوجا ألي. وقد شارك 41 طالباً من كلية الهندسة المدنية في دورة نظمتها الباحثة واستغرقت 15 أسبوعاً وتضمنت 30 ساعة من المحاضرات داخل الصفوف الدراسية. وقاست الباحثة النجاح التعليمي باختبارات تداخلية سابقة ولاحقة للدورة، باستخدام سلم قياس أنشطة الرعاية الذاتية وسلم قياس المرتسم الثاني لأنماط الحياة المعززة للصحة. وبعد انقضاء الدورة لاحظت الباحثة ازدياداً ملحوظاً في أحراز أنشطة الرعاية الذاتية والسلوكيات المعززة للصحة بين طلبة الجامعة. وقد أظهر الطلاب ذوو الأحراز المنخفضة قبل الدورة، أعلى مستويات التقدُّم بعدها.

ABSTRACT The purpose of this pilot study in Turkey was to determine the effects of a health promotion course on enhancement of self-care agency and health-promoting behaviours of University of Kocaeli students. A group of 41 civil engineering students attended a 15-week course developed by the investigator, which included 30 hours of classroom lectures. The success of the education was measured by pre- and post-intervention tests using the Exercise of Self-care Agency scale and the Health Promotion Lifestyle Profile II scale. After the course, the self-care agency and health-promoting lifestyle scores of the university students increased significantly. University students with the lowest scores before the course displayed the most progress after the course.

Effets d'un cours de promotion de la santé sur les comportements des étudiants propices à la santé

RÉSUMÉ L'objectif de cette étude pilote menée en Turquie était de déterminer les effets d'un cours de promotion de la santé sur l'amélioration de la capacité d'auto-soins et le renforcement des comportements favorables à la santé des étudiants de l'Université de Kocaeli. Un groupe de 41 étudiants en génie civil a participé à un cours de 15 semaines mis au point par le responsable de l'étude et comprenant 30 heures de cours magistraux. La réussite de l'enseignement a été mesurée par des tests réalisés avant et après le cours sur la base de l'échelle ESCA (*Exercise of Self-care Agency*) et de l'échelle HPLP II (*Health Promotion Lifestyle Profile II*). À la fin du cours, les scores des étudiants en ce qui concerne la capacité d'auto-soins et les modes de vie favorables à la santé ont augmenté de façon significative. Les étudiants ayant réalisé le plus de progrès étaient ceux dont les scores étaient les plus faibles avant le début du cours.

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Introduction

Reducing health risks and improving health will increase longevity, improve quality of life and reduce health care costs. Today, therefore, increasing emphasis is placed on health promotion, wellness and self-care. Health promotion includes the facilitation of an individual's potential and energy use, an improved quality of life, productivity and use of one's abilities regarding health. For the health of future generations, young people deserve the attention of public health professionals. Increased understanding of health practices and greater efforts toward promoting healthy behaviours and well-being among young adults are essential [*1–3*].

Young people represent the future of families, communities and nations [*4*]. They are at a dynamic transition period of growth and development characterized by rapid, interrelated changes of body, mind and social relationships [*5*]. At this stage of physical, psychological and sexual development, young people gradually assume responsibility for their own health [*2*]. Adolescence and young adulthood are critical periods in the development and stabilization of health and risk behaviour [*4*]. Data have shown that universities contribute to the promotion of an individual's health [*1*]. Unhealthy practices and behaviours formed in college and university can have a sustaining impact on health in later life [*2,4*]. Adjustable unhealthy habits, such as inadequate nutritional intake, rest, and exercise are common among university students. There is a need for health education programmes that will change their behaviours and lifestyles and impart knowledge about how to improve their health [*2,4*]. However, young people are considered to be at a relatively healthy stage of life and, as such, are not viewed as a priority in health promotion efforts throughout the world [*4*]. Promotion of healthy behaviours among young people is therefore neglected.

Universities are establishments where knowledge acquisition is encouraged and skills are taught. The stage of being a university student is a transition period from adolescence to adulthood. Adolescents and youths often live and study at university for approximately 4–5 years. It is therefore a significant time in their lives [*6*]. It has been shown that unhealthy habits exist among college and university students [*2*]. Furthermore, other research has indicated that there is a strong need for health education promotion in the university setting [*1*], and that university-based health promotion programmes could have a substantial effect on students' knowledge, behaviours and lifestyles [*1,7,8*].

Promoting self-responsibility during college and university years can set lifelong positive health habits. Young people experiment with and form many of their behaviours and lifestyles during this period. They should be encouraged to take responsibility for their personal health and well-being [*9*]. Educating students about health promotion and self-care can be expected to increase their self-care abilities and promote health-improving behaviours such as increased physical activity, nutritional food choice and regular sleep habits. Those who have these qualities adapt to their environment better. They create healthy lifestyles, which in turn create a more pleasant work environment. They present themselves in a manner that promotes a positive image of health. Consequently, it has been suggested that these individuals function as change agents in health promotion [*10–13*].

One of the most important ways to promote health is to improve the self-care agency of an individual and this may

be achieved through health education. According to Whitehead, health education is an activity that seeks to inform the individual about the nature and causes of health/illness and that individual's personal level of risk is associated with his/her lifestyle-related behaviour [*14*]. Health education seeks to motivate the individual to accept a process of behavioural change through directly influencing their values, beliefs and attitudes, especially when an individual is at risk or has already been affected by illness/disease or disability.

The objective of this study in Turkey was to identify the effect of a health promotion course on enhancement of health promoting behaviours of students at the University of Kocaeli. The study examined the effects on self-care agency and health-promoting lifestyles of an elective health promotion course included in the curriculum of civil engineering students.

Methods

The study was quasi-experimental. The design of the study was a single group pre–post intervention test to determine the effect of a health promotion course on university students. It was conducted in the civil engineering faculty at the University of Kocaeli, Kocaeli, Turkey. The 15-week, 30-hour health promotion course (2 credits) is scheduled as an elective course in the 2nd semester of the 2nd year and is required for graduation. The health promotion course was delivered by the researcher.

The study group was 41 civil engineering students from the University of Kocaeli enrolled in this course for the year 2004–05. All agreed to participate in this research. The study protocol was approved by the school administration and written permission was obtained.

The content of the classroom lectures encompassed the following: definition and purpose of health promotion; human concept; health promotion throughout the lifespan; environment concept; universal self-care; health and disease concepts; healthy lifestyles; hygiene self-care; nutrition for healthy humans; sleep and rest; healthy sports and yoga; health responsibility; stress management; developing of interpersonal relationships; and performance enhancement and problem-solving. Teaching methods included lectures taught by the instructor, group discussions on individual experiences, demonstrations and instruction with video.

Data were collected by questionnaires that were applied before and after the course. A questionnaire form collected data about sex and age of the student. The Exercise of Self-care Agency (ESCA) and the Health Promotion Lifestyle Profile II (HPLP-II) scales were used. Before the start of the course in the spring term, university students were asked to fill out the 2 scales (pre-intervention test). The scales took about 20 minutes to complete. Approximately 4 months later, following the health instruction course, the 2 scales were reapplied (post-intervention test). The research period was from February to May 2005.

The ESCA scale was developed by Kearney and Fleischer in 1979 [*15*]. The scale is the most commonly used among those that were developed after the introduction of the concept of self-care agency. It includes 43 statements that evaluate attitudes of responsibility for self; motivation to care for oneself; application of knowledge to self-care; the valuing of health priorities; and self-esteem. The scale was translated into Turkish in 1993 by Nahcivan and its reliability and validity has been established [*16*]. There are 35 statements in the Turkish version of the scale. It is 5-item Likert scale with scores from 0 to 4. "Very uncharacteristic of me" receives 0

point, "Somewhat uncharacteristic of me" 1 point, "No opinion" 2 points, "Somewhat characteristic of me" 3 points and "Very characteristic of me" 4 points. In some statements, scores are reversed and scored as 4, 3, 2, 1 and 0. There are no sub-groups for the scale, and evaluations are performed according to the total score. The highest overall score is 140.

The HPLP-II scale was developed by Walker, Sechrist and Pender in 1987 [*9*]. The scale measures health promoting behaviours conceptualized as a multidimensional pattern of self-initiated actions and perceptions that serve to maintain or enhance a level of wellness, self-actualization and fulfilment of the individual. The scale was translated into Turkish in 1998 by Esin and its reliability and validity studies are complete [*17*]. There are 48 statements in the Turkish version of the scale and 6 subscales. The health promoting behaviour subscales are as follows: health responsibility; physical activity; nutritional habits; spiritual growth; interpersonal relations; and stress management. Health responsibility is about the importance of improving one's health and the health of the others; physical activity includes adhering to regular exercise patterns; nutritional habits include establishing meal patterns and making food choices; spiritual growth includes attaining self-actualization and fulfilment; interpersonal relations deal with maintenance of relationships involving a sense of intimacy and closeness; stress management includes both recognizing the sources of stress and taking action to control stress and achieve relaxation. The scale is of a 4-point Likert-type and there are 4 choices for each statement, scored from 1 to 4. "Very uncharacteristic of me" receives 1 point, "Somewhat uncharacteristic of me" 2 point, "Somewhat characteristic of me" 3 points and "Very characteristic of me" 4 points.

The data were evaluated and analysed with descriptive and inferential statistics as percentages, means, standard deviation (SD) and analysis of variance.

Results

Of the 41 civil engineering students who volunteered to participate in the study, 6 (14.6%) were women. The mean age of the sample was 20.7 years (SD 1.05; range 19–23 years).

The students' scores overall on the 2 scales improved after completion of the course. The ESCA scores of university students before and after the health promotion course are shown on Table 1. The mean ESCA scores were 89.43 (SD 20.62) before the health promotion course and 94.17 (SD 18.24) after the course, a 5-point increase. The difference was statistically significant ($t = –2.17$, $P = 0.05$).

The total scores of the 6 subscales of health promoting behaviours were calculated by adding the 4-point Likert scale scores for all items within each subscale. The total score was calculated as the sum of all subscale scores. Generally higher scores indicate more health-promoting behaviours. Table 1 compares the 6 subscale scores on the HPLP-II before and after the health promotion course and shows significant differences using the *t*-test.

Before the course, the mean for the total HPLP-II was 114.12 (SD 18.52), which increased 11 points after the course to 125.00 (SD 20.50). The difference was statistically significant ($t = –4.858$, $P < 0.001$). Students' scores increased significantly on the post-intervention test in the 4 categories of health responsibility, physical activity, spiritual growth and stress management (Table 1).

Before the course, the mean score of university students on the HPLP-II subscale

Table 1 **Difference in pre- and post-intervention tests on the Exercise of Self-care Agency (ESCA) scale and the 6 subscales of the Health Promotion Lifestyle Profile II (HPLP-II) scale for university students (*n* = 41)**

Variable	Pre-intervention		Post-intervention		Paired *t*-test	*P*-value
	Mean score	SD	Mean score	SD		
ESCA						
Total (35 items)	89.43	20.62	94.17	18.24	–2.17	0.03
HPLP-II						
Total (48 items)	114.12	18.52	125.00	20.50	–4.858	< 0.001
Health responsibility (10 items)	16.92	4.82	20.12	5.29	–3.992	< 0.001
Physical activity (5 items)	10.31	3.57	11.24	3.64	–2.256	0.03
Nutritional habits (6 items)	15.75	10.89	14.46	3.72	0.430	0.669
Spiritual growth (13 items)	35.92	5.75	39.14	5.99	–3.677	0.001
Interpersonal relations (7 items)	19.17	3.76	20.24	4.43	–1.797	0.080
Stress management (7 items)	17.58	3.54	19.12	4.25	–3.134	0.003

SD = standard deviation.

"Health responsibility" was 16.92 (SD 4.82), and after the course increased 4 points to 20.12 (SD 5.29). The difference was statistically significant ($P < 0.001$). The mean score on the "Physical activity" subscale also increased significantly from 10.31 (SD 3.57) to 11.24 (SD 3.64) ($P = 0.03$). The mean score on the subscale "Spiritual growth" increased 4 points from 35.92 (SD 5.75) to 39.14 (SD 5.99) ($P = 0.001$) and the "Stress management" subscale increased 2 points from 17.58 (SD 3.54) to 19.12 (SD 4.25) before and after the course ($P = 0.003$).

The mean score on the HPLP-II "Interpersonal relations" subscale increased slightly before and after the course from 19.17 (SD 3.76) to 20.24 (SD 4.43), but the difference was not statistically significant ($t = –1.797$. $P = 0.080$).

A slight decrease was seen in the mean scores on the HPLP-II subscale "Nutritional habits" from 15.75 (SD 10.89) before the course to 14.46 (SD 3.72) after the course, but the difference was not statistically significant ($t = 0.430$, $P = 0.669$).

Discussion

This pilot study aimed to evaluate the efficacy of a health promotion course on university students by examining their self-care agency and health-promoting behaviours before and after the course. Following the health promotion course, there was an increased average score for items on the ESCA scale. The course was expected to increase the self-care abilities of students. The results of this study are similar to findings reported by Hartweg and Metcalfe [*18*], Altun et al. [*19*] and Hsiao et al. [*3*]. The study by Altun et al. showed that nursing students who give high priority to independence also have firm self-caring abilities. In the same study, those with an appreciation of aesthetic value were seen to have high self-caring abilities.

Consequently, it has been suggested that they function as change agents in health care. Those who have these qualities adapt to their environment in a way so as to please their patients and create a pleasant work environment for themselves and others [*20*]. After completion of the nursing curriculum, analysis of covariance on post-intervention test mean scores indicated that nursing students had significantly higher self-care scores. It may be stated that health education given to the university students enhances their self-care agency and that health education is more beneficial for those who have had less self-care agency [*19*]. Several research projects have incorporated Orem's self-care theory. Kearney and Fleischer developed an instrument to measure a person's exercise of self-care agency and administered it to nursing students in an associate degree programme and to students in 2 psychology courses [*15*]. The study concluded that people who exercise a high degree of self-care agency describe themselves as self-controlled, dependable, assertive, intelligent, confident, responsible, helpful and adaptable. Using self-care strategies to make lifestyle changes in the study of Timmerman included social support, tailoring strategies and self-monitoring [*21*]. This result suggested that health promotion education was significantly related to self-care agency in a young population.

Following the health promotion course, the HPLP-II scales overall showed an increased average score of the participants, indicating significant improvement in health promoting behaviours. The results show that the profiled students were more actively engaged in a total health promotion lifestyle. The HPLP-II scales include health responsibility, physical activity, nutritional habits, spiritual growth, interpersonal relations and stress management subscales. We observed a significant improvement in health responsibility and health promoting behaviours as a result of the health promotion course. The results of this study are similar to findings reported by Callaghan [*22*], Choi Hui [*23*] and Ecevit-Alpar, Şenturan and Sabuncu [*24*].

The students' weakest performance was on nutritional habits, which decreased slightly although not significantly. This finding is similar to that of other studies on baccalaureate nursing students [*24*] and university students in Hong Kong [*2*]. According to Lee and Yuen Loke, food consumption patterns of university students tend involve skipping meals and eating "fast foods" and snacks [*2*].

Students were also weak on interpersonal relations. This finding is similar to findings reported by Ulupınar [*25*] and Kaya [*26*] in İstanbul University. Students' lives are filled with adjustment problems, new responsibilities, study pressures and peer interactions and involvement. They often feel helpless under the burden of their roles and responsibilities and have a pervasive sense that they can do nothing to change the state of existing problems [6]. An education involving such a degree of problems also affects the interpersonal relations skills of the students. Therefore it is important to evaluate students' abilities in interpersonal relations and factors that influence interpersonal relations skills. Open discussion between students and instructors concerning issues of interpersonal relations may help students to process information about interpersonal relations. In addition, development of self-awareness will enhance their objectivity and problem-solving capacity.

For health responsibility, the median score of the HPLP-II was higher for knowledge on preventive health and healthy behaviour. Therefore, it may be concluded that in the university curriculum, health education is effective in enhancing the health

responsibility of individuals. This includes attending to and accepting responsibility for one's health and being educated about health and seeking professional assistance when necessary. When student health strategies begin to be applied, students will have sufficient and necessary knowledge and skills to protect and improve their health. As a result of this, they will place more importance on improving their health and the health of others. We also observed a significant improvement in health promoting behaviours such as adhering to regular exercise patterns, attaining self-actualization and self-fulfilment, maintaining intimate and close relationships, recognition of the sources of stress and taking action to control stress and achieve relaxation.

We observed a remarkable improvement in self-care behaviours and health promoting behaviours as a result of the health promotion course. We may confirm that a positive relationship exists between this course and the promotion of healthy behaviour in university students. Therefore, it may be concluded that health promotion education in the university curriculum is effective in enhancing the self-care agency of individuals and that health education is more beneficial for those who had less self-care agency. Therefore, each university should be encouraged to develop a health behaviour control and health promotion programme for their students. We recommend establishing this type of course as part of the regular university education.

We would like to state that the results of the study might not be reliable due to the small sample size. Additional advanced researches with larger groups are needed to obtain more affective and reliable outcomes. It is hoped that professional health educators and other practitioners will find this study data useful and will be able to build on these findings in their future research.

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Environmental noise in Beirut, smoking and age are combined risk factors for hearing impairment

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الضجيج البيئي في بيروت، والتدخين، عاملان أساسيان متداخلان يؤديان إلى فقدان أسرع للسمع مع تقدم العمر

إيلي الزير، صلاح منصور، باسكال سلامة، رامز شاهين

الخلاصة: تم بحث تأثير الضجيج البيئي والتدخين على فقدان السمع لدى 440 شخصاً من قاطني بيروت ممن تتراوح أعمارهم بين 21 و50 سنة. وتم تقسيم المشاركين إلى أربع مجموعات: غير المدخنين؛ والمدخنين الذين يعيشون في مناطق صاخبة (70 – 90 ديسي بل)؛ وغير المدخنين والمدخنين الذين يعيشون في مناطق هادئة (45 – 55 ديسي بل). فَوُجِدَ أن التدخين يصاحبه فقدان للسمع عند مستوى 8000 هيرتز وفقاً لتحليل المتغيرات الثنائية التفاوت والمتعددة التفاوت. كما ظهر تفاعل مترابط في الترددات العالية (غالباً عند 8000 هيرتز) بين التدخين، والضوضاء بعد سن الأربعين. أما في المجموعات العمرية من 21 إلى 39، فلم يلاحظ تأثير ضائر يُعتَدّ به إحصائياً للتدخين ولا للضجيج البيئي على السمع في الترددات المنخفضة.

ABSTRACT Effect of smoking and environmental noise on hearing impairment was investigated in 440 people aged 21–50 years living in Beirut. Participants were divided into 4 groups: non-smokers and smokers living in noisy areas (70–90 dBA) and non-smokers and smokers living in quiet areas (45–55 dBA). Smoking was associated with hearing loss at 8000 Hz, in both bivariate and multivariate analysis. An additive interaction at high frequencies (mostly at 8000 Hz) between smoking and noise appeared after age 40 years. At age 21–39 years, neither smoking nor environmental noise had a significant adverse effect on hearing capacity at low frequencies.

Le bruit ambiant à Beyrouth, le tabagisme et l'âge : des facteurs de risque combinés de déficience auditive

RÉSUMÉ Les effets du tabagisme et du bruit ambiant sur la déficience auditive ont fait l'objet d'une étude chez 440 sujets âgés de 21 à 50 ans vivant à Beyrouth. Les participants ont été divisés en quatre groupes : non-fumeurs et fumeurs vivant dans des quartiers bruyants (70-90 dBA) et non-fumeurs et fumeurs vivant dans des quartiers calmes (45-55 dBA). Le tabagisme était associé à une perte auditive à 8000 Hz, dans l'analyse bivariée comme dans l'analyse multivariée. Une interaction additive aux hautes fréquences (généralement à 8000 Hz) entre le tabagisme et le bruit apparaissait après 40 ans. Entre 21 et 39 ans, ni le tabagisme ni le bruit ambiant n'avait d'effet néfaste significatif sur les capacités auditives aux basses fréquences.

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Introduction

Prolonged or high intensity sound can injure the cell structures of the inner ear, and subsequently cause hearing threshold loss (HL). This can be temporary or can lead to permanent hearing impairment. Slight HL is often unnoticeable, but over time the losses add up and progress to hearing impairments that interfere with daily life. Symptoms of HL vary and may include tinnitus (ringing tone sensation) and muffled or distorted sounds [*1*].

While HL among elderly individuals is common, mostly due to presbyacousis as a normal process of ageing, HL among young people is less common and more frequently caused by a combination of genetic and environmental factors [*2,3*]. One risk factor for noise-induced HL could be smoking. Smoking is a widespread addiction among young people and the damage caused by inhaling toxic substances from cigarettes has been widely reported, particularly regarding the connection between smoking and diseases of the cardiovascular system and lungs, and malignancy. The few reports regarding the relationship between smoking and HL remain equivocal. An association between current smoking and HL among older adults has been reported from Japan [*4*]. Data also indicate that current smokers are 1.7 times more likely to have HL than nonsmokers and that nonsmoking participants who lived with a smoker were almost twice as likely to have hearing loss as those who did not [*5*]. This suggests that exposure to environmental tobacco smoke may also be associated with HL. Other available suggest showed that hyperlipidaemia and smoking, but not smoking alone, showed a significant difference regarding HL compared to a control group [*6*].

In a study on the effect of smoking and noise on hearing, smoking in the absence of other risk factors did not increase the risk for sensory neural HL, but smoking in combination with elevated blood pressure and Raynaud's phenomenon put workers at higher risk for HL than any of these factors alone [*7*]. A study investigating hearing problems in a sample of 3000 elderly Mexican Americans concluded that prevention of hearing problems, common in this population, may be done at many levels: control of hypertension, amelioration of arthritis and decreasing consumption of alcohol and cigarettes [*8*]. Although Noorhassim and Rampal [9] reported a multiplicative association between occupational noise, age and smoking, a Japanese team reported that smoking was not associated with low-frequency hearing loss [*10*].

Smoking may be a risk factor for high-frequency HL, and its combined effect on hearing may compound the effects of exposure to occupational noise. Several studies have reported an association [*11–14*] while others have found no such association [*15,16*].

Most of these surveys were performed in specific places, and mainly targeted elderly people subjected to occupational, non-environmental noise. Environmental noise (also known as community noise or residential noise) is defined as noise emitted from all sources except that of the workplace. The main sources of environmental noise are traffic, industry, construction, public works and the neighbourhood. The open air electricity generators in Lebanon as well as the frequent use of car horns by drivers present a significant source of environmental noise pollution across the country, more so in the heavily populated capital, Beirut.

The present study aims to determine the association between smoking and environmental (non-occupational) noise in Beirut on HL in young people.

Methodology

Environmental noise exposure assessment

Outdoor noise was the parameter used to assess community noise at 8 different points in residential areas of Beirut. Noisy areas were selected at 4 major crossroads in Greater Beirut, 2 in the east and 2 in the west. Similarly, 4 quiet areas were selected near non-commercial roads, 2 in the east and 2 in the west. Measurement of community noise was performed with the sound level meter (Radio Shack, model 33-2050). The average energy equivalent sound level for 8 hours in a residential area (LAeq, 8 h) was measured 4 times at 15 minutes intervals between 08.00 and 04.00 on a crossroads in the residential areas under study during 1 week every month of 2004. We used the World Health Organization (WHO) guideline values for evaluating the measured noise levels [*17,18*]. We considered the effect of the combination of noise events which is related to the combined sound energy of those events.

The sum of the total energy over a certain period of time gives a level equivalent to the average sound energy over that period (LAeq, T) [*17,18*]. The A-weighting filter is most commonly used in noise measurements because it weighs lower sound frequencies as less important than mid frequencies, and higher frequencies as more important. As recommended in the WHO guidelines, LAeq, T, used to measure continuing sounds, such as road traffic noise, is a parameter accepted worldwide. Scientists measure the levels of different sounds with a unit called the A-weighted decibel (dBA). The A-weighting reflects how people respond to sound. In a typical community, noise starts to make people highly annoyed when the sound level outside their home is around 55 dBA.

In this study, noisy areas were defined as the places where noise frequency was ≥ 65 dBA, and quiet areas as places where noise frequency was < 65 dBA.

Participants and protocol

The study population comprised 440 volunteers of both sexes. Participants were recruited through announcements in the municipality and in all the major commercial establishments in each area studied.

In order to preclude the possibility of participants having age-related hearing loss (prebyacousis), we selected participants aged 21–50 years. Exclusion criteria for all groups were: frequent use of mobile phone; hunters, soldiers and ex-soldiers (to rule out acoustic trauma as a cause of hearing loss); people with a history of ototoxicity, tympanic perforation, HL transmission, congenital hearing loss, hereditary hearing loss and Meniere disease. For the non-smokers group we also excluded those who had smoked previously but had ceased.

The study design required 100 participants in each group. We initially recruited > 550 individuals. A questionnaire was filled in before examination and volunteers were excluded either because they did not meet the inclusion criteria or because there were already enough participants in the particular category. In the noisy area, however, we did not recruit enough persons initially, so a second recruitment was carried out and the number of eligible volunteers amounted to 140 persons in total in that group. These were retained in the study. So, overall, we had 240 current smokers and 200 who had never smoked.

The study sample was divided into 4 groups:

- non-smokers living in quiet areas of Beirut (n = 100);

- smokers living in the same quiet areas (n = 100);
- non smokers living in noisy areas of Beirut (n = 100);
- smokers living in the same noisy areas (n = 140).

Participants were divided into 2 age categories, 21–39 years and 40–50 years. The age categories were initially defined in 10-year intervals, but the first 2 categories (21–29 years and 30–39 years) were combined because the corresponding prevalence of HL as defined in the study was ≤ 3%.

Participants completed a questionnaire covering personal data, home and work address, smoking status, number of cigarettes smoked per day, duration of smoking and all activities or diseases related to hearing. Participants from noisy areas had been living there for ≥ 20 years, and lived or worked on a main street. Those from quiet areas had been living and working in the same place for > 19 years, and had never been in a noisy environment for > 1 hour/day. Non-smokers had never smoked; smokers consumed 20–40 cigarettes or 1 or 2 narghuile (water pipes) per day for ≥ 5 years.

Participants were examined every week for a period of 1 year, between 14.00 and 19.00 every Friday for logistic reasons. Examination included otoscopy, screening pure-tone air-conduction (air conduction hearing threshold and speech reception threshold), and bone-conduction audiometry between 500 Hz and 8000 Hz. Hearing loss was defined as a pure-tone average hearing level in the worse ear of > 25 dB for 500 Hz, 1000 Hz and 2000 Hz, and > 40 dB for 4000 Hz and 8000 Hz [*19,20*]. Hearing tests were performed in a sealed, soundproof room with a calibrated clinical audiometer. The audiologist who conducted the tests was unaware of the smoking and noise status of the person being tested.

Hearing impairment was defined as being in the top third of the hearing loss distribution (at 2 kHz, 4 kHz, and 8 kHz) for their age category, and controls as those in the lowest third of the distribution. Whenever the air conduction threshold

Table 1 **Audition deficiency and exposure to noise, smoking and age: bivariate analysis**

Characteristic	Audition deficiency					
	2000 Hz		4000 Hz		8000 Hz	
	No.	%	No.	%	No.	%
Noise						
Yes (n = 240)	22	9.2	38	15.8	54	22.5
No (n = 200)	13	6.5	23	11.5	32	16.0
PR (95% CI) *P*-value	1.45 (0.71–2.96) 0.30		1.45 (0.83–2.52) 0.19		1.52 (0.94–2.47) 0.09	
Smoking						
Yes (n = 240)	18	7.5	37	15.4	56	23.3
No (n = 200)	17	8.5	24	12.0	30	15.0
PR (95% CI) *P*-value	0.87 (0.44–1.74) 0.70		1.34 (0.77–2.32) 0.43		1.73 (1.06– 2.82) 0.03	
Age (years)						
40–50 (n = 220)	20	9.1	36	16.4	48	21.8
21–39 (n = 220)	15	6.8	25	11.4	38	17.3
PR (95% CI) *P*-value	1.37 (0.68–2.74) 0.38		1.53 (0.88–2.64) 0.13		1.34 (0.83–2.15) 0.23	

PR = prevalence ratio; CI = confidence interval.

in one of these frequencies was > 25 dB hearing level, bone conduction threshold and speech discrimination were also examined. Participants found to have impaired hearing were referred for further evaluation and treatment.

Prevalence ratios (PRs) of hearing loss with 95% confidence interval (CI) were calculated for every factor. A subgroup analysis was then performed using the younger non-smokers not exposed to environmental noise as the reference group; double and triple exposures were evaluated. Finally, a multivariate analysis was performed: logistic regression with hearing loss at every frequency taken as a dependent variable, and age, smoking and noise exposure as independent variables.

Results

Noise measurements

Average noise level, LAeq, 8 h, on crossroads in the noisy residential area was 70–90 dBA, relatively sustained during the day and above the WHO threshold (65 dBA). On crossroads in the quiet residential area, LAeq, 8 h was 45–55 dBA, which was also relatively constant during the day and below the WHO threshold. The statistically significant difference ($P < 0.05$) between noise levels in the 2 areas was important for the assessment of exposure.

Acoustic analysis

When each factor (environmental noise, smoking or age) was analysed alone, no significant association with hearing loss was noted in the study sample at 2000 Hz, 4000 Hz or 8000 Hz, except for smoking, which was associated with hearing loss at 8000 Hz. A PR of 1.73 was found (95% CI: 1.06–2.82; $P = 0.03$) (Table 1).

Subgroup analysis of the 3 factors is shown in Table 2. The lowest estimate of people with HL was found among the reference group: nonsmokers, not exposed to noise, aged 21–39 years (6.0%) and the highest prevalence for smokers, exposed to noise, aged 40–50 years (31.4%). When analysed alone or in combination, smoking, noise and age were not positively associated with hearing loss, except for the combination of smoking, noise and age at 8000 Hz, with a PR of 3.36 (95% CI: 1.25–9.06; $P = 0.01$).

Multivariate analysis is shown in Table 3. The association of smoking with hearing loss at 8000 Hz was maintained (adjusted PR = 1.67; $P = 0.04$), even after adjustment for age and noise exposure.

Discussion

It is well established that long term exposure to noise at work causes HL. Although countermeasures have successfully reduced noise levels in many industries, noise is still a common occupational hazard, and noise-induced HL is one of the major occupational diseases worldwide. Nevertheless, long term exposure to a noisy environment, even if it is not apparently as harmful as occupational noise, should also be taken into consideration [*21,22*]. It is a recognized that if we listen to a sound at 85 db for 8 hours, 88 db for 4 hours or 91 db for 1 hour, we are at risk for hearing loss. Normal conversation is 58 db, busy traffic is 70 db and standing next to running truck engine is 84 db [*18*].

Two aspects of this study may be considered innovative: most of the available studies were performed to test the combination between occupational noise and smoking rather than environmental noise and smoking and despite the small number of the sample, the participants were chosen with precise inclusion/exclusion criteria, and several confounding factors were excluded.

Table 2 **Concomitant exposures to noise, smoking, age and audition deficiency: subgroup analysis**

Subgroup characteristic	Audition deficiency 2000 Hz No.	%	4000 Hz No.	%	8000 Hz No.	%
Noise only						
Yes (n = 50)	4	8.0	5	10.0	7	14.0
No (n = 50)	3	6.0	4	8.0	6	12.0
PR (95% CI) *P*-value	1.33 (0.31–5.65) 1.00		1.25 (0.36–4.39) 1.00		1.17 (0.42–3.23) 0.77	
Smoking only						
Yes (n = 50)	3	6.0	5	10.0	9	18.0
No (n = 50)	3	6.0	4	8.0	6	12.0
PR (95% CI) *P*-value	1.00 (0.21–4.72) 1.00		1.25 (0.36–4.39) 1.00		1.50 (0.58–3.90) 0.40	
Age only (years)						
40–50 (n = 50)	4	8.0	7	14.0	8	16.0
21–39 (n = 50)	3	6.0	4	8.0	6	12.0
PR (95% CI) *P*-value	1.33 (0.31–5.65) 1.00		1.75 (0.55–5.62) 0.34		1.33 (0.50–3.56) 0.56	
Noise + smoking						
Yes (n = 70)	5	7.1	11	15.7	16	22.9
No (n = 50)	3	6.0	4	8.0	6	12.0
PR (95% CI) *P*-value	1.21 (0.27–5.29) 1.00		2.14 (0.64–7.17) 0.21		2.17 (0.78–6.02) 0.13	
Noise + age						
Yes (n = 50)	6	12.0	8	16.0	9	18.0
No (n = 50)	3	6.0	4	8.0	6	12.0
PR (95% CI) *P*-value	2.00 (0.53–7.58) 0.49		2.00 (0.64–6.21) 0.22		1.50 (0.58–3.91) 0.40	
Smoking + age						
Yes (n = 50)	3	6.0	7	14.0	9	18.0
No (n = 50)	3	6.0	4	8.0	6	12.0
PR (95%CI) *P*-value	1.00 (0.21–4.72) 1.00		1.75 (0.55–5.62) 0.34		1.50 (0.58–3.91) 0.40	
Smoking + noise + age						
Yes (n = 70)	7	10.0	14	20.0	22	31.4
No (n = 50)	3	6.0	4	8.0	6	12.0
PR (95% CI) *P*-value	1.74 (0.43–7.09) 0.43		2.88 (0.89–9.33) 0.07		3.36 (1.25–9.06) 0.01	

[a]*Compared to controls.*
PR = prevalence ratio; CI = confidence interval.

In our experimental conditions, there was no correlation between smoking and environmental noise on HL at low frequencies. However, for individuals aged 40–50 years exposed to environmental noise and smoking, a positive correlation was noted at high frequencies. The most significant factor seemed to be smoking, with positive associations on both bivariate and multivariate analyses. The failure to find this association in subgroup analysis was probably on account of the small number of individuals in the subgroups. Nevertheless, the finding of smoking being associated with hearing loss is maintained.

Cigarette smoking, a known cardiovascular disease risk factor, may affect hearing through its effects on antioxidative

Table 3 **Exposure to noise, smoking, age and audition deficiency: multivariate analysis**

Variable	PR_a	95.0% CI	*P*-value
Audition deficiency at 2000 Hertz			
Smoking	0.85	0.42–1.69	0.64
Noise	1.47	0.72–3.01	0.29
Higher age	1.37	0.68–2.75	0.38
Audition deficiency at 4000 Hertz			
Smoking	1.30	0.75–2.27	0.35
Noise	1.42	0.81–2.49	0.22
Higher age	1.53	0.88–2.65	0.13
Audition deficiency at 8000 Hertz			
Smoking	1.67	1.03–2.75	0.04
Noise	1.47	0.90–2.39	0.12
Higher age	1.34	0.83–2.17	0.23

PR_a = adjusted prevalence ratio; CI = confidence interval.

mechanisms or on the vasculature supplying the auditory system [*23,24*]. The development of hearing loss may even be accelerated if the 2 factors had a synergistic effect. A possible biological support for underlying pathogenic mechanisms may be vascular changes and consequent cochlear hypoxia related to smoking and also to long-term intense noise exposure. In fact, carbon monoxide present in the mainstream smoke reduces cochlear blood oxygen levels as a result of capillary vasoconstriction. Noise exposure also induces hypoxia in the cochlea, causing direct lesions or interacting with mechanical, noise-induced impairments [*25*]. Chronic hypoxia may result in cochlear lesions, particularly in the basal, high-frequency region, the most vulnerable part of the cochlea. Age-related degenerative changes may also affect neural fibres and those parts of the cochlea, including vascular structures, which most pronouncedly affect the high frequencies [*26*].

Cigarette burning releases organic solvents such as toluene, styrene, xylene, and also lead and mercury. These substances have been described as independent factors interacting with noise exposure in regard to hearing loss [*27*]. Synergisms have been identified for the combined effects of noise and organic solvents [*28*]. Smoking may also strengthen these ototoxic effects by increasing their access to cochlear areas, where carbon monoxide is present in high concentrations, which leads to an elevated blood flow and vascular permeability as a response [*29*].

Our results are comparable with those of Ferrite and Santana on adult workers [*30*]. They found that age and occupational noise exposure were, separately, positively associated with hearing loss and that the effects of smoking, noise exposure and age on HL are synergistic. However, longitudinal studies with improved assessment of smoking and exposure time and also the use of severity levels of auditory damage should be developed to overcome the methodological limitations of our study.

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Smoking habits among university students in Jordan: prevalence and associated factors

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عادات التدخين بين طَلَبة الجامعات في الأردن: معدل الانتشار والعوامل المصاحبة

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الخلاصة: استوفى 712 طالباً في جامعة شمال الأردن استبياناً يستهدف تقدير معدل انتشار التدخين. وكان معدل الانتشار المبلغ عنه حالياً للتدخين هو 35.0% (56.9% للذكور و11.4% للإناث). وكان 80% منهم من مدخني السجائر. وكان معظمهم (86.3%) ممن يدخن يومياً. ومن العوامل التي صاحبت ازدياد معدّل التدخين: الجنس المذكر، وارتفاع الدخل، وتدنّي التحصيل الأكاديمي، وازدياد عدد الأصدقاء أو أفراد الأسرة الذين يدخنون. وقد كان أقل الطَلَبة تدخيناً طَلَبة كليتي الحقوق والشريعة مقارنةً بغيرهما من الكليات. وتدل النتائج على أنه ينبغي على أصحاب القرار السياسي الشروع ببرامج لمكافحة التدخين في الجامعات الأردنية.

ABSTRACT Questionnaires were completed by 712 university students in north Jordan to estimate their prevalence of smoking. The reported prevalence of current smoking was 35.0% (56.9% for males and 11.4% for females). About 80% were cigarettes smokers. The majority (86.3%) of smokers smoked daily. Male sex, higher income, lower academic attainment and higher number of friends or family members who smoke were associated with increased prevalence of smoking. Those in the faculty of religion and law were less likely to smoke compared to those in other faculties. The results suggest that policy-makers need to initiate antismoking programmes in Jordanian universities.

Habitudes tabagiques chez les étudiants de Jordanie : prévalence et facteurs associés
RÉSUMÉ Sept cent douze (712) étudiants du nord de la Jordanie ont complété des questionnaires afin que l'on puisse estimer la prévalence du tabagisme dans cette population. La prévalence déclarée du tabagisme au moment de l'étude était de 35,0 % (56,9 % pour les garçons et 11,4 % pour les filles). Environ 80 % d'entre eux fumaient des cigarettes. La majorité (86,3 %) des fumeurs fumaient quotidiennement. Le sexe masculin, un niveau de revenu élevé, des résultats universitaires peu brillants et un nombre important de fumeurs parmi les amis et les membres de la famille étaient associés à une prévalence accrue du tabagisme. Les étudiants en faculté de religion et de droit étaient moins enclins à fumer que ceux des autres facultés. Ces résultats permettent de penser que les responsables de l'élaboration des politiques doivent mettre en place des programmes de lutte contre le tabagisme dans les universités jordaniennes.

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Introduction

The habit of tobacco smoking has spread throughout the world and, as a major source of morbidity and mortality, is a serious public health problem [*1–6*]. Tobacco smoking reduces life expectancy, increases overall medical costs and contributes to loss of productivity during the lifespan of an individual [*7,8*]. Therefore, smoking prevention programmes have been given a high priority in World Health Organization (WHO) policies [*9*].

A recent study that examined smoking habits among university students in 23 countries showed that the age-adjusted prevalence ranged from 2% in Thailand to 46% in Spain among women and from 14% in Thailand to 47% in Portugal among men [*10*]. Epidemiological studies among different university student populations in Arab and Eastern Mediterranean countries demonstrated a marked variation in the prevalence of smoking [*11–21*]. Prevalence ranged from 13.0% to 42.5%, being the highest in Turkey (42.5%) [*12*] and Kuwait (42.2%) [*11*]. An increasing trend is expected to occur among university students and this could be related to alleviation of stress, life problems, peer pressure, social acceptance, family history of smoking, lower educational level of parents and the desire to attain high personality profile [*22*]. In contrast, religion, negative health effects, bad taste and smell, adverse physiological responses and issues related to family are considered good reasons for not smoking [*22,23*].

Studies on smoking habits among university students in Jordan are scarce, with a focus on a specific group of the university student population [*13,14*]. The prevalence of smoking reflects the magnitude of the problem, and determining it is important since it provides a basis for the planning of public health actions. The present study was an epidemiological survey to determine the prevalence of smoking and its associated factors among university students in the north of Jordan.

Methods

Sample

A descriptive cross-sectional study was conducted in April 2005 to estimate the prevalence of smoking among Yarmouk University students in Irbid, Jordan. The total number of students in Yarmouk University at the time of the study was 17 290. The sample size was calculated using a prevalence of smoking of 28.6% reported by Haddad and Malak [*14*], assuming a degree of precision of 3.3% at the 95% confidence interval. The total number of subjects was estimated to be 692. In Yarmouk University, most students, nearly 90%, were enrolled in undergraduate programmes distributed among different faculties.

Data collection

A sample of 3 to 4 classrooms were selected (using simple random sampling) from each faculty. The study coordinator visited the selected rooms between 09:00 and 11:00 hours and explained the purpose of the study to all students who were present. A pilot-tested structured questionnaire, prepared specifically for the study, was administered by the study coordinator who asked the students to respond freely and truthfully to each question. An assurance of anonymity was provided. Students took 5–10 minutes to complete the questionnaire in class while the class instructor was outside the teaching room to ensure that students completed the questionnaire unaided and to ensure confidentiality.

The questionnaire comprised a mix of open-ended and multiple choice questions, aimed at collecting data on the students' sociodemographic characteristics and their smoking behaviour. The following data were collected: age, sex, monthly family income, university year, faculty and student's academic achievement. Academic achievement was measured using grade point average (GPA) and classified as: excellent, very good, good, and acceptable. The questionnaire included additional information on current and previous smoking status, type of smoking and quantity of cigarettes smoked, age of initiation and source of smoking, reasons for starting smoking and attempts to quit smoking. Questions related to reasons for starting smoking and reasons for not smoking were open-ended. The smoking behaviour of the student, his or her family members and closest friends was obtained.

Each student's smoking status was classified as: daily smoker (smokes some kind of a tobacco product at least once a day); occasional smoker (smokes, but less than once a day); former smoker (smoked daily for at least 6 months, but did not smoke at the time of survey); never smoker (never smoked). For the purpose of international comparisons, occasional smokers and daily smokers were collapsed to produce the category "current smokers". A response category for cigar or pipe or waterpipe (*nargile*) smoking was collapsed into the same category.

A total of 812 structured questionnaires were distributed and 712 (88%) were fully completed. A total of 34 questionnaires were returned unfilled and 66 had missing responses on the main study questions. Seven questionnaires, with 1 or 2 missing responses for some items of the questionnaire, were considered satisfactory and included in the analysis.

Analysis

Data were analysed by comparing the prevalence of smoking between students according to independent variables using the Pearson chi-squared test. Chi-squared test for trend was conducted where appropriate. Multivariate binary logistic regression analysis was conducted to determine factors associated with smoking. *SPSS*, version 11.5, was used for data analysis. A P-value < 0.05 was considered statistically significant.

Results

Participants' characteristics

The study included 369 males and 343 females. The age of respondents ranged from 17 to 28 years with a mean of age of 21.2 years. More than half (60.3%) were between 20 and 24 years old (Table 1). About 60% of respondents were current students in 3 faculties: economic and administrative sciences (28.4%), literature (18.4%) and science (14.5%). About 51% were 3rd year or 4th year students. One-quarter of students had a total family income of more than 750 Jordanian dinars (JD).

Prevalence of smoking and its associated factors

A total of 249 students out of 712 reported being smokers. Thus the prevalence of current smoking among this sample of university students was 35.0% (56.9% among males and 11.4% among females, $P < 0.0005$). The majority of smokers (86.3%) smoked daily. About 80% were cigarette smokers, 19.3% were waterpipe smokers and 0.4% were pipe or cigar smokers. More than half (56.0%) of cigarette smokers smoked < 10 cigarettes/day, 21.5% smoked 10–20 cigarettes/day and 22.5% smoked > 20 cigarettes/day.

Table 1 **Prevalence of current smoking among Yarmouk University students, Jordan, by demographic and academic characteristics**

Variable	Total No.	Smoking No.	Smoking %	*P*-value
Sex				
Male	369	210	56.9	< 0.0001
Female	343	39	11.4	
Age (years)				
17–19	258	60	23.3	< 0.0001
20–24	429	179	41.7	
25–28	25	13	52.0	
Faculty				
Literature	131	36	27.5	< 0.0001
Economic and administrative sciences	202	97	48.0	
Education	75	22	29.3	
Fine arts and sport	66	23	34.8	
Science	103	48	46.6	
Religion and law	72	10	13.9	
Engineering (*hajjawi*)	63	13	20.6	
Year				
1st	167	38	22.8	< 0.0001
2nd	185	64	34.6	
3rd	144	63	43.8	
4th	216	84	38.9	
Academic achievement				< 0.0001
Acceptable	72	47	65.3	
Good	316	118	37.3	
Very good	260	72	27.7	
Excellent	64	12	18.8	
Family income (JD/month)				0.007
< 250	231	62	26.8	
250–500	318	117	36.8	
> 500–750	43	17	39.5	
> 750	120	53	44.2	

JD = Jordanian dinar.

Prevalence of current smoking among university students by selected categorical variables is shown in Table 1. It increased significantly with age ($P < 0.0001$). Third year and 4th year students were more likely to smoke compared with junior students ($P < 0.0001$). There was a significant difference in smoking prevalence among the students who attended different faculties, whereby students from the faculty of religion and law were less likely to smoke compared with students who attended other faculties ($P < 0.0001$). The prevalence of smoking increased significantly with increasing income ($P = 0.007$) and with decreasing academic achievement. Increased prevalence of smoking was significantly associated with an increased number of family members who smoke (*P*-value for trend < 0.005) and an increased number of friends who smoke (*P*-value for trend < 0.0001).

In the multivariate analysis, the only factors that were significantly associated with current smoking were sex, faculty, academic year, academic achievement, family income, number of family members who smoke and number of close friends who smoke (Table 2). Male sex, higher income, lower academic attainment and increased number of friends or family members who smoke were associated with increased smoking. Compared with 1st year students, 2nd, 3rd and 4th year students had higher odds of being smokers. Those in the faculty of literature, economic and administrative sciences, fine arts and sport, and science were more likely to smoke compared to those in the faculty of religion and law.

Initiation of smoking and desire to quit

The majority (85.5%) of smokers started smoking at or after the age of 15 years. Fewer started smoking between 10 and 14 years. Friends were considered the major reason for starting smoking by 47.4% of respondents. Pleasure (38.9%) was the next

Table 2 **Multivariate analysis of factors associated with smoking among Yarmouk University students, Jordan**

Variable	Odds ratio (95% CI)	*P*-value
Sex (male vs. female)	9.38 (6.14–14.33)	< 0.0001
Faculty		
Religion and law	1.00	
Literature	2.43 (1.02–5.78)	0.044
Economic and administrative sciences	2.30 (1.01–5.20)	0.045
Education	2.35 (0.90–6.08)	0.079
Fine art and sport	2.98 (1.12–7.89)	0.027
Science	3.34 (1.38–8.10)	0.007
Engineering (Hijjawi College)	0.77 (0.28–2.11)	0.617
Academic year		
1st	1.00	
2nd	1.81 (1.04 –3.12)	0.034
3rd	2.51 (1.40 –4.48)	0.002
4th	1.99 (1.15 –3.44)	0.014
Academic achievement		
Excellent	1.00	
Acceptable	4.00 (1.56–10.2)	0.004
Good	2.03 (0.93–4.43)	0.073
Very good	1.55 (0.70–3.43)	0.277
Family income (JD/month)	1.01 (1.00–1.01)	0.006
No. of family members who smoke	1.18 (1.04–1.34)	0.008
No. of close friends who smoke	2.22(1.95–2.53)	< 0.0001

CI = confidence interval; JD = Jordanian dinar.

most common reason given for smoking initiation, followed by stress (30.5%) and curiosity (12.8%).

About 54% of smokers reported that they had tried to quit smoking previously but had failed, whereas 46% had not attempted to quit smoking. More smokers (38.9%) did not know if they would quit smoking in the future, compared with about 37% who claimed that they intended to quit smoking in the future. In contrast, about a quarter of smokers did not intend to quit smoking for any reason in the future. Reasons for not smoking among nonsmokers are presented in Table 3; a third reported that they did not smoke because of the side-effects of smoking and another third reported religious reasons as the main reason for not smoking.

Discussion

The main finding of this study was that about a third (35.0%) of Yarmouk University students were current smokers. This prevalence is higher than that reported from the medical and engineering colleges in another university in the north of Jordan (28.6%) [*14*]. The difference may be explained by the greater range of university faculties covered in the present study, as a student's major may be a factor in attitudes toward smoking. Compared to other countries, the prevalence is higher than that

Table 3 **Reasons for not smoking as reported by Yarmouk University students, Jordan**

Reason	No. (*n* = 436)	%
Adverse effects on health	165	35.6
Religious reasons	152	32.8
Useless habit	125	26.9
To save money	9	1.9
Family members dislike smoking	6	1.5
Smoking not acceptable in society	5	1.0
Warning from parents	7	1.7
Have asthma	2	0.4

reported in nearby countries such as the Syrian Arab Republic [*21*], Saudi Arabia [*19*] and Lebanon [*16*] and lower than that reported in Kuwait [*11*] and Turkey [*12*]. However, this variation may be partly due to the use of different criteria for defining smoking, different age groups studied and different methodologies adopted. Therefore, a comparison of data between reports is difficult.

Our finding is consistent with other studies reporting that the most common age for starting smoking was between 15 and 19 years among all ever-smokers [*14,23*]. Comparison of our findings with Haddad and Malak's study in 2002 [*14*] shows a rapid increase in the number of smokers and this may be explained by the expanded marketing of transnational tobacco industries in developing countries [*9*].

This study indicates that the prevalence of smoking increased significantly with higher number of years of university education. This may be because senior students have a longer exposure to older smokers (i.e. older friends, teachers, employees, etc.) within the university environment who are an influence on their attitudes and behaviour. These findings are consistent with the findings of other studies [*14,23*] and suggest a need for an increased emphasis on effective antismoking programmes among students in secondary schools and universities to discourage smoking and raise awareness of the adverse health effects of smoking.

There was a significant difference in the prevalence of smoking by sex: 56.9% among males and 11.4% among females. This is in agreement with many studies conducted in Mediterranean and Arab countries that report a significantly higher prevalence of smoking among males, which may be due to the social acceptability of the smoking habit among men [*12,14,19,24–27*]. However, the prevalence of smoking among women may be underestimated because of reporting bias. Furthermore, the low prevalence of smoking among women is not necessarily "a good sign"; it may indicate the start of a rising trend that needs to be monitored and controlled by public health workers.

Students from the faculty of religion and law were less likely to smoke compared with students who attended other faculties. This finding suggests that functional religiosity in late adolescence may assist in promoting the health of both men and women.

Friends were considered the major reason for starting smoking, followed by pleasure, stress and curiosity. Other researchers had similar results [*14,22*]. It seems that youth use the undesirable behaviour of smoking as a strategy to cope with stress and social anxieties [*24*] rather than beneficial pastimes such as reading books or playing sport.

About 37% of smokers expressed a desire to quit smoking in the near future. A high percentage of students who intend to stop smoking was reported by other studies in the Eastern Mediterranean Region [*14,19,27*]. This may be related to respondents' fears of the harmful effects of smoking upon their health. Another reason could be a desire to save money. This indicates that a high proportion of smokers may respond well to smoking cessation programmes if these were made available in the university.

The main limitation of this study was the inability to generalize our results to all university students in Jordan because students with health-related majors were not included in this study. Furthermore, selection bias and information bias cannot be excluded, especially among female students.

We recommend that the factors identified in this study should be taken into consideration in antismoking programmes to make them more effective and better able to influence the attitudes and behaviours

of smokers. Programmes need to be established that involve adolescents and youths as educators and supply them with correct and appropriate information about the health consequences of smoking to educate the community. The Ministry of Education and Higher Education should apply antismoking programmes in all primary and secondary schools and universities. In addition, the media can assist by disseminating the message of quitting smoking to the whole population in Jordan.

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Risk behaviours for HIV/AIDS infection among men who have sex with men in Cairo, Egypt

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السلوكيات المحفوفة بمخاطر العدوى بفيروس العوز المناعي البشري ومرض الإيدز بين اللواطيين في القاهرة، مصر

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الخلاصة: أجرى الباحثون مقابلات مع عينة تتألف من 73 من اللواطيين في القاهرة، بمصر، مع تحري العدوى بفيروس العوز المناعي البشري لديهم، لدراسة سلوكياتهم المحفوفة بمخاطر العدوى بذلك الفيروس. واتضح أن معظم أفراد العينة المدروسة (65.8%) قد شرعوا في نشاطهم الجنسي قبل سن 15 عاماً، وأن 65.8% منهم يتناوبون دور الفاعل والمفعول فيه في اللواط. وقد بلغ معدل تكرار ممارسة اللواط أقل من مرة أسبوعياً لدى 73.3% ممن هم في سن 25 عاماً أو أكثر، ولكنها قد تزيد على مرة واحدة يومياً لدى 25.9% ممن تقل أعمارهم عن 25 عاماً. وقد وصل معدل الإبلاغ عن العلاقات بين الجنسين في هؤلاء اللواطيين إلى 73.3% في المجموعة العمرية المتقدمة في حين كان 70.7% من المجموعة العمرية الأصغر يقتصرون على اللواط. ولم يَزِدْ الاستخدام الدائم للعازل الذكري على 19.2% من العينة.

ABSTRACT A sample of 73 men who have sex with men (MSM) in Cairo, Egypt, were screened for HIV infection and were interviewed to study their risk behaviours for HIV/AIDS. Most (65.8%) had initiated sexual activity before 15 years; 65.8% took both active and passive roles in sexual acts. The frequency of sexual acts was < 1 per week for 73.3% of those aged 25+ years, but > 1 daily for 25.9% of those aged < 25 years. Heterosexual relations were reported by 73.3% of the older age group, while 70.7% of the younger age group were exclusively MSM. Condoms were always used by only 19.2% of the sample.

Comportements à risque en matière d'infection par le VIH/sida chez les hommes ayant des rapports sexuels avec des hommes au Caire (Égypte)

RÉSUMÉ Un échantillon de 73 hommes ayant des rapports sexuels avec des hommes au Caire en Égypte a fait l'objet d'un test de dépistage de l'infection à VIH et d'un interrogatoire destiné à permettre l'étude de leurs comportements à risque liés à l'infection par le VIH/sida. La plupart d'entre eux (65,8 %) avaient eu leurs premiers rapports sexuels avant l'âge de 15 ans ; 65,8 % avaient à la fois un rôle actif et passif lors des actes sexuels. La fréquence des actes sexuels était inférieure à 1 par semaine pour 73,3 % des sujets âgés de 25 ans et plus, mais supérieure à 1 par jour pour 25,9 % de ceux âgés de moins de 25 ans. Dans le groupe plus âgé, 73,3 % ont déclaré avoir des relations hétérosexuelles alors que 70,7 % du groupe des plus jeunes étaient des hommes ayant des rapports sexuels avec des hommes exclusivement. Seuls 19,2 % de l'échantillon utilisaient systématiquement un préservatif.

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Introduction

It is clear that the HIV/AIDS epidemic is becoming a threat to development in many parts of the world, and in some places is rapidly becoming a security crisis too [*1*]. The HIV/AIDS epidemic continues to spread in the countries of the Eastern Mediterranean Region (EMR) of the World Health Organization, including Egypt. The number of HIV infected cases in the EMR is estimated at 540 000, a little less than 1% of the estimated total number of cases worldwide. One significant route of HIV transmission is sex between men. The issues associated with this type of transmission are frequently difficult to address because in many countries men who have sex with men (MSM) do not view themselves as nonheterosexual and because of social stigmatization may not wish to be identified as such to others [*3*]. It has been estimated that 89% of all cases of HIV infection in the EMR are transmitted via sexual relations, and that 2% of that figure is due to MSM [*2,3*].

In developing countries, there are an estimated 100 million homeless children and youth in the streets of large cities. Prostitution is one way for them to earn money for survival. They may also have sexual relations with each other for enjoyment. Such a group is considered to be one of the high-risk groups for HIV/AIDS transmission in the community [*4*]. The aim of this study was to identify risky behaviours for HIV/AIDS and determine the prevalence of infection among a group of MSM in Cairo, the capital city of Egypt.

Methods

This study was conducted during the year 2003. The theme for the study was identified through observations of groups of homeless male children and youth who gather in the main squares of Cairo, often sleeping under bridges and in parks. They offer their services for any available jobs, for example washing cars in the street or working in the homes of those who may request their services. It was hypothesized that this group of homeless males may be willing to offer sex for money, shelter or food.

The research team used 2 volunteer MSM who used to work with the national HIV/AIDS control programme as peer educators for MSM groups and were therefore already trained in counselling skills. Their help was crucial for the research team to gain access to this group who are regularly threatened by police and are suspicious of people in positions of authority. By personal persuasion, building up confidence and trust and sometimes giving financial incentives, the 2 MSM volunteers succeeded in bringing groups of MSM to be interviewed individually by the researchers in private confidential meetings held at the building of the HIV/AIDS control programme hotline.

A predesigned and pretested questionnaire sheet was used for data collection. The questionnaire included the following data:

- Sociodemographic data (age, marital status, educational level and occupation);
- MSM behaviour (age at first sexual experience, type of sexual practices, number of partners/week, frequency of sexual acts and whether with single or multiple partners, and heterosexuality);
- Knowledge about HIV/AIDS;
- Use of alcohol and illicit drugs;
- Past and present history of any manifestations related to sexually transmitted infections (STIs).

The questionnaire content was revised by 3 experts and MSM peers to ensure its validity.

All participants (n = 73) were recruited by the snowball technique during a period of 8 months of fieldwork. They were all screened for HIV infection using enzyme-linked immunoassay (ELISA) methods, and positive cases were confirmed by western blot test. Written consent was obtained before data collection and testing for HIV infection. The interviewees were informed about their test results after receiving proper pre- and post-test counselling services.

The data collected was organized, tabulated and statistically analysed using the test of significance between 2 proportions (Z-test) and chi-squared tests. The 5% level of significance was adopted for interpretation of results of tests of significance.

Results

The total number of MSM studied was 73. Their age range was 15–47 years. The majority of them were aged 15–25 years (79.5%), not married (84.9%) and working in manual work (71.2%), while 23.3% were jobless. Most (79.5%) had received primary or secondary education; only 1.4% had had higher education and 19.2% were illiterate (Table 1).

Table 1 **Characteristics of the study sample of men who have sex with men**

Characteristics	No. (n = 73)	%
Age (years)		
15–24	58	79.5
25–39	13	17.8
40+	2	2.7
Marital status		
Single	62	84.9
Married	9	12.3
Divorced	2	2.7
Educational level		
Illiterate	14	19.2
Primary	35	47.9
Secondary	23	31.5
Higher	1	1.4
Occupation		
Manual worker	52	71.2
Jobless	17	23.3
Military or police	2	2.7
Administrative	1	1.4
Driver	1	1.4

n = *total number of respondents.*

Sexual practices

The age at which homosexual relations was initiated was < 15 years among 65.8% of respondents. Most of them (65.8%) were both active and passive partners in their sexual relations. However, this percentage was higher (80.0%) among older persons (25+ years) as compared to persons < 25 years (62.1%). Those acting only as passive partners were 27.6% among younger persons, twice the rate among older respondents (13.3%) (Table 2).

Respondents aged < 25 years were found to be more sexually active; 25.9% had sex more than once per day compared with only 6.7% among those 25+ years. Infrequent sexual relations (less than once per week) were reported among 73.3% of the 25+ group compared to 51.7% among the < 25 years group. The number of sexual partners per week was < 3 among 48.3% of younger persons and among 40.0% of the older ones. On the other hand 5.2% of younger persons had > 8 sexual partners per week compared to 0% of the older group. One-third of older MSM (33.3%) had only 1 sexual partner per sex act compared with 15.5% among the younger group. However, the majority reported having both single and multiple partners in their sexual relations (79.3% for younger group and 66.7% for older ones).

Heterosexual relations were reported far more by older persons (73.3%) than younger persons (29.3%); 70.7% of the younger groups were exclusively MSM.

Table 2 **Patterns of sexual practices among men who have sex with men by age**

Pattern of sexual practices	Age (years) < 25 (*n* = 58) No.	%	25+ (*n* = 15) No.	%	Total (*n* = 73) No.	%	Significance
Age at first experience (years)							
< 15	42	72.4	6	40.0	48	65.8	$\chi^2 = 5.56$; $P = 0.018$
15–25	16	27.6	9	60.0	25	34.3	
Role in sexual act							
Active	5	8.6	1	6.7	6	8.2	$\chi^2 = 1.70$[a]; $P = 0.192$
Passive	16	27.6	2	13.3	18	24.7	
Active + passive	36	62.1	12	80.0	48	65.8	
Face to face	1	1.7	0	0.0	1	1.4	
Frequency of sexual act							
> 1/day	15	25.9	1	6.7	16	21.9	$\chi^2 = 3.03$[b]; $P = 0.220$
1/day	9	15.5	3	20.0	12	16.4	
1/week	4	6.9	0	0.0	4	5.5	
< 1/week	30	51.7	11	73.3	41	56.2	
Number of sexual partners/week							
< 3	28	48.3	6	40.0	34	46.6	$\chi^2 = 033$[c]; $P = 0.567$
3–4	19	32.8	7	46.7	26	35.6	
5–8	8	13.8	2	13.3	10	13.7	
> 8	3	5.2	0	0.0	3	4.1	
Number of sexual partners/act							
Single	9	15.5	5	33.3	14	19.2	$\chi^2 = 1.35$[d]; $P = 0.245$
Multiple	3	5.2	0	0.0	3	4.1	
Both	46	79.3	10	66.7	56	76.7	
Heterosexual relations							
Yes	17	29.3	11	73.3	28	38.4	$\chi^2 = 9.77$; $P = 0.002$
No	41	70.7	4	25.7	45	61.6	

[a] *Active and passive versus other groups in relation to age.*
[b] *1/daily and 1/week were grouped together.*
[c] *< 3 versus other groups in relation to age.*
[d] *Both versus other groups in relation to age.*
n = *total number of respondents.*

This difference was statistically significant ($\chi^2 = 9.77$; $P = 0.002$) (Table 2).

Concerning knowledge about HIV/AIDS, it was found to improve with improved level of education. Knowing about HIV was reported by 91.7% of those with secondary or higher education as compared to 50.0% among illiterates. The possibility of acquiring HIV infection and the perception of the protective value of condoms was reported by 62.5% of individuals with higher levels of education compared to only 14.3% among illiterate persons and slightly more than one half (54.3%) of those with primary education. On the other hand, history of symptoms

suggestive of STIs was reported by 64.3% of illiterate MSM, almost twice as many as those with secondary and higher education (37.5%) (Table 3).

Use of illicit drugs

Use of illicit drugs was reported by 31.5% of the study group with no statistically significant difference in relation to age. The most commonly used drugs were cannabis herb (bango) (21.9%), followed by oral drugs (unspecified types) (13.7%). Cannabis herb was used by more of the younger age group (24.1%) than the older age group (13.3%) (Table 4). The highest percentage of those who used drugs was among those with secondary and higher education (45.8%), followed by those with primary education (25.7%) (Table 5).

Condom use

Condoms were never used by just over half of the studied sample (52.1%); 28.8% sometimes used them, while only 19.2% reported always using condoms during sexual relations. Always-use condoms was reported by significantly more of those aged 25+ years (40.0%) than those < 25 years (13.8%) ($\chi^2 = 5.28$, $P = 0.022$). The reasons for not using condoms were: never having hearing about them (21.9% in total, 27.6% of younger persons), decreased sense of pleasure (13.7%) and partner refusal (9.6%) (Table 6).

Condom use increased with increased educational level. Among illiterate respondents, 85.7% reported never using condoms compared with 42.9% and 45.8% among those with primary education and with secondary/higher education, respectively. Always using condoms was reported by 25.7% of those with primary education and 20.8% of those with secondary/higher education compared to 0% of illiterates. These differences were statistically significant ($\chi^2 = 7.91$, $P = 0.019$). For illiterate respondents the main reason for not using

Table 3 **Knowledge, attitude and practices of men who have sex with men towards sexually transmitted infections (STIs) including HIV/AIDS and past history of manifestations of STIs**

Knowledge, attitude and practices and past history of STI manifestations	Educational level					
	Illiterate (*n* = 14)		Primary (*n* = 35)		Secondary/higher (*n* = 24)	
	No.	%	No.	%	No.	%
Know about HIV/AIDS	7	50.0	31	88.6	22	91.7
Realize possibility of HIV risk of infection	4	8.6	15	42.9	15	62.5
Perception of protective value of condoms against HIV infection	2	14.3	19	54.3	15	62.5
Ever used condom or asked partner to use it during last 3 months	2	14.3	20	57.3	13	54.2
Ever complained of discharge, painful micturition or defecation or ulcers on sexual organs during last 6 months	9	64.3	17	48.6	9	37.5
Ever complained of discharge from urethral or anal canal or ulcers on sexual organs during last 6 months	4	28.4	20	57.1	8	33.3

n = *total number of respondents.*

Table 4 **Use of drugs among men who have sex with men by age**

Use of drugs	Age (years) < 25 (*n* = 58)		25+ (*n* = 15)		Total (*n* = 73)	
	No.	%	No.	%	No.	%
Don't use drugs	39	62.2	11	73.3	50	68.5
Use drugs	19	32.8	4	26.7	23	31.5
Cannabis resin	1	1.7	0	0.0	1	1.4
Opium	1	1.7	0	0.0	1	1.4
Alcohol	1	1.7	0	0.0	1	1.4
Oral drugs	8	13.8	2	13.3	10	13.7
Cannabis herb	14	21.1	2	13.3	16	21.9

$\chi^2 = 0.20$; P = *0.651 (comparing nonusers versus all users).*
n = *total number of respondents.*

Table 5 **Use of drugs among men who have sex with men by educational level**

Use of drugs	Educational level Illiterate (*n* = 14)		Primary (*n* = 35)		Secondary/higher (*n* = 24)	
	No.	%	No.	%	No.	%
Don't use drugs	11	78.6	26	74.3	13	54.2
Use drugs	3	21.4	9	25.7	11	45.8
Cannabis resin	0	0.0	0	0.0	1	4.2
Opium	0	0.0	1	2.9	0	0.0
Alcohol	1	9.1	0	0.0	1	4.2
Oral drugs	0	0.0	5	14.3	5	20.8
Cannabis herb	2	18.1	5	14.3	9	37.5

$\chi^2 = 3.49$; P = *0.175.*
n = *total number of respondents.*

condoms was never having heard about them (64.3%), compared with 8.6% among primary educated and 12.5% among those with secondary/higher education. Among primary educated men, the main reason for not using condoms was decreased sense of pleasure (22.9%), while among those with secondary/higher education, the main reasons were partner refusal (16.7%), followed by decreased sense of pleasure and never having heard about them (12.5% each) (Table 7).

HIV screening

HIV screening of this group of MSM revealed only 1 positive case representing 1.4% of the sample. The HIV infected person discovered was a 28-year-old male working as a cook. He was also found to work as a male prostitute. He reported having multiple partners and usually indulging in receptive anal sexual relations.

Discussion

HIV/AIDS is today a major threat to the world's population, to its overall social, economic and political wellbeing, as well as to the individual health of hundreds of millions of people. There are millions of people worldwide living with HIV

Table 6 **Use of condoms among men who have sex with men by age**

Variable	Age (years)					
	< 25 (*n* = 58)		25+ (*n* = 15)		Total (*n* = 73)	
	No.	%	No.	%	No.	%
Use of condoms						
Never	33	56.9	5	33.3	38	52.1
Sometimes	17	29.3	4	26.7	21	28.8
Always	8	13.8	6	40.0	14	19.2
Reasons for not using condom						
Unavailable	3	5.2	1	6.7	4	5.5
Decreased sense of pleasure	8	13.8	2	13.3	10	13.7
Partner refusal	5	8.6	2	13.3	7	9.6
Never heard about them	16	27.6	0	0.0	16	21.9

$\chi^2 = 5.52$; P = *0.022 (*never versus other groups*).*
n = *total number of respondents.*

Table 7 **Use of condoms among men who have sex with men by educational level**

Variable	Educational level					
	Illiterate (*n* = 14)		Primary (*n* = 35)		Secondary/higher (*n* = 24)	
	No.	%	No.	%	No.	%
Use of condoms						
Never	12	85.7	15	42.9	11	45.8
Sometimes	2	14.3	11	31.4	8	33.3
Always	0	0.0	9	25.7	5	20.8
Reasons for not using condom						
Unavailable	1	7.1	2	5.7	1	4.2
Decreased sense of pleasure	1	7.1	8	22.9	3	12.5
Partner refusal	1	7.1	2	5.7	4	16.7
Never heard about them	9	64.3	3	8.6	3	12.5

$\chi^2 = 7.91$; P = *0.019 (never versus other groups).*
n = *total number of respondents.*

and/or AIDS—more than 90% of them in developing countries—and their numbers continue to rise sharply each year. Around 16 000 people around the world become infected with HIV each day [*5*].

Sex between men frequently involves anal intercourse, which carries a very high risk of HIV transmission for the receptive partner and a significant risk, though a lesser one, for the penetrative partner. At least 5%–10% of all HIV cases worldwide are due to sexual transmission between men, although this figure varies considerably from one region to another [*6*]. Among the world's young people, some are more exposed to HIV than others. Some of the most vulnerable are young people who are out of school, who live on the streets or engage in commercial sex [*7*].

The present study was conducted on a group of MSM in Cairo city. Groups of people who live on the margins of society exist in every country, although their number and composition differ from place

to place. What marginalized groups have in common is an increased vulnerability to HIV [*1*]. Sex, generally unprotected, can represent not just a source of pleasure but a means of survival, or of dominating girls or other boys [*8*]. Youth living in the streets sometimes engage in an informal trade of sex for money, protection, a meal or a place to sleep. HIV has now been added to the panoply of risks and dangers such youth face daily, including violence and abuse at the hands of other older street kids, adults and authority figures [*7*].

The studied group was predominantly of younger age (79.5% aged 15–25 years), not married (84.9%) and working as manual workers (71.2%) or jobless (32.3%). Other studies of MSM show that a number of identifiable groups of men are at continuing risk of HIV infection. These are men less than 25 years and men with low educational and literacy levels. Age is clearly one of the most important of these factors, because it relates to several of the others. Many younger people are likely to use alcohol and drugs while having sex and many young gay men have low incomes. Young people of all sexual orientations are prone to the opinion that nothing bad can happen to them, which frequently further aggravates the risk of HIV infection [*9*].

The age of initiation of sexual activity was found to be less than 15 years among 65.8% of our sample. Worldwide, many studies showed that the majority of young people have begun to have sexual intercourse before thy leave their teens and at least half of them by the age of 16 years [*10–16*].

Little is known about the pattern of sexual relations between MSM, whether they practise safe or protected sexual relations or not. However, studies conducted all over the world indicated that 30%–80% of MSM usually have unprotected anal sex [*4*].

The majority of our group of MSM indulged in both penetrative and receptive anal sex (65.8%) and in each act there may be more than 1 partner (76.7%). Again, more than half of them (53.4%) had more than 3 partners per week. During interviews, the motives for these sexual acts were reported to be both commercial as well as for pleasure. This pattern of sexual practice indicated that they are highly liable to risk of HIV infection. Younger MSM were found to have more partners compared to older ones. This observation was documented by other studies, which indicated greater partner turnover during adolescence and the early 20s than in later years [*11,17*].

Worldwide, a high percentage of MSM are married or have sex with women as well. [*6*]. This was also observed in our research, especially among the older age group, where 73.3% were bisexual. On the other hand, 70.7% of MSM < 25 years were exclusively MSM. This pattern may denote that with advancing age MSM are more likely to indulge in sexual relations with partners of the opposite sex. A study in Brazil of MSM indicated that among those reporting unprotected sex with a woman, two-thirds had also had unprotected anal sex with a man. This overlap of risk behaviour provides a classic bridge for HIV, allowing it to pass from a population with high prevalence rates to a heterosexual population with typically lower infection rates [*1*].

Educational level was found to have its effect on the knowledge of this group about risks and protective measures for HIV/AIDS. The majority of the study group were illiterate or of only primary education which means that they are at high risk for HIV infection. Many MSM have limited educational level and poor literacy skills [*9*]. Even when there are high levels of basic knowledge, however, millions of people

around the world are still vulnerable to HIV because they do not know the basic facts. The right to information about HIV transmission and prevention has sometimes been denied to young people on the grounds that they are, or should be, sexually abstinent. In general, people with more education lead healthier and more productive lives. There are several reasons for this: better educated people generally have greater access to information than those who are illiterate or uneducated, and they are more likely to make well-informed choices and decisions based on that information [*1*].

Among the study group, 48.0% (35/73) reported a history of manifestations of STIs during the previous 6 months. This increased to 64.3% among illiterate persons, who also had greater lack of knowledge about HIV/AIDS. An important indicator of the scale of unprotected sex and hence of potential exposure to HIV is the incidence of other STIs. It has been reported that around half of the 333 million new STI cases per year were found among young people less than 25 years old [*7*].

There is a direct connection between drug and substance use and HIV infection transmission. Injecting drug use is estimated to be directly responsible for over 5% of HIV infections worldwide. Of the estimated 6–7 million persons around the world who inject drugs, four-fifths are men. Men who inject drugs have a higher risk of HIV propagation to others than women; they are more likely to have noninjecting partners to whom they may transmit the infection. They are more likely to share needles than women, and tend to be the first to share injecting equipment, thus increasing the probabilities of transmitting the infection to the subsequent injectors. In a major 13-city study, the majority of injecting drug users with regular sex partners reported never using condoms [*6*].

Drug use was reported by about one-third of our studied sample (31.5%) with no significant differences in relation to age or educational level, although the percentage of drug use increased with increased level of education. The drugs most commonly abused were cannabis herb and oral drugs of various types. Apart from the HIV risk connected with needle-sharing, it is known that alcohol and other drugs can affect sexual behaviour and increase young people's vulnerability to HIV. Excessive drinking, for example, diminishes inhibitions; it also impairs the ability to use important information that has been learnt regarding AIDS prevention and how to make decisions about protection [*7*].

Used properly and consistently, condoms are one of the most effective methods of protection against HIV infection. They are relatively cheap and generally have no side-effects. They can readily be made available on a mass scale through regular commercial sales. At the present time, the number of condom users as a proportion of those who are sexually active remains low in many countries. In addition, those who use condoms often do so irregularly or only with selected partners. In many places, it is difficult to obtain condoms for a variety of reasons [*18*]. In the present study only 19.2% of the sample reported regular use of condoms. The rest of the study group never used them or infrequently so. The percentage of regular use of condoms was found to increase significantly with increased age and level of education.

In many countries, condom use was not part of the culture before the HIV/AIDS epidemic, and acceptance of the use of condoms in these places has been slow. People may not be adequately informed about the protective effects of condoms against STIs and HIV [*19*]. Among illiterate participants in this study 64.3% repor-

ted never hearing about condoms as a protective method for HIV/AIDS.

Recommendations

- The presence of MSM communities in our society should not be ignored.
- Encouraging better religious and moral behaviour of youth is crucial to avoid sexual practices not accepted by our community that also expose our youth to high risk for HIV/AIDS and other STIs.
- Outreach programmes should be established for better understanding the risk behaviours of MSM in our community, and for raising the awareness of this group about HIV/AIDS and methods of protection, with special emphasis on building the skills of condom use.
- The problem of street children and young adults should be tackled in an integrated approach by all ministries concerned and nongovernmental organizations.

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National AIDS programmes: a guide to monitoring and evaluation

In the early years of the HIV/AIDS epidemic, programme managers had little information about what interventions were likely to work in reducing the spread of the virus, and little idea of how they might measure the success of their interventions. It was widely believed that sensitive behaviours such as sex and drug injection—known to spread the virus—could not be reliably measured at all. There was an urgent need to respond in any way possible; measuring the success of the response was not high on the list of priorities for most programme managers.

Over the last decade, this thinking has changed. Much more is known about how HIV spreads, and what changes are needed to slow the spread. It has been amply demonstrated that people will answer questions about their sex lives, and there is growing evidence that their answers give a fairly reliable picture of trends in behaviour over time. This guide can be accessed at: http://www.emro.who.int/GFATM/guide/guide.html

Waist circumference and central fatness of Egyptian primary-school children

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محيط الخصر وتراكم الشحوم المركزي لدى الأطفال المصريين في المدارس الابتدائية

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الخلاصة: تناولت هذه الدراسة المستعرضة 1283 طفلاً من الأطفال الأصحّاء (681 ذكراً و602 أنثى) تتراوح أعمارهم بين 6 و11 عاماً، لدراسة الترابط بين محيط الخصر وبين السِّمنة المركزية. وقد صُنِّفَ الأطفال وفقاً لمنسب كتلة الجسم إلى طبيعيين ومفرطي الوزن وسِمَان. ولوحظ ترابط إيجابي مرتفع في كلا الجنسين بين محيط الخصر ومنسب كتلة الجسم، والنسبة المئوية للشحمِ في الجسم، وثخانة الطية الجلدية تحت لوح الكتف وفوق الحرقفة، ومجموع قياسات الطيات الجلدية. وكانت السِّمنة المركزية وفرط الوزن بسبب تراكم الشحوم في مركز الجسم من المؤشرات على السِّمنة لدى كل من الأطفال الذكور والإناث الذين يعانون من السِّمنة، باستثناء من كان منهم في الفئة العمرية 6.5 ± 1 سنة. وكان محيط الخصر مؤشراً جيداً على السِّمنة المركزية (فرط الوزن والسِّمنة) في الأعمار التي تتراوح بين 8.5 ± 1 سنة و10.5 ± 1 سنة.

ABSTRACT This cross-sectional study of 1283 healthy children (681 boys, 602 girls) aged 6–11 years tested the degree of correlation between waist circumference measurements and adiposity. The children were classified as normal, overweight or obese according to their body mass index (BMI). For both sexes a highly positive correlation was found between waist circumference and BMI, percentage of body fat, subscapular and suprailiac skinfold thicknesses, and the sum of skinfold measures. Central overweight and obesity were indicators for central fatness for both overweight boys and girls and for obese girls except in age group 6.5 ± 1 years. Waist circumference was a good indicator of central fatness (overweight and obesity) in children aged 8.5 ± years and 10.5 ± 1 years.

Tour de taille et adiposité centrale chez les enfants des écoles primaires en Égypte

RÉSUMÉ Cette étude transversale réalisée auprès de 1283 enfants en bonne santé (681 garçons et 602 filles) âgés de 6 à 11 ans a permis d'évaluer le degré de corrélation entre les mesures du tour de taille et l'adiposité. Les enfants ont été classés comme normaux, en surpoids ou obèses en fonction de leur indice de masse corporelle (IMC). Pour les deux sexes, on a constaté une corrélation très positive entre le tour de taille et l'IMC, le pourcentage de tissu adipeux, l'épaisseur des plis cutanés sous-scapulaire et sus-iliaque, et la somme des mesures des plis cutanés. La surcharge pondérale et l'obésité centrales étaient des indicateurs d'adiposité centrale chez les garçons et les filles en surpoids et chez les filles obèses, sauf dans le groupe d'âge des 6,5 ± 1 ans. Le tour de taille était un bon indicateur d'adiposité centrale (surpoids et obésité) chez les enfants âgés de 8,5 ± 1 ans et de 10,5 ± 1 ans.

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Introduction

Central fatness, mostly intra-abdominal fat, is medically more important than subcutaneous fat in the trunk. The accumulation of both types of fat is affected by high food consumption and is therefore a historic novelty for human populations [*1*]. A central fat pattern has adverse health implications in both children and adults. Recent studies in children showed that a greater deposition of central fat correlates with less favourable patterns of serum lipoprotein concentrations, increased blood pressure [*2*], adverse levels of cardiovascular risk [*3*] and increased risk of metabolic complications [*4*].

The ability of simple anthropometric techniques to correctly measure central adiposity needs to be assessed because adiposity tracks from childhood into adulthood [*5*]. Routine evaluation of regional fat distribution on a wide scale requires methods that are simpler than dual-energy X-ray absorptiometry (DXA), computerized tomography (CT) or magnetic resonance imaging (MRI). However, studies on the efficacy of anthropometric techniques for identifying children with high central adiposity are scare. There is a suggestion that waist circumference alone may be a more useful and accurate tool in children than DXA etc. [*6*]. Taylor et al. found that waist circumference performed well in identifying children with high trunk fat as measured with DXA [*5*]. Waist circumference correctly identified > 90% of children as being true positives (high waist circumference and high trunk fat mass) or true negatives (low waist circumference and low trunk fat mass).

The circumference of the waist relates closely to body mass index (BMI) and is also the dominant measure in the waist-to-hip ratio, which reflects the proportion of the body fat located intra-abdominally, as opposed to subcutaneously [*7*]. The waist circumference is a better index of android (abdominal) obesity than waist-to-hip ratio and is the best indicator of changes in the intra-abdominal fat during weight loss [*8*]. Waist circumference independently contributes to the prediction of non-abdominal (total fat – abdominal fat), abdominal subcutaneous and visceral fat in both sexes. It has the ability to act as a surrogate for abdominal fat [*9*]. These observations reinforce the importance of using waist circumference in clinical practice [*10*].

We therefore believed that an examination of waist circumference in a group of primary-school Egyptian children would add valuable comparative data to BMI data in assessment of central fatness in overweight and obese children. BMI is a poor proxy for central fatness [*4*] as it is an expression of weight not adiposity [*11*] and it provides no information on body fat distribution, so it can mask true obesity-related risk in children [*3*].

The aim of our study was to test the degree of correlation between waist circumference measurements of a sample of Egyptian schoolchildren with their adiposity (whether total or central), and to quantify the association of waist circumference measurements with age and degree of BMI (overweight or obese) in the same children.

Methods

Sample

This data were obtained from a cross-sectional survey of a sample of 1283 Egyptian schoolchildren, 681 boys and 602 girls, aged 6–11 years. The pupils were recruited from 2 public schools (El Zahraa primary school and El Orman El-Tagribia school) situated in Giza governorate,

during the period October 2002 to April 2004. Permission to perform the study was granted by the Ministry of Education and the directors of the schools included in the research. Parents were informed about the purpose of the study and their permission (in the form of written consent) was obtained.

Data collection

The following was performed for each child:

- A simple questionnaire was directed to the parents about personal abd socio-economic data (parental education and occupation, crowding index), the presence or absence of consanguinity, the medical history of the child with special emphasis on any chronic condition or long-term systemic treatment. The socioeconomic status of the pupil was characterized by scoring parental education, occupation and crowding index as low (score 3–11), medium (12–16) and high (> 17). Only the medium-level pupils were enrolled in the study (the majority of the pupils in these 2 particular public schools).
- Complete clinical examination to exclude organic and genetic disorders that might interfere with normal growth.
- Anthropometric assessment was then made using standardized equipment, following the recommendations of the International Biological Program [*12*]. Three consecutive measurements were taken and when the difference between the readings was acceptable, the mean was recorded. Body weight was measured with minimal clothing (for which no correction was made) using Seca scales and approximated to the nearest 0.01 kg. Height was measured without shoes using a Holtain portable anthropometer and approximated to the nearest 0.1 cm. Waist circumference was taken midway between the 10th rib and the top of the iliac crest (at the level of the umbilicus) using a flexible nonstretchable plastic tape and approximated to the nearest 0.1 cm. Subscapular and suprailiac skinfold thicknesses were measured on the left side of the body using Harpenden skinfold callipers and approximated to the nearest 0.2 mm. BMI (weight in kg/height^2 in m) and the sum of the subscapular and suprailiac skinfold thicknesses (as an indicator of central adiposity) were calculated.
- Each pupil was also examined by the Holtain Body Composition Analyser using bioelectrical impedance analysis to measure his/her body fat percentage (an estimate of the fraction of the total body mass that is adipose tissue) and percentage of lean using his/her age, weight and height approximated to the nearest unit.

The sample was classified into 3 age groups (6.5 ± 1, 8.5 ± 1 and 10.5 ± 1 years) for boys and girls. The limits proposed by the 2002 standard growth curves for Egyptian children and adolescents [*13*] were applied in reclassifying the sample according to BMI into normal (≥ 15% to < 85%), overweight (≥ 85% to < 95%) or obese (≥ 95%) according to the National Center for Health Statistics criteria [*14*].

Statistical analysis

Mean and standard deviation (SD) for all studied anthropometric measurements, indices and body fat percentage were calculated for each age and sex. Then the percentiles of waist circumference for overweight and obese children were estimated.

The correlation between waist circumference and BMI, subscapular skinfold thickness, suprailiac skinfold thickness, the sum of the 2 skinfold measures and

body fat percentage was investigated using Pearson's correlation test for each age and sex subgroup. Adjustment of age, BMI, percentage body fat, subscapular and suprailiac skinfold thicknesses was done using regression equations to investigate the relation between waist circumference and the sum of subscapular and suprailiac skinfold thicknesses in normal, overweight and obese children.

All the data were analysed using *SPSS*, version 9. The charts were drawn using Microsoft *Excel* software.

Results

The percentage of excess adiposity was nearly equal in girls and boys (12.2% of boys were overweight and 5.4% obese, while 11.8% of girls were overweight and 6.0% obese). Mean and SD for all the studied anthropometric measurements and the percentage of body fat by sex and age are presented in Tables 1 and 2. Waist circumference was nearly equal between boys and girls at all ages, except at age 6.5 ± 1 years when girls recorded higher values than boys with no significant difference ($P > 0.05$).

The correlation between waist circumference and the selected indicators of body fatness for both sexes is presented in Table 3. A highly positive correlation was noticed between waist circumference and BMI, percentage body fat, subscapular skinfold thickness (as an indicator for upper trunk fat), suprailiac skinfold thickness (as an indictor for lower trunk fat), and the sum of subscapular and suprailiac skinfold thick-ness (as an indicator for central adiposity) for both sexes ($P < 0.0001$). After adjustment for age, BMI, percentage body fat, subscapular and suprailiac skinfold thickness (Figures 1 and 2), the sum of subscapular and supra-iliac skinfolds still had a high correlation with waist circumference in normal, overweight and obese pupils (R^2 = 0.43, 0.59 and 0.54 for boys and R^2 = 0.45, 0.50 and 0.69 for girls, respectively).

The means of waist circumference measurement and their corresponding percentiles for overweight and obese pupils are presented in Table 4 for each age and sex. Central overweight was detected with waist circumference percentile ≥ 85th for boys and girls aged 8.5 ± years and 10.5 ± 1 years, while lower values were recorded for those aged 6.5 ± 1 years (75th percentile for boys and 80th percentile for girls) in the overweight group. Central obesity was observed with waist circumference percentile ≥ 95th for boys and girls in all studied age groups, with lower values only for girls aged 6.5 ± 1 years (90th percentile) among obese children.

Discussion

Central fatness in children is correlated with a less favourable metabolic profile [*2*]. Visceral fat or intra-abdominal adipose tissue (IAAT) can only be directly quantified with imaging techniques. IAAT has been detected in children as young as 5 years of age. IAAT generally increases in proportion with general fatness but the relationship between IAAT and total body fat is complex. In children, a major portion of the variance in IAAT is independent of total body fat. Central skinfold and waist circumference alone are highly correlated with IAAT as well as subcutaneous abdominal adipose tissue [*16*].

The definition of child overweight and obesity is arbitrary [*16*]. Comparison of our results regarding prevalence of overweight and obesity with another Egyptian study in Cairo [*17*] shows that they recorded

Table 1 **Descriptive data of the anthropometric measurements for boys by age**

Variable/group	Age 6.5 ± 1 years			Age 8.5 ± 1 years			Age 10.5 ± 1 years		
	No.	Mean	SD	No.	Mean	SD	No.	Mean	SD
BMI (kg/m²)									
Normal	179	16.57	1.20	232	17.39	1.47	150	17.72	1.79
Overweight	43	19.54	0.73	22	22.25	1.03	18	24.50	0.99
Obese	12	23.32	1.51	13	25.31	1.36	12	28.34	1.32
Total	234	17.47	2.11	267	18.18	2.54	180	19.11	3.62
Waist circumference (cm)									
Normal	177	53.06	3.84	231	57.50	4.67	150	62.10	5.69
Overweight	43	56.56	4.65	22	68.52	8.18	18	75.67	9.61
Obese	12	63.43	6.57	13	76.01	5.60	12	86.03	8.05
Total	232	54.25	4.87	266	59.32	7.02	180	65.05	9.37
Subscapular skinfold (mm)									
Normal	179	5.42	1.29	231	5.95	1.72	150	8.06	3.51
Overweight	43	6.98	2.64	22	12.60	4.68	18	21.12	6.26
Obese	12	8.70	4.69	13	18.22	5.85	12	22.70	6.38
Total	234	5.87	2.09	266	7.10	3.95	180	10.34	6.54
Suprailiac skinfold (mm)									
Normal	179	4.17	1.41	225	4.75	1.78	150	6.01	2.72
Overweight	43	5.21	2.08	22	9.70	3.64	18	13.24	5.87
Obese	12	7.42	3.37	13	13.95	5.48	12	13.90	5.53
Total	234	4.53	1.85	260	5.63	3.28	180	7.26	4.38
Sum of 2 skinfolds (mm)									
Normal	179	9.59	2.09	225	10.71	3.28	150	14.06	5.91
Overweight	43	12.19	3.78	22	22.30	7.56	18	34.36	10.66
Obese	12	16.12	7.05	13	32.17	0.73	12	36.60	9.29
Total	234	10.40	3.32	260	12.76	7.04	180	17.60	10.40
Body fat (%)									
Normal	164	12.72	6.52	211	12.71	7.78	138	15.98	9.75
Overweight	43	17.11	7.44	21	27.01	7.01	18	35.72	9.13
Obese	10	29.27	5.57	13	31.26	8.67	12	38.19	5.26
Total	217	14.35	7.61	245	14.92	9.53	168	19.68	12.33

SD = standard deviation; BMI = body mass index.

higher values than our study (14.3% of boys and 13.8% of girls were overweight while 6.3% of boys and 6.7% of girls were obese). However they used BMI-for-age percentiles according to Hammer et al., not national reference standards, which might overestimate the real prevalence [*18*].

The mean waist circumference and the corresponding percentiles for overweight and obesity were estimated for each age and sex. Mean waist circumference increased with age in both boys and girls. This agrees with other research, for example a study about the development of waist

Table 2 **Descriptive data of the anthropometric measurements for girls by age**

Variable/group	Age 6.5 ± 1 years			Age 8.5 ± 1 years			Age 10.5 ± 1 years		
	No.	Mean	SD	No.	Mean	SD	No.	Mean	SD
BMI (kg/m²)									
Normal	149	16.64	1.20	186	17.02	1.57	160	17.98	2.17
Overweight	33	19.71	0.64	18	21.82	0.75	20	24.54	0.93
Obese	23	23.14	1.67	7	25.57	1.92	6	28.14	1.07
Total	205	17.86	2.49	211	17.71	2.50	186	19.01	3.33
Waist circumference (cm)									
Normal	147	53.18	4.32	186	57.98	6.51	160	62.34	7.20
Overweight	33	58.78	5.15	18	66.89	5.88	20	77.33	5.47
Obese	23	64.23	8.12	7	73.50	5.89	6	86.32	8.71
Total	203	55.34	6.26	211	59.26	7.37	186	64.72	9.32
Subscapular skinfold (mm)									
Normal	147	6.23	2.20	186	8.07	3.76	160	9.83	4.25
Overweight	33	9.08	2.88	18	14.54	4.52	20	20.39	6.67
Obese	23	11.03	5.06	7	18.80	5.80	6	26.75	7.88
Total	203	7.24	3.25	211	8.98	4.66	186	11.51	6.35
Suprailiac skinfold (mm)									
Normal	148	4.76	1.64	186	5.92	2.93	160	7.61	3.35
Overweight	33	6.61	2.49	18	9.04	4.51	20	14.18	6.45
Obese	23	8.00	2.82	7	12.96	8.62	6	17.47	9.35
Total	204	5.43	2.26	211	6.42	3.68	186	8.63	4.80
Sum of 2 skinfolds (mm)									
Normal	147	10.96	3.26	186	13.99	6.28	160	17.44	7.00
Overweight	33	15.69	5.16	18	23.59	8.04	20	34.57	11.83
Obese	23	19.03	6.99	7	31.76	3.96	6	44.22	12.58
Total	203	12.64	5.05	211	15.40	7.87	186	20.14	10.42
Body fat (%)									
Normal	146	14.66	6.82	179	16.34	7.83	155	19.14	9.22
Overweight	33	25.00	7.74	18	29.71	7.41	19	34.82	9.30
Obese	21	30.98	10.58	7	34.40	3.88	5	42.56	4.93
Total	200	18.08	9.42	204	18.14	9.09	179	21.45	10.91

SD = standard deviation; MBI = body mass index.

circumference percentiles in British children aged 5–16 years [*19*]. Fernandez et al. described waist circumference percentiles of African–American, European–American and Mexican–American children and adolescents, and stated that waist circumference measurements increased in a monotonic fashion across ages but at non-constant rates and in a manner that varied with age and sex [*20*].

Waist circumference was equal between boys and girls in all the studied age intervals except age 6.5 ± 1 years, when girls recorded higher values with no significant difference. However, Fredriks et al. found that mean waist circumference was slightly higher in boys than in girls and this difference was statistically significant from 11 years of age onwards among Dutch children [*21*]. The same was reported by Soar et al. among

Table 3 **Correlation between waist circumference and the selected indicators of body fatness for boys and girls**

Variable	Correlation (*r*) with waist circumference					
	Boys			Girls		
	Age 6.5 ± 1 years (*n* = 233)	Age 8.5 ± 1 years (*n* = 270)	Age 10.5 ± 1 years (*n* = 201)	Age 6.5 ± 1 years (*n* = 206)	Age 8.5 ± 1 years (*n* = 245)	Age 10.5 ± 1 years (*n* = 206)
Body mass index	0.601	0.779	0.818	0.697	0.515	0.801
Subscaplar skinfold	0.518	0.769	0.787	0.733	0.759	0.760
Suprailiac skinfold	0.352	0.739	0.696	0.646	0.567	0.613
Sum of 2 skinfolds	0.523	0.779	0.788	0.759	0.720	0.742
Body fat %	0.354	0.779	0.629	0.571	0.520	0.680

*All correlations were staristically significant (*P *< 0.0001).*
n = *number of participants.*

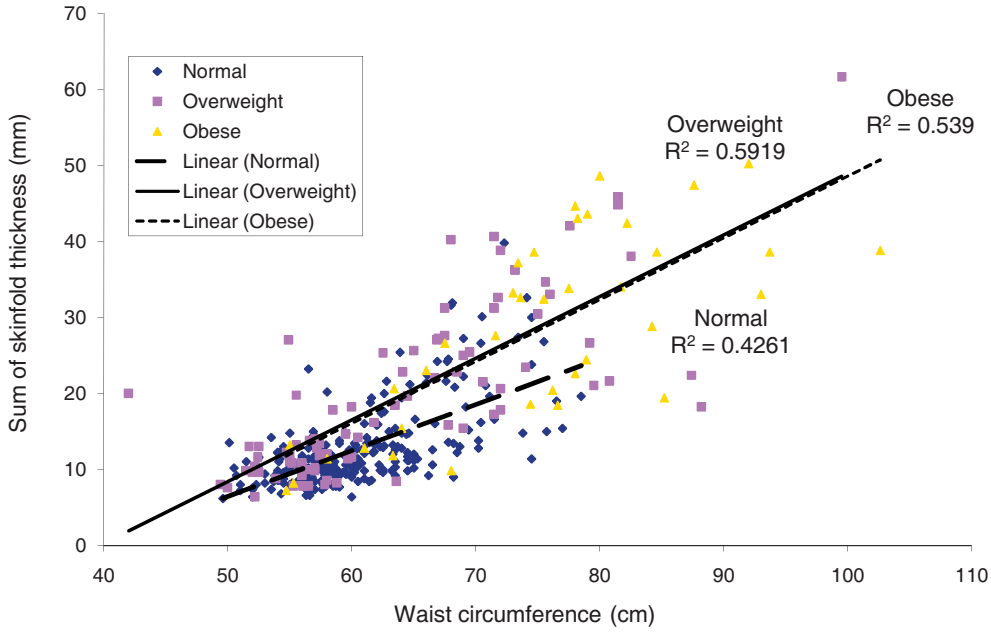

Figure 1 **Regression lines for normal, overweight and obese boys**

schoolchildren aged 7–9 years in Brazil [*22*].

In summary, we have shown that waist circumference correlates with total body fat percentage and BMI, and especially with central adiposity in the trunk region (central subcutaneous fat) in this age group of Egyptian primary-school children of both sexes in the 3 studied categories of BMI. Our results confirm the finding that waist circumference is a convenient measure of abdominal adipose tissue [*23*]

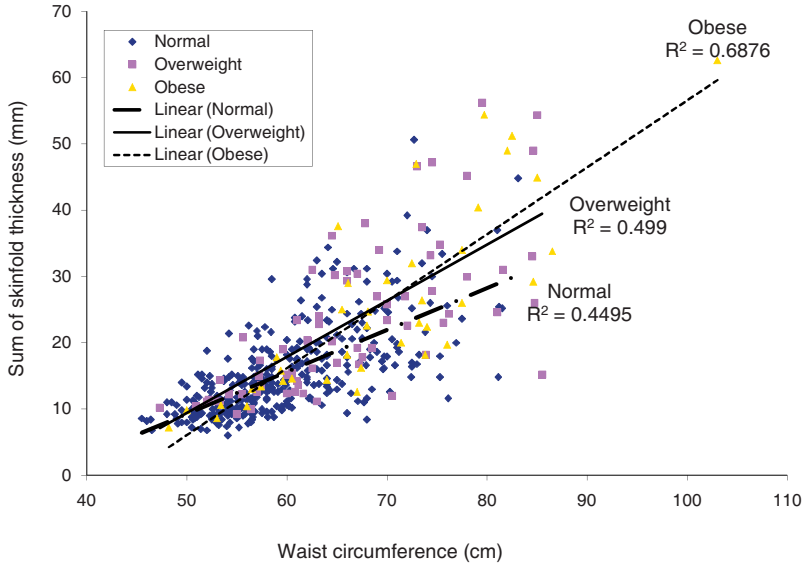

Figure 2 **Regression lines for normal, overweight and obese girls**

Table 4 **Estimated percentiles of waist circumference for overweight and obese boys and girls**

Sex & age (years)	Overweight		Obese	
	Mean	Per-centile	Mean	Per-centile
Boys				
6.5 ± 1	56.56	75	63.43	95
8.5 ± 1	68.52	89	76.01	96
10.5 ± 1	75.67	89	86.03	97
Girls				
6.5 ± 1	58.78	80	64.23	90
8.5 ± 1	66.89	85	73.50	96
10.5 ± 1	77.33	90	86.32	99

and correlates closely with BMI [*8,22*], with centralized or upper body fat in young people [*3,4,24*] and with total body fat [*25*]. Taylor et al. also found in their study in New Zealand children aged 3–19 years that waist circumference performs well as an index of central adiposity in children and adolescents of both sexes over a wide age range [*5*].

A positive correlation was found between waist circumference and the sum of the 2 selected central skinfolds after adjustment for age, BMI, percentage fat and each of these skinfolds, which confirms the advantage of waist circumference as an indicator for central fatness. Our results support Mueller and Kaplowitz, who noted that the sum of subscapular and suprailiac skinfolds was a good indicator for central adiposity [*26*].

Conclusions

Waist circumference is a good indicator for central fatness in children aged 8.5 ± 1 years and 10.5 ± 1 years. Waist

circumference should be routinely measured in schoolchildren. Further work is necessary to examine the link between waist circumference, body fatness and morbidity in young people. National standards for waist circumference are needed to study trends in, and the likely medical and psychological costs of, obesity in young people.

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Effects of an awareness symposium on perception of Libyan physicians regarding telemedicine

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تأثيرات ندوات رفع مستوى الوعي على إدراك الأطباء الليبيين للتطبيب عن بُعد

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الخلاصة: يُعَدُّ رفع مستوى الوعي بين القائمين على تقديم الرعاية الصحية، ولاسيما الأطباء منهم بالتطبيب عن بُعد، أمراً بالغ الأهمية لتطوير هذا النوع من التطبيب. وقد وزع الباحثون استبيانات على الأطباء الليبيين المشاركين في ندوة طبية حول التطبيب عن بُعد عقدت في المدة من 28 شباط/فبراير إلى الأول من آذار/مارس 2005. وتكونت عينة المشاركين من 28 طبيباً و13 طبيبة يمارسون اختصاصات مختلفة ويعملون في أنحاء مختلفة من ليبيا. وأوضحت الإجابات أن معظم المشاركين كانوا يعانون من عدم وضوح (53.7%) أو عدم إطّلاع في ما يختص بالتطبيب عن بُعد (14.5%) قبل حضورهم الندوة. وبعد مشاركتهم بالندوة انخفض عدد من يعاني من عدم الوضوح ليصل إلى 12.2% فيما أبدى 39.0% منهم تفهماً ممتازاً لهذا الأمر، و48.8% منهم تفهماً لا بأس به. وقد أوضح 97.6% من المشاركين دعمهم لتطبيق التطبيب عن بُعد في البلاد مع تقدير أهميته في توطيد الخدمات الصحية في المناطق النائية.

ABSTRACT The awareness of health care providers, particularly physicians, towards telemedicine is pivotal to its development. In this study we distributed questionnaires among Libyan physicians attending a medical symposium on telemedicine, held in the period 28 February–1 March, 2005. The sample comprised 28 males and 13 females from different specialties and from different parts of the country. Most reported being confused (53.7%) or unaware (14.6%) regarding telemedicine before the symposium. Afterwards, 12.2% were confused, 39.0% showed excellent understanding and 48.8% reported fair understanding; 97.6% supported the implementation of telemedicine in the country and appreciated the importance of establishing remote health services.

Effets d'un colloque de sensibilisation sur la perception de la télémédecine par les médecins libyens

RÉSUMÉ La sensibilisation des prestataires de soins de santé à la télémédecine, en particulier celle des médecins, joue un rôle essentiel dans le développement de cette pratique. Pour cette étude, nous avons distribué des questionnaires à des médecins libyens qui participaient à un colloque médical sur la télémédecine organisé du 28 février au 1er mars 2005. L'échantillon était constitué de 28 hommes et de 13 femmes représentant différentes spécialités et venant de différentes parties du pays. Avant le colloque, la plupart d'entre eux déclaraient ne pas savoir quoi penser (53,7 %) ou ne rien savoir (14,6 %) de la télémédecine. Après, 12,2 % restaient perplexes, 39,0 % avaient d'excellentes connaissances sur cette pratique et 48,8 % disaient en avoir une bonne compréhension ; 97,6 % soutenaient sa mise en place dans le pays et estimaient important de créer des services de santé à distance.

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Introduction

Telemedicine is defined as "the use of electronic communication and information technologies to provide or support clinical care at a distance" [*1*]. Tele-health, a broader concept, is defined as "the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration" [*1*]. These 2 developments have great potential to change structures, procedures, and eventually outcomes in healthcare systems worldwide.

Owing to factors such as lack of knowledge and interest by health professionals, these e-health innovations are still dominated by committed efforts of research and development conducted by pioneers. Other factors have contributed in the inhibition of the telemedicine and tele-health industry from reaching its full global potential. These include lack of significant reimbursement, cross-state licensure problems, privacy issues, lack of universal standards and high transmission costs [*2*]. However, since 1999 there has been a steady growth in interest among the international medical community in the potential application of these innovations [*3*], and some telemedicine concepts and applications have already been implemented in clinical routine or are ready to be implemented [*4,5*].

In the Libyan Arab Jamahiriya, which is facing an era of heath reformation and restructuring, telemedicine is one of the notions relied upon to facilitate health promotion. This is shown in the establishment of governmental bodies specialized in providing telemedicine services aiming to connect the major hospitals with rural areas and in the establishment of a telemedicine department in the Libyan General Medical Council.

The extent of knowledge in Libyan health care providers regarding telemedicine and their readiness to implement it in daily clinical practice and in medical education has not been explored. This study was designed to evaluate the knowledge and attitudes of Libyan physicians towards telemedicine and to assess the influence of education on their knowledge and attitudes towards the subject.

Methods

We distributed pre-prepared questionnaires to assess the knowledge and attitudes of the participant doctors towards telemedicine during the Tele-Cardio Symposium which was organized by the Libyan Cardiac Society in Misurata, Libyan Arab Jamahiriya, during the period 28 February–1 March 2005. The questionnaire was in 2 parts: part A covered personal data, and part B comprised 2 questions formulated to assess the level of previous knowledge regarding telemedicine and whether the participant agreed about establishing telemedicine in Libya.

The question on knowledge of telemedicine was assessed on a 4-part scale: "none", "confused", "fair", and "excellent". The second question was answered either "yes" or "no". The same questionnaire was redistributed among the participants at the end of the symposium during the final proceedings to evaluate the influence of the meeting on their knowledge and attitudes.

The symposium comprised 22 dedicated lectures on telemedicine: the "virtual Euro-Mediterranean hospital" concept was introduced, the telecardiac experiences of Great Ormond Street Hospital were outlined and the Italian "Telecardio Sea Project" was also demonstrated. Professor N.D. Giovanni, the scientific adviser of

the project demonstrated the satellite DC shock which, in the event of cardiac arrest in the middle of the sea, connects to the 24-hour Sea Project centre where direct resuscitation guidance will be provided to save the victim. The programme has been published as an abstract book [*6*].

Statistical analysis

All results were expressed as percentages. Comparisons were made using the simple *t*-test. *P*-values < 0.05 were considered significant. Mean, standard deviation and *t*-test were evaluated using *Microsoft Excel*.

Results

Study sample

All the participants returned completed questionnaires both before and after the conference and agreed to supply personal details (which was optional). The sample comprised 41 Libyan physicians from different parts of the country, 28 males (68.3%) and 13 females (31.7%). Age range was 25–55 years, mean 37.3 (standard deviation 3.4) years.

Cardiologists, 6 (14. 6%), or paediatric cardiologists, 11 (26.8%), made up the greater proportion of the participants. The other medical specialties were represented in approximately equal numbers. There were 18 consultants, 5 senior registrars, 3 registrars, 11 senior house officers and 4 house officers.

Geographically, most of the participants, 47.4% (n = 18), were from the capital city, Tripoli, or from the symposium-hosting city Misurata 34.1% (n = 14). Three were from Benghazi, 2 from Tobruk, and 1 from each of Sebha, El Zawaya, Sert and Zletin.

Table 1 **Participants' perception of telemedicine before and after the symposium**

Perception of telemedicine	Before No.	Before %	After No.	After %
Understanding				
Excellent	3	7.3	16	39.0
Fair	10	24.4	20	48.8
Confused	22	53.7	5	12.2
Unaware	6	14.6	0	–
Attitude to introduction				
Agree	2	4.9	40	97.6
Disagree	39	95.1	1	2.4

P *< 0.05 for all categories.*

Attitude and perception towards telemedicine

Before the symposium, 22 of the participants (53.7%) reported they were confused about telemedicine; and 6 (14.6%) were completely unaware. Afterwards, no-one was still unaware of telemedicine, and 36 (87.8%) reported excellent or fair understanding ($P < 0.05$ for all) (Table 1).

Before the symposium, 39 of the 41 participants (95.1%) said they did not support the establishment of telemedicine facilities in Libyan hospitals. Following the meeting, 40 (97.6%) supported the scheme ($P < 0.05$) (Table 1).

Discussion

If health modernization is established as a key health policy objective in Libya, it is important to ensure that health care providers are ready to acknowledge and support the new radical instrumental and administrative changes, which will not only change current medical practice but also

professional behaviour. Recent advances in information and communication technology, particularly telemedicine and tele-health, have been seen as key mechanisms by which these changes can be engendered [*4*]. Directed investment in telemedicine and tele-health promises the rapid distribution and deployment of patient-centred information across internal organizational boundaries towards global health care [*7*].

This preliminary report suggested that the knowledge and perception of Libyan doctors concerning telemedicine was extremely low, and even those who had some knowledge, were rather confused. However, the positive responsiveness of all those who participated in the study indicates the readiness of Libyan doctors to cooperate to further their knowledge.

The study sample, though small, represented most of the medical specialties and the main cities. In order to obtain a clearer picture, however, a comprehensive study involving a larger, randomized spectrum of physicians is required.

In this study, it was very interesting to note the significant influence of the symposium on the participants. Both perception and attitudes towards telemedicine improved markedly following the meeting. In other studies exploring physicians' perception towards telemedi-cine in different countries, it was found to vary from conservative to optimistic [*8–10*]. Physicians perception remain one of the major barriers to the diffusion of telemedicine, and therefore knowing that Libyan doctors are cooperative and agreeable to participating in open studies, and that with education may change their attitudes indicates that the path towards introducing these innovations may not be so arduous.

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Eastern Mediterranean Region Observatory on Human Resources for Health

The Observatory on Human Resources for Health (URL: http://www.emro.who.int/hrh-obs/hrh_about.htm) is a governance tool to complement the Health System Observatory for continuously collecting, updating and disseminating key information into one consolidated electronic source. While the content of the Observatory on Human Resources for Health covers primarily country profiles pertaining to health workforce dynamics, it offers an analytical platform needed for evidence-based health workforce planning with policy and regulatory implications. The Observatory will assist WHO Member States in using a proactive approach to tackle HRH-related challenges. It is an up-to-date Regional resource on numbers, significant correlations between major health workforce determinants and ratios, with an operational and policy linkage to national benchmarks and Regional targets. The aim is not merely to disseminate information but rather to facilitate continuous sharing of models that have worked well and successful experiences in resolving related problems.

Casemix in the Islamic Republic of Iran: current knowledge and attitudes of health care staff

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نظام تبويب الحالات المرضية في جمهورية إيران الإسلامية: المعارف والمواقف الراهنة للعاملين في الرعاية الصحية

شهرام غفاري، كريستفر دورن، أندرو ويلسون

الخلاصة: إن نظام تبويب الحالات المرضية هو أداة لتصنيف المرضى وفقاً للتشابه في ما بينهم من حيث الحالة السريرية والتجانس في الموارد المطلوبة. وقد أجرى الباحثون دراسة وصفية لتقييم مستوى المعارف والمواقف تجاه نظام التمويل المستند على هذه الأداة، وذلك في أوساط العاملين في المنظمة الإيرانية للضمان الاجتماعي في طهران. وقد أظهر المسح الذي أجراه الباحثون أن المعرفة بهذه الأداة وبالمجموعات المتعلقة بالتشخيص ضئيلة لدى العاملين الذين شملتهم الدراسة، وأن أي محاولة لتطبيق هذا النظام الخاص بتبويب الحالات المرضية، والذي لم يسمع عنه ما يقرب من ثلاثة أرباع العاملين في المراكز العليا من قبل، سيكون مصيرها الفشل. ويؤكّد البحث على ضرورة رفع مستوى الوعي حول هذا النظام ونظم المجموعات المتعلقة بالتشخيص بين العاملين في المستشفيات قبل اتخاذ أي خطوات عملية.

ABSTRACT Casemix is a tool that classifies patients according to their clinical similarity and the homogeneity of resources required. A descriptive study was conducted to assess the level of knowledge and attitude toward the casemix-based funding system among staff working in the Iranian Social Security Organization in Tehran. The survey showed that knowledge of casemix and diagnosis-related groups (DRG) was poor among the study group and any attempt to implement the casemix system—which about three-quarters of high-level staff had never heard of—would be likely to fail. This highlights the necessity for creating awareness of the casemix and DRG systems among the hospital staff before any action takes place.

Le « case-mix » en République islamique d'Iran : connaissances actuelles et attitudes du personnel de santé

RÉSUMÉ Le « case-mix » (ou ensemble des divers cas pris en charge par un établissement hospitalier ou un praticien) est un outil qui permet de classer les patients en fonction de leur similitude clinique et de l'homogénéité des ressources requises. Une étude descriptive a été réalisée afin d'évaluer le niveau de connaissances et les attitudes envers le système de financement fondé sur le « case-mix » parmi le personnel de l'Organisation de la sécurité sociale iranienne à Téhéran. Cette étude a montré que les connaissances relatives au « case-mix » et aux groupes homogènes de malades (GHM) étaient faibles dans le groupe visé par l'étude et que toute tentative de mise en place du système de « case-mix » – dont une majorité d'environ 75 % des responsables n'avaient jamais entendu parler – risquait fort d'échouer. Ce constat met en lumière la nécessité de mieux faire connaître les systèmes de « case-mix » et GHM au personnel hospitalier avant d'adopter des mesures.

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Introduction

Casemix is a tool that classifies patients according to their clinical similarity and the homogeneity of resources required [*1*]. Casemix was initially designed for the comparative study of hospital efficiency [*2*] and quality assurance, but is now broadly used for funding purposes. The main objectives of the use of casemix-based funding in hospitals have been to introduce a fair resource allocation system in the context of overall budget reduction; to improve the efficiency of hospitals; and to reduce waiting lists by motivating hospitals to treat more patients [*3*]. Casemix is in fact a broad term that can apply to the classification of acute patients, sub- and non-acute patients, outpatients, etc. Diagnosis-related groups (DRG), which classify hospital acute patients, are the best-known example of the casemix system [*1*].

The use of casemix has become an important part of hospital funding systems in developed countries [*4*] and is becoming increasingly common in Asia and developing countries. China examined the feasibility of applying the all-patient (AP)-DRG system in the 1990s and the Australian-refined (AR)-DRG system to the description of Chinese hospital activity in 2003 [*5*], and Malaysia held its 2nd international casemix conference in September 2005 to better understand the application of the casemix system to hospital cost administration.

The Islamic Republic of Iran is steadily preparing itself for implementing the casemix system in its hospitals. A 2-day workshop was held in August 2005 to introduce the concept of casemix to employees of the Iranian Social Security Organization (SSO). The workshop was organized by the SSO in conjunction with the World Health Organization (WHO) and the Iranian Ministry of Health.

The funding for hospitals in the Iranian SSO is based on annual budgeting. This system does not provide adequate incentives for efficiency improvement [*6*]. Efficient use of scarce health resources is of critical importance for hospitals because they consume 30%–40% of total health care expenditure in developed countries [*7*] and 50%–80% of government expenditure in developing countries [*8*].

To move from the current system of annual budgeting to the new one of casemix funding, sound knowledge and education of hospital staff and physicians are essential. Evidence suggests that resistance to change, which is a common problem whenever new systems are to be implemented, is closely tied to the participants' knowledge of and attitudes towards the new system [*9*]. The purpose of this study was to examine the feasibility of the casemix and DRG systems through assessing the knowledge of high-level staff and identifying their attitudes toward these concepts.

Methods

This was a descriptive study conducted in 2005 to assess the level of knowledge of and attitude toward the casemix funding and DRG systems among high-level staff working in the SSO in Tehran, Islamic Republic of Iran, including heads of hospitals and hospital managers, heads of clinics, nurse mangers, accountants and health care experts. This study also aimed to identify the staff's expectations and preferences towards the casemix system.

An 11-item questionnaire, including 6 multiple-choice and 5 open-ended questions, was designed to identify the participants' knowledge of the current funding system, and of the concepts of casemix and DRG. There was no gold standard to evaluate

the questionnaires, so criteria identified in the literature were used to evaluate the questions about the current funding system [*10–12*], and casemix and DRG [*1,3,13*].

Question 1 asked respondents what the current funding mechanism used for resource allocation in their hospital was (global budgeting, capitation, per diem, fee-for-services, case-based payment, mixed payment, don't know). Questions 2–4 asked about the benefits and constraints of the current funding system and respondents' views about its efficiency. Questions 5–8 asked respondents if they had ever heard about the casemix classification system and about DRG and to explain their concept of them. Question 9 asked what they saw as the benefits of casemix and DRG. Questions 10 and 11 aimed to measure participants' attitudes toward the feasibility of implementing casemix and DRG within their hospital and the anticipated barriers.

The survey was administered twice, before and after an educational session (hereafter called pre- and post-intervention study). The pre-intervention study aimed to measure the current funding and knowledge about casemix of the participants before the educational session. Based on the assumption that the casemix knowledge of the participants would not be at a reasonable level, a 2-hour educational session was held immediately after the pre-intervention study to provide some basic information about the different systems of hospital funding as well as their strengths and weaknesses. The focus of the educational session was to introduce the casemix classification system and its funding applications. At the end of the educational session, the participants were asked to complete the same questionnaire again (i.e. post-intervention study).

A scoring system was used to assess the level of the knowledge of the current funding, casemix and DRG:

- Score 0: had no idea about the current funding system (or chose incorrect answers); had not heard of casemix or DRG.
- Score 1: knew what the current funding system was but had no further information; knew the terms "casemix" and '"DRG" but unable to explain them correctly.
- Score 2: could explain the relevant advantages or disadvantages and had the correct concepts of the funding system; could explain the concept of DRG and casemix properly.
- Score 3: had the right concept of, and could address some advantages or disadvantages of, casemix and DRG to varying degrees.

Using *STATA* statistical package [*14*], the 2-sample test of proportion was calculated to determine changes in participants' knowledge of casemix and DRG before and after the educational session.

Results

Pre-intervention results

Participants' demographic information

Overall 63 participants (70% of the total number of participants in the workshop) took part in the pre-educational survey and completed the questionnaire. The demographic information of the participants is outlined in Table 1: 54% were male, 41% had a BSc degree, and 43% had more than 10 years work experience. In the SSO context, chiefs of hospitals are always physicians (MD degree), and the hospital managers are second to the hospital chief and could be a physician, a professional in health care management systems or other qualified staff. A health care expert was someone working in the central office to supervise the system.

Table 1 **Demographic background of the study participants (*n* = 63)**

Variable	%
Sex	
Male	54
Female	46
Age (years)	
< 30	11
30–50	84
> 50	5
Education	
High-school diploma	6
BSc degree	41
MSc degree	18
MD degree	35
Job position	
Hospital chief	3
Hospital manager	9
Head of clinic	17
Nurse manger	13
Accountant	16
Health care expert	35
Unknown	7
Work experience (years)	
< 5	15
5–10	37
> 10	43
Unknown	5

Knowledge of and attitudes to the current funding system

In total, 51% of the participants at the initial survey (n = 63) acknowledged that they had no idea about the current funding system, 21% knew the current system but had no more information about it, and 28% in addition to understanding the system were able to address advantages and disadvantages to varying degrees (Table 2). Using the 2-sample proportion test there was no significant difference (P = 0.75) comparing the proportions who did not know about the current funding system at all (score 0) and those who knew about it (sum of score 1 and 2), or between the proportion of participants who were grouped into score 1 and 2 (P = 0.17). Regarding job positions, 30% of the accountants and 86% of the nurse managers did not understand the current funding system.

Only 18 (28%) of respondents answered the questions about the benefits/constraints of the current funding system. Benefits were identified as: ability to control total hospital costs (21%); capped budget (18%); easy implementation (12%); sufficient level of autonomy to managers (9%); and overcoming the budget deficit by lobbying for extra funds (9%). Participants identified the constraints of the current funding system mainly as: an unfair system which does not take account of hospital activities (25%); disincentives for innovation (24%); and budget crises when facing unpredicted events (20%). About 31% gave irrelevant answers to these questions.

From a total of 31 (49%) participants who knew what the current funding system was (score 1 and 2), 69% believed that it was a low efficiency/inefficient system

Table 2 **Participants' knowledge scores about the current funding system, the casemix system and diagnosis-related groups (DRG) in the pre-intervention study (*n* = 63)**

Knowledge item	Score 0		Score 1		Score 2		Score 3		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Current funding system	32	51	13	21	18	28	n/a		63	100
Casemix	47	75	5	8	6	9	5	8	63	100
DRG	37	58	8	13	8	13	10	16	63	100

n/a = not applicable.

compared with 10% who believed that it was an efficient system. About 21% had no idea about the efficiency of the current funding system.

Knowledge of and attitudes to casemix and DRG

According to the initial survey, the majority of participants had no knowledge of casemix (75%) and DRG (58%) (score 0) (Table 2). About 8% and of the participants acknowledged that they had only heard about the term casemix and 13% had heard of DRG (score 1). Only 9% explained casemix and 13% explained DRG correctly, to a varying degree, and were classified into the group with moderate knowledge (score 2). Finally, some of the participants could address some advantages of the systems (8% for casemix and 16% for DRG) and were grouped as having good knowledge (score 3). Significantly more participants had never heard about the casemix and DRG at all (score 0) compared with those who had some or a good degree of knowledge about them (total of score 1, 2 and 3) ($P < 0.05$).

From those who knew about casemix (score 1, 2 and 3, $n = 16$) and DRG (score 1, 2 and 3, $n = 26$), almost 56% were health care experts and 16% were hospital managers; only 4% were accountants and nurse mangers. Almost 50% of the participants who knew both casemix and DRG and could explain them properly (score 1 and 2[*0*], $n = 11$), still did not have a correct understanding of the current funding system.

The term casemix and DRG were explained (score 2 and 3), by 17% ($n = 11$) and 29% ($n = 18$) of the participants respectively. The majority of the participants at the initial survey explained casemix and DRG as cost allocation and funding tools instead of patient classification or acute inpatient classification systems, quality improvement or management tools. They referred to casemix mainly as: a cost allocation system (25%); a patient classification system (13%); and a patient classification and cost allocation system (10%) (other answers were not relevant). Almost 42% of the participants explained casemix incorrectly. DRG was also described mainly as a system for cost allocation (40%), patient classification (20%), both cost allocation and patient classification (20%), and a quality improvement tool (4%).

Almost 37% of the total participants, and 89% of those who could explain casemix and DRG properly, believed that casemix would be a feasible model in their system. All physicians (MD degrees) believed that casemix would be applicable, compared with 88% of the 41 participants with MSc and BSc degrees and 66% of the 6 people with a high-school qualification. Almost all of the hospital managers, clinic heads and nurse mangers believed that casemix would be an applicable model compared with 67% of the accountants and 88% of health care experts.

The possible barriers associated with casemix implementation were inappropriateness of the system and lack of a good climate, as mentioned by 12 (20%) of the total participants. Difficulty in accessing the data (15%), lack of or incomplete knowledge about casemix and DRG among the chief managers and staff (15%), invalid DRG and DRG creep (10%) were some other problems identified by the participants (40% gave irrelevant answers to the question).

Post-intervention study

Knowledge of casemix and DRG

Out of 37 questionnaires returned by the participants at the post-intervention study, 32 were matched to identify the effect of the educational session on the participants' knowledge. There were no significant

changes in participants' knowledge about the current funding system in the post-intervention survey compared to the pre-intervention study (Table 3). Global budgeting was believed to be the current system by 48% of participants in the pre-intervention study and 53% in the post-intervention study ($P = 0.57$).

Table 3 **Participants' knowledge scores about the current funding system, the casemix system and diagnosis-related groups (DRG) comparing those who participated pre- and post-intervention (matched group) ($n = 32$)**

Knowledge item	Score 0				Score 1				Score 2				Score 3			
	Pre		Post		Pre		Post		Pre		Post		Pre		Post	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Current funding	15	47	17	53	6	19	3	9	11	34	12	38	n/a		n/a	
Casemix	26	81	2	6	1	3	2	6	3	9	9	28	3	9	19	59
DRG	18	56	1	3	4	13	0	0	6	19	9	28	4	12	22	69

n/a = not applicable.

Table 4 **Demographic background of those who participated in the post-intervention study ($n = 32$) with those who did not ($n = 31$)**

Variable	Participation		No participation	
	No.	%	No.	%
Sex				
Male	13	40	21	68
Female	19	60	10	32
Age (years)				
< 30	6	22	1	3
30–50	23	72	29	94
> 50	2	6	1	3
Education				
High-school diploma	2	6	3	10
BSc degree	21	66	5	16
MSc degree	4	12	6	19
MD degree	5	16	17	55
Job position				
Hospital head	0	0	2	6
Hospital manager	1	3	5	16
Clinic head	4	13	7	23
Nurse manager	7	22	1	3
Accountant	7	22	3	10
Health care expert	12	37	11	35
Unknown	1	3	2	6
Work experience (years)				
< 5	7	22	4	13
5–10	9	28	14	45
> 5	15	47	12	39
Unknown	1	3	1	3

However, participants' knowledge about casemix and DRG (score 2 and 3) increased considerably (Table 3). About 9% of the participants could explain some advantages or disadvantages of the casemix system in the initial study compared with 60% in the follow-up survey, a statistically significant difference ($P < 0.001$).

A positive attitude to the feasibility of the casemix system increased from around 37% of participants in the pre-intervention study to about 70% after the educational session ($P < 0.001$).

Comparison of participants and non-participants in the post-intervention study

Out of 63 participants, 31 did not participate at the post-intervention study. The demographic information of those who did not participate and those who did is given in Table 4. The female participants, those aged < 30 years, and those with work experience < 5 years were keener to participate in the post-intervention study. Accountants and nurse managers had a higher participation rate at the post-intervention study compared with the others.

Knowledge about the current funding system was not statistically significant different (between the 2 groups $P = 0.15$); 38% of those who did not participate at the post-intervention study chose global budgeting compared with 56% who did participate. Also, in general, there was no statistically significant difference in knowledge about casemix and DRG among the participants who took part at the post-intervention study and those who did not (Table 5). An average of 69% of those who did not participate in the post-intervention study stated that they had no idea of the casemix system and DRG compared with 62% of those who did participate ($P = 0.065$).

About 35% of the participants who did not participate at the post-intervention study believed that casemix could be a feasible model compared with 37% of those who did participate.

Discussion

The casemix classification system, which is a popular method used for patient classification [*15*], employs DRG to classify hospital inpatients according to the condition they suffer and the treatment they receive [*1*]. Casemix is a technically complicated model to apply due to the requirement of a comprehensive classification system of

Table 5 **Participants' knowledge scores about the current funding system, the casemix system and diagnosis-related groups (DRG) comparing those who participated in the post-intervention study (*n* = 32) and those who did not (*n* = 31)**

Knowledge item	Score 0		Score 1		Score 2		Score 3	
	Participation %	No participation %	Participation %	No participation %	Participation %	No participation %	Participation %	No participation %
Current funding	44	62	22	8	34	30	n/a	n/a
Casemix system	82	71	18	3	16	17	9	9
DRG	57	67	43	4	31	13	15	16

n/a = not applicable.

output and regular updating of the system in line with changes in clinical practice [*16*]. Invalid demographic and clinical information about patients, including incorrect principal diagnoses, and other data entry problems are some issues that limit the performance of casemix system. The implementation of casemix needs a well-organized and computerized system with well-oriented staff, otherwise the system will fail.

Improving knowledge and understanding of the funding system among staff and mangers in hospitals and health systems can provide the groundwork for service improvements. A simple questionnaire can reveal the level of knowledge about the funding system as well as the need for education, not only about casemix, but about the funding mechanisms in general. About 50% of the participants in our study had no information about the current funding system or they had incorrect knowledge.

The results provide a better understanding of the current level of casemix and DRG knowledge of staff occupying the top positions and highlight the need for education about the funding system and casemix. The survey showed that knowledge of the casemix and DRG systems was poor among the study group and a short educational programme did influence the level of knowledge of and attitudes toward the casemix system. However, the result of the study cannot be extrapolated to all staff working at the SSO in Tehran province and as such the results may not be a good indicator of the staff knowledge throughout the country. The level of knowledge of the participants may be overestimated owing to personal communication of some of the participants with the author before the study took place.

Any attempt to implement casemix, which about three-quarters of the top level staff had never heard of, into the current system would be likely to fail. The problems become more complex when casemix is considered as a cost allocation and cost containment tool, as in this study. The majority of the participants in the initial survey believed that casemix was a funding tool rather than a tool for quality promotion, which was the original aim of the casemix designer [*17*]. This misunderstanding would result in an increasing resistance to change among health care staff. Therefore, further education should focus on introducing the different uses of the casemix system, such as efficiency improvement, utilization review, management and benchmarking applications, to ensure a better understanding of the casemix system.

To implement casemix in the Islamic Republic of Iran, a high level of cooperation is required by managers, staff and clinicians. A survey by Bridges, Mazevska and Haas to develop better casemix education for rural staff working in New South Wales identified that clinical staff would not be interested in the casemix system until they were assured that there would be no negative effects either on the hospital or on the financial status of the staff [*18*]. "What does the casemix mean for a clinician as an individual? "Does it mean more money or less money?" Answers to such questions could act as incentives for staff and clinicians to cooperate [*18*]. Nursing staff may not encourage casemix if they identify it as a tool with a negative impact on their practice and patient care, which was the common concern identified by Baker in a study on the evaluation of Australian nurses' attitudes toward the casemix funding: most of the participants (about 75%) believed that casemix was part of a scenario to maintain costs and reduce the state debt [*19*]. This view should be modified by explaining the various uses of the casemix system. Otherwise resistance to

change would reduce the active participation and cooperation of the staff in the new programme. Resistance to change poses serious challenges for the system, especially when the changes need active participation and cooperation.

In a study by Gleeson it was concluded that limited knowledge of the casemix system may result in negative attitudes to casemix [*20*]. In our survey, only 8% of the participants had knowledge of both casemix and DRG and could explain them adequately and most of them did not consider casemix a management tool designed for improvement of quality and efficiency.

Conclusion

The study illustrates that knowledge of the casemix system as well as knowledge of the current funding system in hospitals in Tehran is poor among the high-level staff surveyed. This highlights the need to create awareness of the casemix and DRG systems among staff before any action takes place. Considering that they are mostly known as funding and cost containment tools rather than management or quality and efficiency improvement systems, staff and clinician resistance would be a real challenge if continuing education is not put in place. To increase the cooperation of clinicians and allied health staff, further education should focus on how casemix can be used to improve patient care and how it affects the funding situation of the departments and staff in hospitals. While a single education session may positively affect the participants' knowledge of the casemix and DRG systems, an integrated and comprehensive educational programme and periodic feedback are recommended.

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Safety of patient meals in 2 hospitals in Alexandria, Egypt before and after training of food handlers

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سلامة وجبات المرضى في مستشفيَـيْن بالإسكندرية، في مصر، قبل وبعد تدريب المشرفين على الطعام فيهما

هشام الدرع، إجلال سالم، محمد فوزي، منى عبد العظيم

الخلاصة: درس الباحثون ما لدى 23 من المشرفين على الطعام في مستشفيَـيْن في الإسكندرية، بمصر (مستشفى جمال عبد الناصر ومستشفى معهد البحوث الطبية) من معلومات حول سلامة الغذاء وما يتبعونه من ممارسات لتقديم الطعام، وذلك قبل وبعد إخضاعهم لبرنامج تدريبي حول سلامة الغذاء، وحول معدّات المطبخ، وجودة وجبات المرضى. وقد لوحظ تحسُّن ملحوظ في جميع المتغيرات المرتبطة بالمعارف باستثناء النظافة الشخصية في مستشفى جمال عبد الناصر. كما لوحظ تحسُّن في ممارسات سلامة الغذاء في كلا المستشفيَـيْن مع تحسُّن في الجودة البكتريولوجية لدى معظم وجبات المرضى وسطوح تحضير الغذاء وأوانيه بعد التدريب، وكانت الجودة البكتريولوجية للوجبات المقدَّمة في مستشفى جمال عبد الناصر أفضل بشكل عام مما كانت عليه في مستشفى معهد البحوث الطبية.

ABSTRACT We assessed the food safety knowledge and food handling practices of 23 food handlers in 2 hospitals in Alexandria, Egypt [Gamal Abdel Nasser (GAN) and Medical Research Institute (MRI)] before and after a food safety training programme, and also the bacteriological quality of patient meals and kitchen equipment. There was a significant improvement in all knowledge-associated parameters except for personal hygiene in GAN. There was an improvement in the food safety practices in both hospitals. The bacteriological quality of most patient meals and food preparation surfaces and utensils improved after training. The bacteriological quality of patients' meals served in GAN was generally better than that in MRI.

Sécurité sanitaire des repas servis aux patients dans deux hôpitaux d'Alexandrie (Égypte) avant et après la formation des personnes manipulant les aliments

RÉSUMÉ Nous avons évalué les connaissances en sécurité sanitaire des aliments et les pratiques de 23 personnes qui manipulent les aliments dans 2 hôpitaux d'Alexandrie (Égypte) [Gamal Abdel Nasser (GAN) et Institut de recherche médicale (IRM)] avant et après un programme de formation sur la sécurité sanitaire des aliments, ainsi que la qualité bactériologique des repas servis aux malades et des équipements de cuisine. On a observé une amélioration significative de tous les paramètres associés aux connaissances, à l'exception de l'hygiène personnelle à l'hôpital GAN, et une amélioration des pratiques en matière de sécurité sanitaire des aliments dans les deux hôpitaux. La qualité bactériologique de la plupart des repas servis aux patients et des surfaces et ustensiles servant à la préparation des aliments s'est améliorée à la suite de la formation. D'une façon générale, celle des repas servis aux patients de l'hôpital GAN était meilleure qu'à l'IRM.

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Introduction

The importance of safe food for hospitalized patients and the detrimental effect that contaminated food could have on their recovery has been emphasized [*1*]. Patients receiving foods from a single kitchen with poor food handling practices could suffer a foodborne infection which could result in an outbreak involving the whole hospital [*2*].Outbreaks of foodborne infection in hospitals are associated with high attack rates and disruption of services [*3*]. In 2002, hospitals in The Netherlands were implicated in 9% of 281 gastroenteritis outbreaks [*4*]. In Poland, the annual outbreaks of food poisoning and foodborne infections in hospitals and sanatoria from 1985 to 1999 constituted from 1.5% to 6.3% of the total number of such outbreaks in the country [*5*]. A foodborne outbreak of salmonella infection at a private hospital in London in 1994 had an attack rate estimated to be 5% among the approximately 200 patients and staff at risk [*3*].

Outbreaks of foodborne infections in hospitals are preventable but are facilitated by several factors; these include staff carriers, poor hygiene conditions in the kitchens, carelessness, and lack of training of food handlers. The particular danger of contaminated food in hospitals is that such food is given to consumers in poor health [*6*]. In Bavaria, a *Salmonella enteritidis* outbreak in hospitals and nursing homes resulted in 6 deaths [*7*], and in Australia [*8*], outbreaks in hospitals and facilities caring for the aged were responsible for 35% of deaths from foodborne infections. Hence there is a great need for education and increased awareness among food services staff in hospitals regarding safe food handling practices [*9*].

The aims of this study were to assess the bacteriological quality of patients' meals and the kitchen utensils in 2 hospitals in Alexandria and the food safety knowledge and food handling practices of the food handlers before and after a training programme of food safety.

Methods

This study was carried out in the kitchens of the Medical Research Institute (MRI) hospital and Gamal Abdel Nasser (GAN) hospital in Alexandria, which are health insurance hospitals. The study began in March 2003 and lasted about 15 months. It was preceded by a 3-month pilot study to check the effectiveness of the predesigned food safety knowledge questionnaire and food handling checklist in covering the required data. The study was carried out in 3 stages separated by 2–4-month intervals.

- Pre-training stage (7 months) (4 months in MRI and 3 months in GAN)
- Training stage (2 months) (1 month in each hospital)
- Post-training stage (6 months) (4 months in MRI and 2 months in GAN).

Pre-training stage

The food safety knowledge and food handling practices of all 23 food handlers (14 in MRI and 9 in GAN) were assessed. The handlers were interviewed using a predesigned questionnaire to assess their knowledge while an observational sanitation checklist was completed to assess food handling practices. The following parameters, with their associated items, were included.

- Building and facilities (location of the kitchen and its surroundings, its design and construction, cleaning and waste disposal, pest control and toilet facilities)
- Equipment and utensils (materials and

condition of food equipment and utensils and methods of cleaning).
- Personal hygiene (presence of health certificates and their validity, health status of food handlers, hand-washing and drying practices, avoidance of bad habits).
- Food handling (receipt of food, its storage, preparation, cooking and serving)

Each item was composed of several questions, each question was given a score of 1 if the answer (knowledge/practice) was correct or zero if incorrect. The knowledge/practice score of each parameter was calculated by summing the question scores and converting into percentages. The score percentage of each parameter of each food handler was used to calculate the mean percentage of each hospital.

During this stage, samples of patients' meals during their serving and swabs from food contact surfaces were collected and examined for the bacteriological quality.

Training stage

Training needs were identified based on inadequacies in food safety knowledge and practices of the food handlers that were noted during the pre-training stage. The observed misconceptions that most or some of the handlers had included the following:
- It is preferable to use pieces of cloth to dry cleaned hands rather than paper towels or a mechanical hand drier.
- It is not necessary to dry cleaned equipment and utensils before storage.
- Health certificates are substitutes for observing personal hygiene.
- It is preferable to use unheated tap water and soap rather than using warm water and soap for cleaning hands.
- Raw foods of animal origin are rarely contaminated with microorganisms.
- Food products that look uncontaminated cannot cause food poisoning.
- There is no problem of repeated thawing and refreezing of frozen foods.
- Cooking foods will destroy all microbial forms.
- Cooked foods and salads can be stored safely at room temperature until serving.

Most of the food handlers interviewed failed to specify the correct temperatures for storage of frozen foods and prepared salads; they also failed to specify the correct temperature to ensure thorough cooking.

On-the-job food safety training was given to 23 food handlers (14 in MRI and 9 in GAN). Food safety leaflets were distributed to all handlers and posters were used to demonstrate the importance of safe food handling practices. The importance of practising personal hygiene was illustrated through demonstrating the results of the bacteriological analysis of their hands after washing using various washing and drying routines. Also, the results of bacteriological analysis of food samples and swabs were used to draw the attention of the handlers to certain inadequacies during their food handling.

Post-training stage

At this stage the food safety knowledge and practices of all the food handlers in the 2 kitchens were reassessed using the food safety knowledge questionnaire and food handling checklist previously used in the pre-training stage to determine the effect of the training programme. Also, samples of patients' meals and swabs from food contact surfaces were again collected to evaluate the impact of training on their bacteriological quality.

Bacteriological examination

Two hundred and sixty (260) samples of patients' meals (160 of animal origin and 100 of plant origin) in addition to 52 swabs from food contact surfaces were examined, with the distribution illustrated in Tables 1 and 2. A sample of about 100 g or 100 mL from each item in the patients' meals was aseptically collected in a sterile plastic bag during serving. In case of swabs of large food utensils, an area of 100 cm^2 of their contact surfaces was swabbed using a sterile cotton swab moistened with sterile quarter strength Ringer solution, while the small food utensils, i.e. knives, spoons, etc. were aseptically immersed in sterile plastic bags containing 100 mL of this solution. The samples were transported as soon as possible to the laboratory using an insulated ice box containing an ice pack. They were subjected to the following bacteriological examination after making 10-fold serial dilutions [*10*].

- Estimation of aerobic mesophilic count [*11*]: standard plate count agar was drop-plated and incubated at 30 ºC for 72 hours
- Enumeration of coliforms using the most probable number (MPN), multiple tube technique and detection of faecal coliforms [*12*]: MacConkey broth was inoculated and incubated at 35–37 ºC for 24–48 hours and then several loopfuls of randomly chosen positive tubes were transferred into other tubes containing brilliant green bile broth and incubated at 44 ± 0.1 ºC and examined for gas production after 24–48 hours.
- Detection of coagulase-positive staphylococci [13]: Baird–Parker agar base supplemented with egg tellurite emulsion was drop-plated and incubated at 35–37 ºC for 24–48 hours. The suspected colonies were transferred into brain heart infusion and incubated for 24 hours at 37 ºC and then subjected to tube coagulase test [*14*].

Statistical analysis

Data were analysed using *SPSS*, version 9.0. The cut-off point for statistical significance was $P < 0.05$ and all tests were 2-sided. Kruskal–Wallis test was used to compare mean score percentages of different food safety knowledge parameters. Paired *t*-test was used to compare mean knowledge percentages and to compare the mean bacterial counts before and after training [*15*].

Results

Tables 1 and 2 show the bacteriological profiles of samples collected from the patient meals and the kitchen surfaces and utensils in the 2 hospitals before and after training. With regard to patients' meals, there was an overall improvement in their quality; there was a significant decrease in the aerobic mesophilic count of dairy products served in GAN and the chicken and eggs in MRI ($P < 0.05$). There was also a significant decline in coliform count of meat products, chicken and eggs, and stewed beans in MRI, and raw salads in both hospitals ($P < 0.05$) (Table 1).

The training resulted in marked improvements in the bacteriological profile of most swabbed food preparation surfaces in both hospitals. There was a drop in the value of the highest aerobic mesophilic count from 1.0×10^7 CFU (cooking pan) in GAN before training to 6.0×10^2 CFU after training. The highest coliform count dropped from 1200 MPN in a vegetable knife used in GAN to < 3 MPN after training. Also, the highest staphylococci count (8.0×10^5 CFU) in the meat chopping board used in MRI dec-

Table 1 **Microbiological profile of food samples collected from the kitchens pre- and post-training**

Food sample	Hospital	No. of samples[a]	Total aerobic mesophilic count[b] CFU/g or mL		Coliform count[b] MPN/g or mL				Faecal coliforms[c] %		Staphylococci Count[b] CFU/g or mL			Coagulase test %[c]	
			Pre	Post	PST	Pre	Post	PST	Pre	Post	Pre	Post	PST	Pre	Post
Animal origin															
Dairy products	MRI	20	1.6×10^4	1.3×10^4	0.304	27	9	1.860	10.0	20.0	1.2×10^3	1.2×10^3	0.146	0.0	0.0
	GAN	25	6.6×10^3	6.7×10^2	3.752*	16	6	1.809	0.0	0.0	9.1×10^2	3.2×10^2	1.956	12.0	0.0
Meat products	MRI	10	1.4×10^4	5.8×10^3	0.915	213	< 3	6.359*	30.0	0.0	1.5×10^3	5.7×10^2	0.906	0.0	0.0
	GAN	10	6.3×10^3	1.8×10^3	1.835	6	< 3	1.137	10.0	0.0	2.1×10^2	< 200	0.917	0.0	0.0
Chicken/eggs	MRI	10	1.3×10^4	4.9×10^2	3.367*	24	< 3	2.742*	10.0	0.0	4.1×10^2	2.0×10^2	2.204	0.0	0.0
	GAN	5	4.7×10^2	2.2×10^2	1.595	< 3	< 3	1.000	0.0	NCO	< 200	< 200	1.633	0.0	NCO
Total	MRI	40	1.3×10^4	4.9×10^2	3.367*	24	< 3	2.742*	10.0	0.0	4.1×10^2	2.0×10^2	2.204	0.0	0.0
	GAN	40	4.7×10^2	2.2×10^2	1.595	< 3	< 3	1.000	0.0	NCO	< 200	< 200	1.633	0.0	NCO
Plant origin															
Cooked	MRI	5	5.7×10^2	2.6×10^2	1.254	< 3	< 3	NS	NCO	NCO	< 200	< 200	NS	0.0	0.0
vegetables	GAN	5	4.0×10^2	3.0×10^2	0.440	< 3	< 3	NS	NCO	NCO	< 200	< 200	1.500	0.0	NCO
Jams	MRI	5	2.2×10^3	1.1×10^3	0.418	< 3	< 3	1.000	NCO	0.0	< 200	< 200	NS	NCO	NCO
	GAN	5	< 200	< 200	1.000	< 3	< 3	NS	NCO	NCO	< 200	< 200	1.000	20.0	NCO
Stewed beans	MRI	5	1.9×10^3	8.6×10^2	0.889	177	< 3	6.497*	20.0	0.0	< 200	< 200	1.000	0.0	0.0
	GAN	5	5.4×10^2	2.7×10^2	1.285	32	3	2.527	0.0	0.0	2.2×10^2	< 200	1.174	0.0	NCO
Bread	MRI	5	1.8×10^4	1.3×10^3	2.252	46	6	1.975	0.0	0.0	7.0×10^2	< 200	1.585	0.0	0.0
	GAN	5	1.3×10^3	1.8×10^3	0.746	< 3	5	1.534	0.0	0.0	< 200	< 200	1.000	20.0	0.0
Raw salad	MRI	5	9.9×10^4	4.8×10^3	2.972*	810	24	3.621*	20.0	0.0	1.3×10^3	4.9×10^2	0.885	40.0	0.0
	GAN	5	7.2×10^3	1.3×10^3	3.871*	88	4	3.698*	0.0	0.0	7.0×10^2	< 200	3.206*	0.0	0.0
Total	MRI	25	2.6×10^3	1.2×10^3	1.605	11	<3	4.096*	5.7	NCO	3.0×10^2	2.2×10^2	1.646	5.7	NCO
	GAN	25	8.7×10^2	4.0×10^2	2.469*	3	<3	1.478	0.0	0.0	2.5×10^2	1.9×10^2	2.513*	8.9	0.0

[a]*Each number of samples was collected before training and again after training.*
[b]*Values shown are the geometric mean.*
[c]*Percentage of positive samples.*
**Significant at* $P < 0.05$.
PST = paired-sample t-test; CFU = colony forming units; MPN = most probable number; MRI = Medical Research Institute hospital; GAN = Gamal Abdel Nasser hospital; NCO = not carried out; NS = no statistics because the standard error equalled zero.

reased to reach 1.2×10^3 after training (Table 2).

Food safety training of 23 food handlers in the 2 studied hospitals resulted in significant differences in the mean score percentages of all the different knowledge parameters in both hospitals after training ($P < 0.05$) (Table 3) and in an improvement in their overall food safety knowledge. The highest knowledge improvement in MRI was in food handling (310.1%) and in GAN it was in building and facilities (63.9%). The lowest improvement was in personal hygiene for both hospitals (78.0% and 33.5% respectively).

Table 4 shows that food safety practices improved after the training programme where the overall score increased to 72.6% with an improvement percentage of 37.9% in MRI and increased to 77.0% with an improvement of 17.0% in GAN. The lowest improvement percentage was in food handling in MRI (26.6%) and building and facility in GAN (8.2%) while the highest was in the equipment and utensils parameter in both hospitals (58.3% and 33.3% respectively).

Discussion

Experience from industrialized countries has shown that a comprehensive and well-funded regulatory system alone cannot prevent foodborne diseases. On the other hand, where regulatory and educational measures have been combined, they have been found to be effective in reducing foodborne diseases [*16*]. Before training, food handlers in GAN had greater food safety knowledge than those in MRI, while after training food handlers in both hospitals had approximately similar scores. Supervisors working in the GAN kitchen (there were 3 in GAN and 6 in MRI) were observed to be always directing the staff to improve all food safety related issues and this may account for the initial difference in knowledge between the hospitals. Moreover, all supervisors in GAN were university graduates compared to only half of the supervisors in MRI and hence could possess greater knowledge of food safety issues. A study on 290 food services staff in 36 hospitals in Italy showed that knowledge about foodborne pathogens was significantly higher among those with a higher educational level. Staff who had attended continuing education courses on food hygiene and hospital foodborne diseases had a significantly higher knowledge of safe temperatures for food storage [*17*].

Adhering to food safety measures among food services staff in hospitals is vital for the prevention of foodborne outbreaks [*9*]. There have been several reported food poisoning outbreaks in hospitals that were attributed to improper food handling. An outbreak of *Clostridium perfringens* food poisoning affected 17 of 44 (38.6%) patients in 2 hospital wards in the United Kingdom where the incriminated food was roast pork. This was because the cuts were too large and equipment to ensure rapid cooling of cooked meat was not installed [*18*]. In a teaching hospital in Spain, *S. enteritidis* infection was identified in 22 inpatients. After compliance with kitchen hygiene procedures, no more cases were detected [*19*]. In an outbreak of *S. enteritidis* phage type 4 food poisoning in a hospital for mentally handicapped people, deep-fried beef rissoles were implicated as the vehicle of infection and inadequate cooking was the contributing factor [*20*]. An outbreak of *S. enteritidis* gastroenteritis took place among tertiary care hospital workers in Mexico City and was probably caused by salmonella-contaminated foodstuffs again due to inadequate cooking [*21*].

Table 2 **Microbiological profile of swabs of various food utensils used in the kitchen pre- and post-training**

Food utensil	Hospital	No. of samples[a]	Total aerobic mesophilic count[b] CFU/g or mL wash or 100 cm²		Coliform count[b] MPN/g or mL wash or 100 cm²		Faecal coliforms[c] %		Staphylococci			
									Count[b] CFU/g or mL wash or 100 cm²		Coagulase test %[c]	
			Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Meat knife	MRI	1	1.0×10^3	<200	7	<3	0	NCO	4.0×10^2	<200	0	NCO
	GAN	1	5.0×10^3	<200	200	<3	0	NCO	2.0×10^2	<200	0	NCO
Vegetable knife	MRI	1	4.0×10^3	<200	210	<3	0	NCO	2.0×10^3	<200	0	NCO
	GAN	1	5.0×10^4	2.0×10^2	1200	<3	0	NCO	2.0×10^3	<200	0	NCO
Meat chopping board	MRI	1	1.2×10^5	2.0×10^3	210	14	100	0	8.0×10^5	1.2×10^3	100	0
	GAN	1	4.0×10^3	8.0×10^3	200	7	0	0	1.0×10^3	<200	0	NCO
Salad chopping board	MRI	1	1.4×10^5	4.0×10^2	1200	4	0	0	1.4×10^4	6.0×10^2	0	0
	GAN	1	1.0×10^5	2.0×10^2	210	<3	0	NCO	1.4×10^4	4.0×10^2	0	0
Cooking pan	MRI	1	1.0×10^3	<200	70	<3	0	NCO	6.0×10^2	<200	0	NCO
	GAN	1	1.0×10^7	6.0×10^2	<3	<3	NCO	NCO	<200	1.0×10^3	NCO	0
Roasting pan	MRI	1	1.0×10^4	4.0×10^2	15	4	0	0	1.0×10^3	2.0×10^2	0	0
	GAN	1	1.4×10^3	2.0×10^4	9	<3	0	NCO	<200	2.0×10^2	NCO	0
Patient tray	MRI	5	2.6×10^2	<200	<3	<3	0	NCO	2.3×10^2	<200	0	NCO
	GAN	5	2.6×10^2	<200	<3	<3	NCO	NCO	<200	<200	0	NCO
Food distribution container	MRI	2	<200	<200	<3	<3	0	NCO	<200	<200	0	NCO
	GAN	2	<200	<200	<3	<3	NCO	NCO	<200	<200	NCO	NCO

[a] *Each number of samples was collected before training and again after training.*

[b] *Values shown are the geometric mean.*

[c] *Percentage of positive samples.*

CFU = colony forming units; MPN = most probable number; MRI = Medical Research Institute hospital; GAN = Gamal Abdel Nasser hospital; NCO = not carried out.

Table 3 **Mean score and improvement percentages of food safety knowledge parameters of food handlers pre- and post-training**

Parameter	Level of food safety knowledge							
	MRI (*n* = 14)				GAN (*n* = 9)			
	Mean score (SD)		*t*-test	Mean improvement (SD) %	Mean score (SD)		*t*-test	Mean improvement (SD) %
	Pre	Post			Pre	Post		
Building and facilities	55.6 (23.2)	94.4 (3.8)	6.338*	144.8 (225.7)	68.4 (22.2)	93.6 (2.3)	3.739*	63.9 (101.6)
Equipment and utensils	52.7 (27.8)	90.2 (16.4)	7.449*	138.6 (155.5)	72.2 (21.4)	93.1 (14.1)	2.887*	40.9 (56.0)
Personal hygiene	69.0 (27.7)	100.0 (0.0)	4.178*	78.0 (95.8)	81.0 (22.8)	96.3 (9.6)	1.880	33.5 (61.4)
Food handling	42.6 (26.7)	95.9 (4.3)	7.719*	310.1 (381.9)	69.9 (15.1)	95.3 (6.9)	5.213*	44.9 (48.9)
Overall knowledge	55.0 (27.4)	95.1 (9.2)	6.723*	124.9 (123.1)	72.9 (20.3)	94.6 (9.0)	3.792*	42.1 (58.7)
Kruskal–Wallis test	5.828	15.922*			5.159	12.315*		

**Significant at* P *< 0.05.*
MRI = Medical Research Institute hospital; GAN = Gamal Abdel Nasser hospital; SD = standard deviation.

Table 4 **Scores and improvement percentages of food safety practices before and after training**

Parameter	Level of food safety practice					
	MRI			GAN		
	Score %		Improvement %	Score %		Improvement %
	Pre	Post		Pre	Post	
Building and facilities	46.8	71.8	53.3	76.5	82.8	8.2
Equipment and utensils	40.0	63.3	58.3	50.0	66.6	33.3
Personal hygiene	72.4	93.1	28.6	79.3	93.1	17.4
Food handling	54.8	69.5	26.6	58.5	70.7	20.8
Overall practices	52.6	72.6	37.9	65.8	77.0	17.0

MRI = Medical Research Institute hospital;
GAN = Gamal Abdel Nasser hospital.

Our study showed that after launching the training programme, there was an improvement in the overall food safety practices and their associated parameters in both hospitals. GAN had better scores both before and after training, although it had a lower improvement percentage than MRI. Personal hygiene parameter had the highest score while equipment and utensils parameter had the lowest in the 2 hospitals both before and after training. Utensils used in the hospitals were made of aluminium

and were washed with unheated tap water with detergent before training, while after training they were washed with warm water and detergent. Disinfection was not practised in either hospital before or after training. All utensils must be washed in warm water containing an adequate amount of suitable detergent and then disinfected [*22*]. Although, the improvement in the building and facility parameter in MRI was about 6 times higher than that of GAN, the latter hospital had higher mean score both before and after training as its kitchen building and facilities had been recently renewed.

One of the most important factors related to foodborne illnesses is the lack of knowledge on the part of food handlers or consumers and negligence (despite knowledge) in safe food handling [*16*]. Our study showed that there was a gap between food handlers' knowledge and food safety practices followed in the hospitals, where their knowledge score was usually higher than the corresponding practice score both before and after training. In fact, the knowledge scores were worse than the corresponding practice score only before training in the case of personal hygiene and food handling in MRI and the building and facility parameter in GAN. Another study that assessed the knowledge, attitudes, and practices of food services staff regarding food hygiene in government and private hospitals in Shiraz, Islamic Republic of Iran, showed that they had little knowledge regarding the pathogens that cause foodborne diseases and the correct temperature for the storage of hot or cold ready-to-eat foods. Most of them had positive attitudes, but disparity between attitude and practice was noted [*9*].

Items that contain a preponderance of ingredients of animal origin are likely to be excellent media for the multiplication of pathogenic bacteria and thus to be potentially dangerous [*23*].The improvement of the food safety knowledge and practices in both hospitals after launching the training programme consequently improved the bacteriological profile of most meals served to patients in both hospitals; however, the quality of patient meals of animal origin that were analysed in MRI were worse than that of meals served in GAN. Before training, faecal coliforms were detected in 30% of meat products, 10% of each of dairy products, chicken and eggs in MRI and in 10% of meat products in GAN. After training, such coliforms were not detected except in 20% of dairy products in MRI. Coagulase-positive staphylococci were detected before training in 12% of dairy products in GAN. This may be attributed to cross-contamination between ready-to-eat and raw foods mediated by the inadequately sanitized utensils and/or by the food handlers who were not following hygiene standards. It is worth mentioning that pasteurized milk samples in MRI were free of faecal coliforms before training although they were detected after training; the hospital changed the supplier of dairy products during the study, who unfortunately supplied the hospital with products of worse bacteriological quality.

Vegetables can become contaminated with microorganisms capable of causing human diseases while still in the fields or during harvesting or post-harvest handling in food services establishments [*24*]. Bacteriological analysis of the majority of patients' meals of plant origin revealed contamination of those served in MRI with higher microbial loads than those served in GAN both before and after training. The highest aerobic mesophilic, coliform and staphylococci counts were among raw salad served in MRI both before and after training. This may be attributed to the preparation

of the salads using bare hands, the use of inadequately cleaned raw vegetables and their storage until service at a temperature that permits multiplication of bacteria. A study in a university hospital in France showed that 10% of patients' meals, all of which were salads, had total viable bacteria counts above the recommended limits [*25*]. Another study in a national hospital in Costa Rica revealed that all tested salad samples were positive for faecal coliforms [*26*]. In our study faecal coliforms and coagulase-positive staphylococci were detected in foods of plant origin only before training.

Poorly cleaned utensil and equipment surfaces harbour and promote the spread of microorganisms [*27*]. After training, there was an improvement in the bacteriological quality of most swabbed food contact surfaces. Neither faecal coliforms nor coagulase-positive staphylococci were detected on any surface except the meat chopping board in MRI before training. This chopping board also had the highest staphylococci count both before and after training and the highest coliform count after training. Despite changing the cleaning of the board after training to be with heated tap water and detergent instead of tap water alone, lack of adherence to this disinfection may explain this contamination. It is preferable to replace such wooden boards by more hygienic ones made of easily cleaned and sanitized materials.

The goal of any hospital caterer should be to provide food that meets nutritional requirements and is microbiologically safe. Food distribution to hospital wards plays a critical role in the safety of hospital food [*28*]. Moreover, for immunocompromised patients, the potential for food to cause infection is even greater and hospitals may impose dietary restrictions to limit pathogen exposure [*29*].

Our study showed that food safety knowledge and food handling practices in the 2 hospitals were unsatisfactory before training as was the bacteriological quality of the patient meals and kitchens surfaces/utensils. However, the training programme improved all aspects of the food safety issues assessed in both hospitals, although practice still lagged behind knowledge.

Given the importance of ensuring that hospital patients are not put at risk of foodborne infections, continuous on-the-job training should be launched for all food handlers in both food safety knowledge and practices. In addition implementation of a HACCP system would be beneficial to ensure the safety of the patient meals. Further studies on the handling practices of patient meals in the hospital wards are warranted.

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International Food Safety Authorities Network (INFOSAN) Information note no. 3/2008 "Food safety and nutrition during pregnancy and infant feeding"

While all population groups are susceptible to foodborne disease, there are groups which are more susceptible. This note focuses on ٢ high-risk groups: pregnant women and infants, including the developing fetus. Hormonal changes during pregnancy affect the mother's immune system, resulting in decreased immune function and greater susceptibility. The developing fetus is susceptible to pathogens that may not cause illness in the mother. Infants and young children are more prone to foodborne disease because of their immature immune systems and developing organs, particularly kidney and brain. In addition, they consume more food in proportion to their body weight than adults; hence they have greater relative exposure to foodborne toxins and contaminants.

This information note is available in the 6 WHO official languages Arabic, Chinese, English, French, Russian and Spanish at: http://www.who.int/foodsafety/fs_management/infosan_archives/en/

Assessment of the educational environment at the College of Medicine of King Saud University, Riyadh

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تقييم البيئة التعليمية لكلية الطب بجامعة الملك سعود

إبراهيم العايد، شافي شيخ

الخلاصة: استُخدمت الترجمة العربية (التي روجعَت في هذه الكلية) لمقياس دندي للبيئة التعليمية DREEM في تقييم البيئة التعليمية في كلية الطب، بجامعة الملك سعود، في الرياض. ووزع أكثر من 500 استبيان، تم تحليل 222 منها. وكانت النتيجة الإجمالية 45.0%؛ حيث كان إدراك الطلاب للعملية التعليمية 40.7%، وإدراك المدرسين 48.2%، والإدراك الأكاديمي الذاتي 46.3%، والجَوْ العام 44.4%، والأوضاع الاجتماعية 46.1%. وكانت درجات طلاب السنة الأولى أعلى من زملائهم في السنوات التالية. كما كانت درجات طلاب المرحلة الأساسية (قبل السريرية) أعلى بشكل كبير من درجات طلبة سنوات الدراسة السريرية. أما جنس الطلاب كمتغيِّر فلم يكن مِمَّا يُعتَدّ به إحصائياً.

ABSTRACT We used an Arabic translation (revised in our college) of the Dundee Ready Education Environment Measure (DREEM) inventory to assess the educational environment at the College of Medicine in King Saud University, Riyadh. Over 500 questionnaires were distributed and 222 were analysed. Scores were: 45.0% overall; 40.7% for students' perception of learning, 48.2% for perception of teachers, 46.3% for academic self-perception, 44.4% for perception of atmosphere, and 46.1% for social self-perception. Scores for first year students were significantly higher than the others. Scores for pre-clinical students were also significantly higher than those of students in clinical years. Sex was not a statistically significant variable.

Évaluation de l'environnement pédagogique de la Faculté de médecine de l'Université du Roi Saud de Riyad

RÉSUMÉ Nous avons utilisé une traduction en arabe (révisée dans notre faculté) de l'inventaire DREEM (*Dundee Ready Education Environment Measure*) pour évaluer l'environnement pédagogique de la Faculté de médecine de l'Université du Roi Saud (*King Saud University* - KSU) de Riyad. Plus de 500 questionnaires ont été distribués et 222 ont été analysés, avec les résultats suivants : score général : 45,0 % ; perception que les étudiants ont de l'apprentissage : 40,7 % ; perception qu'ils ont des enseignants : 48,2 % ; perception qu'ils ont de leur niveau de préparation: 46,3 % ; leur perception de l'ambiance : 44,4 % ; et perception que les étudiants ont de leur vie en société : 46,1 %. Les scores des étudiants de première année étaient significativement plus élevés que ceux des autres. Ceux des étudiants en formation préclinique étaient eux aussi significativement plus élevés que ceux des étudiants en formation clinique. Le sexe ne représentait pas une variable statistiquement significative.

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Introduction

In adult learning theories, teaching is as much about setting the context or climate for learning as it is about imparting knowledge or sharing expertise [*1*]. The learning environment has been defined as everything that is happening in the classroom or department or faculty or university [*2,3*]. Measurement of the medical education environment comprehensively assesses what is happening, or how things are [*2*]. It is a way of assessing the nature of the educational practice of the school. It also provides a holistic, comprehensive, systematic and detailed picture of the overall state of affairs in the education process [*4*]. The World Federation for Medical Education singled out the learning environment as one of the targets for what it terms "the conduction of the evaluation of medical education programme" [*5*].

The Dundee Ready Education Environment Measure (DREEM) inventory was originally developed and validated between 1994 and 1996 by a Delphi panel of nearly 100 medical and health profession educators from several countries who were enrolled in various courses in the Medical Education Centre in Dundee, Scotland. It is intended to be a universal and culture-free inventory.

The DREEM inventory is a validated inventory with proven high reliability and has been used in various countries around the world to assess the educational climate of health professionals and medical schools. It comprises 50 items, divided into 5 subscales:

- students' perceptions of learning, 12 items, maximum score 48;
- students' perceptions of teachers, 11 items, maximum score 44;
- students' academic self-perception, 8 items, maximum score 32;
- students' perceptions of atmosphere, 12 items, maximum score 48;
- students' social self-perception, 7 items, maximum score 28.

The total possible score is 200. Each item is scored 0–4 (4 = strongly agree, 3 = agree, 2 = unsure, 1 = disagree and 0 = strongly disagree). There are 9 negative items scored in reverse manner; for all items, however, results should be presented so that the higher the score the more positive the reading (more favourable educational environment).

The college of medicine at King Saud University gives a traditional 6-year course: the first year is preparatory (pre-med), the next 2 years are devoted to basic medical sciences and the last 3 are for clinical rotations. These parts are separate and the overcrowded curriculum depends heavily on the use of lectures. All activities are teacher centred with few open discussions or problem-solving sessions. Current annual intake of students is approximately 300.

Though El-Hazmi and Haque reported an enthusiastic attempt to review the curriculum of the medical school [*6*], there have been no significant changes in the real educational sense since its establishment in 1969. Apart from that report using a modified version of Sheehan's instrument for assessment of the college environment [*6*], to our knowledge this is the first study assessing the educational environment of this medical school using DREEM inventory.

Recently the college has started a project to review and reform its curriculum. This current study is one of several undertaken to produce baseline pre-change data. The aim of our study was to assess the educational environment at the college of medicine of King Saud University using the DREEM inventory, and to quantify the differences between students in the 5 years of study

and between male and female students in relation to the total scores and the scores of the 5 domains of the DREEM inventory. We also aimed to identify the gaps and weaknesses in the existing educational environment in order to suggest feasible and appropriate remedies.

Methods

A copy of the original Dundee Education Environment Measure (DREEM) was obtained directly from the Medical Education Centre at Dundee University, Dundee, Scotland. The currently available Arabic translation of the inventory, prepared in Dundee University, was revised and refined by staff members in our College Medical Education Centre to remove any possible lack of clarity or ambiguity in wording and/or phrasing. The questionnaire was produced in Arabic and English.

A covering letter indicating the purpose of the study, the anonymity of respondents and the optional status of the response was attached to the questionnaire. Students' cooperation was requested and it was made clear that participation was entirely on voluntary basis. We distributed 500 questionnaires randomly through group leaders of each class and the students' affairs office.

Data management and statistical analysis

Data was entered in MS-Excel and analysed using *SPSS*, version 11.0. As the study outcome variables (scores of 5 domains and total score) are continuous, they were quantified by mean and standard deviation. Comparison of all mean values with the total scores was done using the Student *t*-test for a single sample. Comparison of mean values of scores between male and female students was done using the Student *t*-test for 2 independent samples, and the comparison of scores between the 5 study years was done using 1-way analysis of variance, followed by Duncan's multiple range test for pair-wise comparison.

Results

We had 223 responses from the 500 questionnaires distributed (44.6% response rate); 222 were complete and were analysed, 155 (69.8%) from male students and 67 (30.2%) from females. Considering year of study, 98 (44.1%) students were from basic sciences years (pre-clinical years) and 124 (55.9%) were from clinical years; they included 43 (19.3%) first year, 55 (24.7%) second year, 27 (12.2%) third year, 55 (24.7%) fourth year and 42 (18.9%) fifth year students. The sample of students who returned questionnaires amounted to almost 20% of the total number of students enrolled in the school at the time of the study (22.3% for girls and 18.3% for boys).

The overall score was 89.9/200. All scores were statistically significantly lower than the maximum possible ($P < 0.0001$) (Table 1). The total score for pre-clinical years was 93.8/200 and that for clinical years was 84.9/200. The scores of first year students were significantly higher when compared with their seniors' scores (Table 1).

There was no statistically significant difference between male and female students for the DREEM subscale scores, and in only 3 of the 50 DREEM items (I am encouraged to participate in class; the teachers ridicule the students; last year's work has been a good preparation for this year's work) was the difference statistically significant ($P < 0.05$).

Regarding students' perception

Table 1 **Comparison of Dundee Ready Education Environment Measure (DREEM) scores for medical students at King Saud University according to year of study**

Item	Score (%)								
	Maximum possible	Sample mean (SD)	*t*-value	Academic year 1	2	3	4	5	*F*-value
Total (all items)	200	89.9 (24.2)	–67.8	108.6[a]	84.3	89.3	85.2	84.6	9.5
SPL	48	19.5 (7.9)	–53.8	25.6[a]	16.8	19.8	18.1	18.5	10.1
SPT	44	21.2 (6.0)	–56.6	25.5[a]	20.2	22.4	19.9	19.3	8.9
SASP	32	14.8 (5.0)	–51.1	16.9[a]	14.1	14.3	14.2	14.8	2.6
SPA	48	21.3 (7.3)	–54.9	25.9[a]	20.5	20.7	20.0	19.6	6.1
SSSP[b]	28	13.0 (4.2)	–52.9	14.4	12.7	12.7	12.8	12.2	1.8

[a] *Significantly different (using Duncan's multiple range test):* P *< 0.0001 for all items except where indicated.*
[b] P *= 0.127 for academic year.*
SD = standard deviation; SPL = students' perceptions of learning; SPT = students' perceptions of teachers; SASP = students; academic self-perception; SPA = students' perceptions of atmosphere; SSSP = students' social self-perception.

of learning, the majority, indicated that teaching was not stimulating, long-term learning was not emphasized, they were not encouraged to be active learners, were not encouraged to participate in class, the teaching time was not put to good use, and teaching was too teacher-centred and over-emphasized factual learning.

Score for students' perception of teachers 48.2% (21.2/44) was the highest obtained. A majority of our students pointed out that the teachers are knowledgeable but not good at providing feedback and constructive criticism to students: they ridicule students, get angry in class and are authoritarian.

Students' academic self-perception score was 46.3% (14.8/32). Only 14.8% of students indicated they were able to memorize all they needed to; 28.3% agreed that the learning strategies they used before were still useful for them. However, more than half agreed/strongly agreed that much of what they learned seemed relevant to a career in medicine and they had learnt a lot about empathy in their profession.

The score for student's perception of atmosphere was 44.4% (21.3/48). It seems that students perceived different teaching methods differently: while 65.9% agreed that the atmosphere was relaxed during seminars and tutorials, only 24.2% felt relaxed during the ward round, and 39.9% were relaxed during lectures. Only about 25% felt that enjoyment outweighed the stress of study.

Students' social self-perceptions score was 46.4% (13.0/28). Only 3.6% of students agreed that there was a good support system for stressed students; 91.5% agreed/strongly agreed that they had good friends in the school; and 74.0% were too tired to enjoy the course and around 80% admitted that they got bored.

Discussion

The fact that fewer than 50% of the distributed questionnaire were completed may indicate that students were not keen enough to participate in such studies. Students may not think that the results of such studies would lead to any significant changes in their education. It may also be indicative of student's fears that participation in such studies may adversely affect their results,

perhaps as a reflection of the authoritarian atmosphere in the school.

Our results showed a low overall score on the DREEM inventory: as far as we can verify, a score of 45.0% (89.9/200) is the lowest score reported among published studies using the relatively recently validated DREEM inventory. The only published study result close to ours was from Canada, which reported an overall score of 48.5% [*7*]. In a report from another Saudi medical school, overall score was 51.1% [*8*]. All other published studies reported overall mean DREEM scores of 55%–68% (Table 2). Among the subscale scores, students' perception of learning was lowest in our study (40.69%). This is very close to the score of 39.58% reported by Till [*7*], and comparable to the 45.8% (22/48) reported by Al Hazmi et al. [*8*]. First year students' overall score and subscale scores were higher than those of senior students; this is similar to the finding in a previous report that students who had been enrolled at the school longer were significantly less satisfied with the teaching and with the support system for stressed students [*9*].

In a report from a Thai nursing school, 14.8% of students rated their institution below 50% and generally the scores decreased from the first year to the second year nursing course and increased from the second year to the third and fourth year nursing course in all 5 scales [*10*]. This decrease may be because first year students are not experienced enough to give a valid report of the educational process. This may be supported by the observation of Till that first year students in particular sometimes gave mixed messages which may have contributed to lower the scores [*7*]. In some of the areas surveyed by the DREEM inventory, the first year students might not have been too sure how to respond although this might simply means that the first years students were not (yet) too stressed by their studies. It became clear that the students lost some of the neutrality that they exhibited in the first year and became more critical of the educational environment as they progressed

Table 2 **Comparison of Dundee Ready Education Environment Measure (DREEM) scores at King Saud University (this study) and in other studies**

Year, country [*reference*]	TP[a]	Score (%)					
		Overall mean	SPL	SPT	SASP	SPA	SSSP
1997, UK [*8*]	7905	66.2	65.8	65.8	64.3	68.6	65.4
1997, Thailand [*12*]	236	68.7	–	–	–	–	–
2001, Nigeria [*9*]	127	59.0	68.8	59.1	65.6	56.3	46.4
2001, Nepal [*9*]	86	65.0	68.8	59.1	68.8	66.7	64.3
2001–2002, Trinidad [*6*]	106	55.0	58.3	53.6	58.8	52.2	51.6
2004, Canada [*7*]	407	48.5	39.6	54.5	46.9	52.1	53.6
2004, Saudi Arabia [*11*]	450	51.1	45.8	45.5	53.1	47.9	53.5
2005, Saudi Arabia [this study]	222	45.0	40.7	48.3	46.3	4.4	46.3

[a] *Total no. participants*

SPL = students' perceptions of learning; SPT = students' perceptions of teachers; SASP = students' academic self-perception; SPA = students' perceptions of atmosphere; SSSP = students' social self-perception.

through the programme. It could also be explained by the enthusiasm and the illusion of first year students on successfully gaining entry into medical college. However, a study of Nepalese students reported a trend towards improved perceptions in years 2 and 3 over year 1 as reflected in different DREEM totals from the 3 years [*11*].

Our study did not show a statistically significant difference between males and females for the total score of DREEM. This is in agreement to that reported by Till from Canada [*7*] but is contrary to that reported in a study carried out in Argentina in which a statistically significant difference between the sexes was found, with women in general more critical about the quality of teaching and the general climate of the school, especially in the areas of student participation in class and the authoritarian attitudes of teachers. Women reported far less satisfactory social lives than men [9]. Roff et al. from the United Kingdom reported that men had a mean score of 27.6/44 for their perception of teachers while for women this was 33.0/44; overall, the males' DREEM score was 129 and the women's was 135 [*9*]. In Nigeria, a statistically significance difference between the mean scores of male and female students was reported in only 5 of the 50 items of the inventory [*11*]. A study from Trinidad found that the mean total score for males was less than that for females (105.39 vs 112.79) [*12*]. In our study, students' perceptions of learning and its items were similar to those in Till's study [*7*]. Our students' perception of atmosphere was also in agreement with that in Bassaw et al. [*12*]. For the subscale of students' social self-perceptions, a very low proportion agreed that there was a good support system for stressed students, which coincides with the findings of Roff et al [*11*] and Al Hazmi, Al Hyiani and Roff. [*8*].

Similar to previous studies [*7,9–12*], our results indicate a need for the creation of a supportive environment as well as designing and implementing interventions to remedy unsatisfactory elements of the environment if effective and successful learning is to be realized.

The nature of self-reporting of questionnaires imposed some limitations to the conclusions of this study. The validity and accuracy of students' perceptions of their learning and the learning environment has been questioned [*13*].

Conclusion

This study indicated widespread and large defects in the educational environment in this school. A larger study may need to be undertaken to verify the above results and conclusions.

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Short communication

Serum level of anti-hepatitis B surface antigen 6–8 years after hepatitis B vaccination at birth

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المستويات المصلية للمستضد السطحي للالتهاب الكبدي B بعد 6 – 8 سنوات من تلقي لقاح الالتهاب الكبدي B وقت الولادة

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الخلاصة: نظراً لعدم معرفة مدة الحماية التالية للتلقيح ضد الالتهاب الكبدي B للأطفال؛ صمَّم الباحثون هذه الدراسة للتعرف على مستوى أضداد ومستضدات الالتهاب الكبدي السطحية في المصل لدى 273 من أطفال مدارس مدينة زنجان، بجمهورية إيران الإسلامية، ممن تتراوح أعمارهم بين 7 و9 سنوات؛ والذين تلقّوا لقاح الالتهاب الكبدي B عند ولادتهم. مع اعتبار العيارات التي تساوي أو تقل عن 10 مكرو وحدة/مل غير واقية. وقد لوحظ أن ما يزيد على نصف الأطفال الخاضعين للدراسة (52 %) لديهم عيار مساوٍ أو أقل من ذلك، دون تفريق بين الجنسين، في حين كان المستضد السطحي للالتهاب الكبدي B غير موجود لدى 81 طفلاً (29.1 %). وكان لدى 3 أطفال أضداد للبروتين اللبي للالتهاب الكبدي B. وتمس الحاجة إلى مزيد من الدراسات للتعرف على ضرورة إعطاء الجرعات المعزِّزة الضرورية وتوقيتها.

ABSTRACT The duration of protection after hepatitis B vaccination in children is unknown. We determined the serum level of antibody to hepatitis B surface antigen (anti-HBsAg) in 273 randomly selected 7–9-year-old schoolchildren from Zanjan City, Islamic Republic of Iran, who had been fully vaccinated against hepatitis B starting at birth. Titres ≤ 10 mIU/mL were considered unprotective. Just over half of the children (52%) had titres ≤ 10 mIU/mL with no difference between the sexes, while 81 (29.7%) had no anti-HBsAg (0 mIU/mL). Three of the children had antibodies to hepatitis B core protein. More studies are needed to determine the necessity for or timing of booster doses.

Concentration sérique en anticorps antigène de surface de l'hépatite B 6 à 8 ans après la vaccination contre l'hépatite B à la naissance

RÉSUMÉ La durée de la protection après la vaccination des enfants contre l'hépatite B est inconnue. Nous avons déterminé le taux sérique d'anticorps dirigés contre l'antigène de surface du virus de l'hépatite B (anti-HBs) chez 273 écoliers âgés de 7 à 9 ans de la ville de Zanjan (République islamique d'Iran) choisis au hasard, qui avaient bénéficié d'une vaccination complète contre l'hépatite B dès la naissance. Des titres inférieurs ou égaux à 10 mUI/mL étaient considérés comme non protecteurs. Pour à peine plus de la moitié des enfants (52 %), les titres étaient inférieurs ou égaux à 10 mUI/mL, quel que soit le sexe, alors que 81 d'entre eux (29,7 %) n'avaient pas d'anticorps anti-HBs (0 mUI/mL). Trois enfants présentaient des anticorps dirigés contre l'antigène central du virus de l'hépatite B (anti-HBc). D'autres études sont nécessaires pour établir la nécessité de doses de rappel ou leur calendrier d'administration.

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Introduction

Hepatitis B virus (HBV) is a major global health concern with >350 million people chronically infected [*1*]. The prevalence of hepatitis B carriers varies in different parts of the world, ranging from less than 1% to 15% [*2*]. A large number of cases are seen in eastern Asia and sub-Saharan Africa [*3*]. It is estimated that over 35% of Iranians have been exposed to HBV and about 3% are chronic carriers, ranging from 1.7% in Fars Province to over 5% in Sistan va Balouchestan [*2*]. It appears that 8% of Iranians infected with HBV will become chronic carriers [*2*]. In 1991, the World Health Organization (WHO) recommended that hepatitis B vaccination be included in national immunization programmes in countries with a hepatitis B surface antigen (HBsAg) carrier prevalence of 8% or greater by 1995 and in all countries by 1997 [*4*]. The strategy for the control of HBV infection, as outlined by the WHO and endorsed by the Advisory Committee on Immunization Practices (ACIP), is the introduction of hepatitis B immunization at birth [*5,6*]. This strategy has dramatically reduced the carrier rate of HBV and significantly decreased the incidence of childhood hepatocellular carcinoma in many areas of the world [*7*]. It has been reported that when hepatitis B vaccination is initiated at birth, there is an increased likelihood that the child will complete the series [*8,9*] hence an advantage of starting immunizing at this point. The neonatal vaccination programme for hepatitis B was launched in 1992 in the Islamic Republic of Iran.

The duration of hepatitis B vaccine protection has not been firmly established [*10*]. Zanetti et al. suggested that strong immunological memory persists more than 10 years after immunization of infants and adolescents with a primary course of vaccination, and a booster dose does not seem necessary [*11*]. McMahon and colleagues reported that hepatitis B vaccination strongly protects against infection for at least 15 years, that antibody levels decrease the most among persons immunized at 4 years of age or younger, and that a booster dose is not needed before the onset of sexual activity [*12*].

In the Islamic Republic of Iran the level of antibodies to hepatitis B in vaccinated individuals is not known. Therefore, we examined the long-term persistence of antibody to HBsAg (anti-HBsAg) in 7–9-year-old children who had been vaccinated at least 6–8 years before with 3 doses of hepatitis B vaccine starting at birth to provide information on the effect of the immunization strategy for hepatitis B and the need for booster doses.

Methods

This was a cross-sectional serological study carried out from February 2003 to February 2004 in Zanjan City. Zanjan City is in the centre of Zanjan province, north-west Islamic Republic of Iran, and has 1 million inhabitants (1.5% of the Iranian population).The distribution of health care services is good throughout the territory, and vaccinations are delivered through local health districts which are able to reach the whole population.

The sample consisted of 300, 7–9-year-old schoolchildren. The minimum sample size for the study was calculated as 273, assuming 23% of children had non-protective serum level of anti-HBsAg [*10*], with 95% confidence interval and 5% error. The children were drawn from 30 (out of 187) randomly selected primary schools in the city; 10 children were selected from each school by systematic random

sampling. Only children who received all 3 doses of hepatitis B vaccine after birth were included in the study. This was ascertained by vaccination certificates recorded at the Public Health Service or at the local health units which were consulted for each year of the study and matched with birth certificate data. In our country, hepatitis B vaccination is initiated within the first 7 days of life, with the second dose given at 8 weeks and the third at 12 months of age.

The purpose and potential risk factors of this study were explained to all the subjects and their parents before informed consent was obtained. The study procedures were approved by an institutional review board of Zanjan University of Medical Sciences.

The accepted protective concentration of serum anti-HBsAg was considered > 10 mIU/mL [*10*]. A 5-mL blood sample was collected from each child and the serum level of anti-HBsAg was measured. We also assessed antibodies to HBV core protein (anti-HBc) in all serums to check for hepatitis B infection.

Antibody testing was performed at Vali-Asr laboratory, using a commercial HBsAb and HBcAb ELISA system (Radium, Italy) and following manufacturer's instructions. For privacy reasons, sera were anonymous to laboratory personnel; the only identifying data being age and sex. Demographic factors (other than sex and age) were not considered in the current study. For descriptive analysis results are shown as absolute numbers and percentage. *SPSS*, version 10 was used for analysis.

Results

A total of 300 children 7–9 years of age were selected. The final sample consisted of 273 children [134 boys (49%) and 139 girls (51%)] because the parents of 27 children did not agree to participate in the study. The children were divided into 3 groups according to age: 7 years group (89 children, 32.6%), 2) 8 years group (88 children, 32.2%), and 3) 9 years group (96 children, 35.2%).

Table 1 **Serum levels of anti-hepatitis B surface antigen (HBsAg)**

Anti-HBsAg serum levels (mIU/mL)	No. (*n* = 273)	%
0	81	29.7
0–10	61	22.3
10–100	75	27.5
> 100	56	20.5

Table 2 **Number of hyporesponders to hepatitis B vaccination (anti-hepatitis B surface antigen levels ≥ 10 mIU/mL) according to age**

Age of children (years)	No. (*n* = 142)	%
7	45	31.7
8	45	31.7
9	52	36.6

Table 1 shows the anti-HBsAg levels in the serum of the studied children. Table 2 illustrates the frequency of hyporesponders to hepatitis B vaccination according to age. There were no significant differences by sex and age. Our study showed that 52.0% of the children had low serum titre of anti-HBsAg (≤ 10 mIU/mL), and more than half of these (29.7% of the total) had no serum titre of anti-HBsAg (0 mIU/mL). Thus at the 95% confidence interval level, serum levels of anti-HBsAg were non-protective in 46%–58% of school-aged children of Zanjan. In effect, half of vaccinated children were non-responders to hepatitis B vaccine or had a rapid fall-off of anti-HBsAg levels in

Zanjan according the results of our study.

We also found that 3 children (1% of total) (1 boy, 2 girls) had positive anti-HBc in their serum; 2 of them were also hyporesponsive for anti-HBsAg.

Discussion

In the current report, we studied groups of children aged 7–9 years who had been vaccinated with 3 doses of a hepatitis B vaccine in infancy and showed that 52% of them had low serum titre of anti-HBsAg (≤ 10 mIU/mL), and more than half of these (29.7% of the total) had zero serum titres. There were no differences between boys and girls.

Our findings of the loss of anti-HBsAg over time differ from those reported by other researchers. A study of children at 12 years of age who had received a plasma-derived vaccine in infancy and were at low risk for hepatitis B exposure found that none had anti-HBsAg < 10 mIU/mL [*10*]. Another study followed children at low risk who were vaccinated in infancy with a recombinant vaccine [*10*]. By 5 years of age, only 7% had titres of anti-HBsAg < 10 mIU/mL. The major difference between the children in those studies and ours is their age at initial vaccination. Those subjects were 2–3 months of age or older when they began their hepatitis B vaccination, whereas the children in our study began their series in the first week of life, a schedule recommended by ACIP. Some studies suggest that starting the initial vaccination series later in infancy may result in better persistence of anti-HBsAg as the prevalence of anti-HBsAg titres ≥ 10 mIU/mL ranged from 79% to 85% at 10–12 years of age [*13,14*]. In another study of 1630 persons, anti-HBsAg titres were >10 mIU/mL in 76% of the sample 10 years after vaccination and in 82% of those age 6 months–19 years at the time of vaccination [*10*].

Symptomatic hepatitis B is very rare in immunized persons who have antibody titres ≥ 10 mIU/mL, although there is eventual loss of detectable antibody in up to 50% of these persons 5 to 10 years after immunization [*15*]. The latter idea concurs with our results. Some may have anti-HBc that are indicative of HBV infection, but there is usually no evidence of disease [*15*]. In our research 1% of the children had positive results for anti-HBc.

A study from Hawaii of low-risk infants given recombinant vaccine starting at birth showed that only 19% had anti-HBs > l0 mIU/mL at 6 years, yet all responded to a booster dose [*16*]. Booster doses of hepatitis B vaccine are not currently recommended [*10,16*]. It would seem that they are not needed before the onset of sexual activity and the long-term effectiveness of hepatitis B vaccine, even in those who have lost detectable anti-HBs, militates against routine monitoring of anti-HBs titres and the administration of late booster doses [*15*]. Our study showed that vaccine efficacy against infection waned with time, 48% of the children had antibody level greater than 10 mIU/mL and 22.5% had measurable antibody levels, which is considered sufficient to prevent infection, so a booster dose is not recommended for these 2 groups. However, about 29.7% had no antibody at all. A larger study is necessary before we can conclude that a booster dose is needed for this group of children but we think a booster dose may be needed for children who have undetectable antibody after at least 5 years of universal hepatitis B vaccination. However, some believe that in populations at high risk for continuing exposure to hepatitis B virus, hepatitis B vaccine is protective for at least 10 years, the time during which the greatest risk of

chronic infection after exposure occurs [*17*]. Some data suggest that one-fourth of children who responded to a plasma-derived hepatitis B vaccine in infancy lost protective antibody by early adolescence and did not show evidence of an anamnestic response to a booster dose, although the small number of participants makes it difficult to draw precise conclusions. In addition, the lack of an anamnestic response may not mean that children are not protected against HBV disease [*10*]. The long-term protection afforded by immunization reflects the normally lengthy incubation period of hepatitis B, which permits previously immunized persons to mount protective anamnestic antibody responses on exposure to virus [*15*].

In conclusion, our results showed that the anti-HBsAg level was < 10 mIU/mL 6–8 years after the last dose of hepatitis B vaccine in nearly half of the children who were vaccinated from birth. Long-term follow-up studies at school entry and at adolescence, including ones evaluating the effects of a booster dose at these times, may be needed to determine the duration of protection and the necessity for or timing of booster doses for low-risk children initially vaccinated for hepatitis B starting at birth. We think a booster dose may be needed for children who have undetectable antibody levels after at least 5 years of universal hepatitis B vaccination.

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Correction

Prevalence of smoking among high-school students of Tehran in 2003 by G. Heydari, H. Sharifi, M. Hosseini and M.R. Masjedi. Eastern Mediterranean Health Journal, 2007 13(5):1017–21.

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Short communication

Clinical pattern of nocardiosis in Saudi Arabia: a case series

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النمط السريري لداء النوكارديات في المملكة العربية السعودية: سلسلة حالات

أحمد محمد حقوي، فهد عبد العزيز الربيعة

الخلاصة: استهدف الباحثان دراسة هذه الأنماط السريرية لداء النوكارديات في إحدى مستشفيات الرعاية الثالثية (التخصصية) في المملكة العربية السعودية، مستخدمَيْن في ذلك مراجعة استعادية للحالات في المدة بين 1987 و2003، وقد اكتشفا 19 حالة ثبتت بالزرع إصابتها بعدوى النوكارديات. وقد كانت الحالة المستبطنة الأكثر شيوعاً هي زراعة الكلية في 8 مرضى (42 %). وكانت الرئتان هما أكثر مواقع الإصابة شيوعاً (12 مريضاً يشكلون 63 % من الحالات). وقد استفردت ثلاثة أنواع من النوكارديات لدى هؤلاء المرضى، وهي النوكاردية النجمية (58 %)، والنوكاردية البرازيلية (21 %) والنوكاردية الملهبة لأذن القُبَيْعة (21 %). ويتطلب تشخيص المرض رفع منسوب الاشتباه بالمرض لدى المرضى الذين لديهم استعداد للإصابة به، والذين يراجعون لإصابتهم بارتشاحات رئوية أو بخراجات دماغية أو بخراجات الأنسجة الرخوة العميقة، كما يتطلب التشخيص أيضاً متابعة دؤوبة وفعالة للإجراءات التشخيصية مع إعطاء المعالجة الملائمة في وقت مبكر.

ABSTRACT We aimed to study the clinical pattern of nocardiosis in a tertiary care hospital in Saudi Arabia using a retrospective review of cases from 1987 to 2003. A total of 19 patients were identified as having culture-proven nocardial infection. The most common underlying condition was renal transplantation in 8 patients (42%). Lungs were the most common sites of involvement in 12 patients (63%). Three *Nocardia* species were isolated in our series: *N. asteroides* (58%), *N. brasiliensis* (21%), and *N. otitidiscaviarum* (21%). A high index of suspicion is essential in susceptible patients presenting with pulmonary infiltrate, cerebral abscess or deep soft-tissue abscess and usually requires an active diagnostic workup and early administration of appropriate therapy.

Tableau clinique de la nocardiose en Arabie saoudite : série de cas

RÉSUMÉ Notre objectif était d'étudier le tableau clinique de la nocardiose dans un hôpital de soins tertiaires d'Arabie saoudite grâce à une analyse rétrospective des cas entre 1987 et 2003. Au total, on a établi que 19 sujets étaient atteints d'une infection à *Nocardia* confirmée par culture. L'antécédent le plus fréquent était une transplantation rénale, chez 8 patients (42 %). L'atteinte pulmonaire, chez 12 patients (63 %), représentait la localisation la plus courante. Trois espèces de *Nocardia* ont été isolées dans la série concernée : il s'agit de *N. asteroides* (58 %), *N. brasiliensis* (21 %) et *N. otitidiscaviarum* (21 %). Un indice de suspicion élevé est déterminant chez les sujets vulnérables présentant un infiltrat pulmonaire, un abcès cérébral ou un abcès profond des tissus mous et nécessite généralement une démarche active de diagnostic ainsi que l'administration rapide d'un traitement approprié.

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Introduction

Nocardia spp. are aerobic, branching, partially acid-fast actinomycetes that inhabit the soil [*1*]. The majority of cases in humans are acquired through inhalation or direct skin inoculation [*2*]. No human-to-human transmission has been documented so far [*3*]. Nocardiosis is usually an opportunistic infection and most commonly presents as pulmonary disease. Clinical diagnosis is difficult as the symptoms and signs are not as specific as the radiological findings. Techniques for serological diagnosis are unreliable and unavailable commercially in most of the world [*1*], thus evaluation of appropriate specimens by smear and culture remains the principal method of diagnosis. If *Nocardia* spp. are isolated from normally sterile sites there can be a strong suspicion of the organism's role as an etiologic agent [*2*].

We have retrospectively reviewed 19 patients with nocardiosis in a tertiary care centre in Saudi Arabia, which represents, to our knowledge, the largest series of patients with nocardiosis reported from the Eastern Mediterranean Region.

Methods

A retrospective chart review study of patients diagnosed as having nocardiosis at King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia. The hospital is a 650-bed tertiary care centre serving patients from the whole of Saudi Arabia. The hospital is designed to manage patients with complex medical problems, including immunocompromised patients and organ transplant recipients. The study period was from 1987 to 2003. The medical records were complete for all the patients as our centre has a very well-established health information system. We reviewed their clinical, microbiological, and radiological characteristics in addition to the types of treatment given. The cases of nocardiosis were identified from databases of the infectious diseases service and the microbiology laboratory. Cases of nocardiosis were defined as any case with culture-proven *Nocardia* spp. from a specimen obtained through an invasive procedure (e.g. bronchoalveolar lavage, deep-tissue biopsy, etc.).

Results

A total of 19 patients were identified as having a culture-proven diagnosis of nocardiosis; 16 were male (84%) and 3 were female (16%). The mean age was 40.3 (standard deviation 12.2) years. Fever was the presenting complaint in 15 patients (79%), and leukocytosis (white blood cells $> 12 \times 10^9$ cells/L) was present in 12 patients (63%).

Predisposing factors for developing nocardiosis were identified in 17 patients (89%). Renal allograft transplantation recipients constituted 42% of those patients, while underlying malignancies were found in 26% (Table 1). In 2 patients of our series (11%), there was no clear risk factor identified. There were no data suggesting a nosocomial origin for the pathogens as all the patients came from the community. The most common site of involvement was the lung in 12 patients (63%), followed by the skin in 3 patients (16%). Other sites of involvement were the brain in 2 patients (11%) and joints in 2 patients (11%).

Invasive procedures are often needed to reach the diagnosis of nocardiosis. Among the 12 patients with pulmonary nocardiosis, bronchoscopy and bronchoalveolar lavage were carried out for 9 patients (75%), while the other 3 underwent open lung biopsy

Table 1 **Underlying conditions identified in patients with nocardiosis (*n* = 19)**

Underlying conditions	No.	%
Renal transplantation	8	42
Liver transplantation	1	5
Bone marrow transplantation	1	5
Leukaemia	2	11
Lymphoma	1	5
Other malignancies	2	11
Chronic steroid use	2	11
Unknown	2	11

to reach the diagnosis. The most common radiological pattern noticed in pulmonary nocardiosis was bilateral airspace consolidation found in 10 out of 12 patients (83%) with pulmonary nocardiosis. Other radiological patterns seen in our patients include a solitary lung nodule in 1 patient and a cavitary lung lesion in 1 patient. Brain biopsy was essential to diagnose cerebral involvement in the 2 patients with intracranial nocardiosis. At the same time, skin biopsy and joint aspiration were needed to diagnose nocardiosis in patients presenting with septic arthritis and skin abscess.

The most common species was *N. asteroides*, which was isolated from 11 patients (58%). Other species isolated in our series included *N. brasiliensis* in 4 patients (21%) and *N. otitidiscaviarum* (formerly *N. caviae*) in 4 patients (21%) (Table 2). Unfortunately sensitivity testing was not available for most of the isolates.

Trimethoprim–sulfamethoxazole(TMP–SMX) was the first line of therapy for 12 patients (64%), and was used in combination with other antibiotics in 5 patients (26%). There were only 2 patients who received a course of antibiotics not including TMP–SMX. These were imipenem, amikacin, and ceftriaxone. TMP–SMX was withdrawn from 4 patients (21%) who experienced side-effects attributed to this drug. These included hepatotoxicity in 2 patients, renal toxicity in 2 patients and severe nausea and vomiting in 1 patient. The duration of treatment ranged from 3 to 12 months. Both patients with brain nocardiosis underwent surgical drainage of the abscesses in addition to antibiotic therapy.

Outcome analysis was available for 15 patients (79%), as 4 patients (21%) did not attend for follow-up visits. There were 11 patients (58%) who had documented clinical, microbiological and radiological cure of the illness and 4 patients (21%) who died during hospitalization (all with pulmonary nocardiosis) because of the concomitant bacterial pneumonia complicated by septic shock leading to death in the intensive care unit.

Discussion

Infections caused by *Nocardia* spp. are infrequent, but challenging to clinicians.

Table 2 **Isolates of *Nocardia* spp. and their sites of involvement (*n* = 19)**

Nocardia spp.	Total		Site of involvement			
			Lung	Brain	Skin	Joints
	No.	%	No.	No.	No.	No.
Nocardia asteroides	11	58	9	2	0	0
Nocardia brasiliensis	4	21	3	0	1	0
Nocardia otitidiscaviarum	4	21	0	0	1	3

In recent years, the number of case reports has been increasing, and this could be attributed to improvements in diagnostic capabilities and the increased prevalence of immunocompromised patients. In our series, most of the nocardial infections occurred in patients with suppressed immunity, especially organ transplant recipients. Chronic use of corticosteroids is a major predisposing factor for pulmonary nocardiosis [*4*]. Immunocompetent people could develop nocardial infections, as shown in our series and in previous reports as well [*5*]. The mean time to develop nocardiosis in renal transplant recipients was 18 months from the time of transplantation, and this is compatible with what had been reported previously [*6,7*]. Although there is an emerging problem of nocardial infection among patients with human immunodeficiency virus (HIV) [*8*], this was not noticed in our series, as all patients were HIV-negative.

Pulmonary nocardiosis, which is the most common disease entity in our series, usually presents with productive cough with no specific sputum colour. The radiological pattern commonly seen in those patients is bilateral airspace consolidation and this is consistent with other reports [*4,9–11*]. Extrapulmonary dissemination was not detected in any of our patients with pulmonary nocardiosis, although previous estimates suggest it is seen in 10%–15% of cases [*9,12–14*].

Patients with brain abscess due to *Nocardia* spp. usually present with fever, seizures and focal neurological signs. The radiological pattern of *Nocardia*-associated brain abscesses shows them to be variable in location and number [*15,16*]. They can occur at any site of the brain with single or multiple lesions. Both of our patients had parietal lobe involvement with a single lesion. The treatment of brain nocardiosis should include a combined medical and surgical approach [*16–18*].

Septic arthritis due to *Nocardia* spp. is a rare clinical entity. Synovial fluid cultures are required to make the diagnosis. The synovial fluid analysis usually reveals an inflammatory pattern of cells with predominant polymorphonuclear leucocytes. These findings were shown in our patients and in previous patients reported in the literature [*19–21*]. Treatment with TMP–SMX for a minimum of 6 months is adequate [*21,22*].

Subcutaneous nocardial infection is a rare disease which tends to follow dissemination from other parts of the body [*23–26*]. Interestingly, all 3 patients with nocardial skin abscess in our series were found to have primary skin infections with no evidence of involvement of other sites. Similar cases were reported by other investigators [*27–29*].

Sulfa-containing antimicrobials remain the drugs of choice for nocardiosis. They have been proven to improve survival when used alone or in combination with other antimicrobials [*30,31*]. Primary agents that have been used successfully in treatment of nocardiosis include minocycline, amikacin, ceftriaxone, imipenem and linezolid [*18,31,32*]. Combining one or more of these agents with sulfa-containing antimicrobials has been recommended for serious systemic infections. Other potentially efficacious choices include amoxicillin–clavulanate, the new macrolides and the fluoroquinolones [*33–37*]. The duration of therapy is uncertain, but it should be at least 3 to 6 months. In some cases, such as central nervous system involvement, the duration of treatment could be extended to 12 months [*18,30*].

The outcome for patients with nocardiosis is favourable for those who are diagnosed early and receive adequate treatment. The

cause of death in nocardiosis patients is attributed to concomitant bacterial infections that are prevalent in the type of patients who are prone to nocardiosis.

In conclusion, our case series confirms that there is no clinical syndrome that is pathognomonic for nocardiosis. A high index of suspicion is essential in susceptible patients presenting with pulmonary infiltrate, cerebral abscess, or deep soft tissue abscess, and usually requires an active diagnosis workup and early administration of appropriate therapy.

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Case report

Massive ovarian oedema: literature review and case presentation

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Introduction

Massive ovarian oedema is an uncommon cause of adnexal mass, first described by Kalstone in 1969 [*1–7*]. Massive solid enlargement of the ovary can be associated with interstitial oedema without neoplastic changes and is considered to be the result of torsion of the ovary. This can be easily mistaken for neoplasm, in which case the appropriate treatment will be removal of the whole ovary. However, when this condition is a benign enlargement of the ovary it needs conservative intervention. The group most commonly affected are young women in the child-bearing period, but a few cases have been described in prepubertal girls. Masculinization is a common feature of many adult cases, but there has been a case with precocious puberty as the presenting symptom [*8,9*], and it has been described during pregnancy [*10*]. Geist et al. stated that massive oedema of the ovary is a rare entity affecting mainly young women [*2*]. It is important to recognize the condition as it is often misdiagnosed for a malignancy, putting the younger patient at risk of over-treatment with the resultant loss of hormonal function and fertility.

We present the case of a 30-year-old woman with findings of massive ovarian oedema on ultrasound imaging, and a discussion and literature review aiming to clarify that this is a benign tumour-like condition which every gynaecologist can encounter and that the most appropriate treatment is conservative surgery. A Medline search on PubMed since 1969 using the keywords [massive ovarian oedema case report] found around 117 cases reported.

Case report

Our case was a 30-year-old Jordanian women married as a second wife to a Jordanian man for the previous 8 months, gravida 1, para 0, with reported history of no contraception use. Her menstrual cycles were regular with menarche at the age of 12 years. She had an uneventful past medical history.

This woman was referred to our clinic with chronic lower abdominal pain for the previous 3 months. The pain was mild, colicky, mainly on the left lower abdomen which occasionally referred to the back with no other associated symptoms. Physical examination showed findings of mild lower abdominal tenderness on the left side with a tender mobile adnexal mass felt during bimanual examination. Ultrasound examination showed a large left ovarian hypoechoic homogenous solid mass

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lesion 7 × 6 cm (Figure 1), which showed poor vascularity on colour Doppler scan. There was no ascitic fluid seen. The serum level of CA125, the marker for ovarian cancer, was 27.56 U/mL, beta-human chorionic gonadotropin (β-HCG) < 5 μ/mL, luteinizing hormone (LH) 15.4 mIU/mL, follicle stimulating horomine (FSH) 11.4 mIU/ml and, α-fetoprotein 1.14 ng/mL; progesterone, oestradiol and testosterone levels were within normal values.

Laparotomy was performed with findings of a grossly enlarged left ovary (8 × 6 cm), twisted once, intact smooth shiny white capsule, oedematous left tube, with normal right tube and ovary. Other pelviabdominal organs were normal. When the capsule of the left ovary was incised, copious amounts of clear fluid emerged and bulging was observed at the cut surface. Our previous readings on these findings raised the possibility of ovarian oedema as the condition. More than a quarter of the ovary was removed by wedge resection and was sent for frozen sectioning. Ovarian oedema was confirmed. Later histopathological examination showed normal germinal follicles, multiple follicular cysts with normally developed theca interna and externa, and some follicles showing an attenuated layer of cells. The ovarian stroma showed extensive oedema. The ovary was sutured and fixed to the postlateral aspect of the uterus near to the left ovary.

The patient showed marked improvement in her pain as the main symptom, and was discharged on oral contraceptive pills. One week later the patient was seen at the clinic, where transvaginal ultrasound showed a marked decrease in the size of the left ovary back to normal (3.5 × 2.2 cm). One month later, after stopping the course of oral contraceptives, the patient became spontaneously pregnant, which continued to term and delivery of a healthy female baby weighing 3.35 kg.

What is special in our case is our previous knowledge of the condition, the ultrasound findings and the clinical features which made the diagnosis and thus the management straightforward with wedge resection, frozen section and fixation of the ovary to the uterus followed by successful pregnancy.

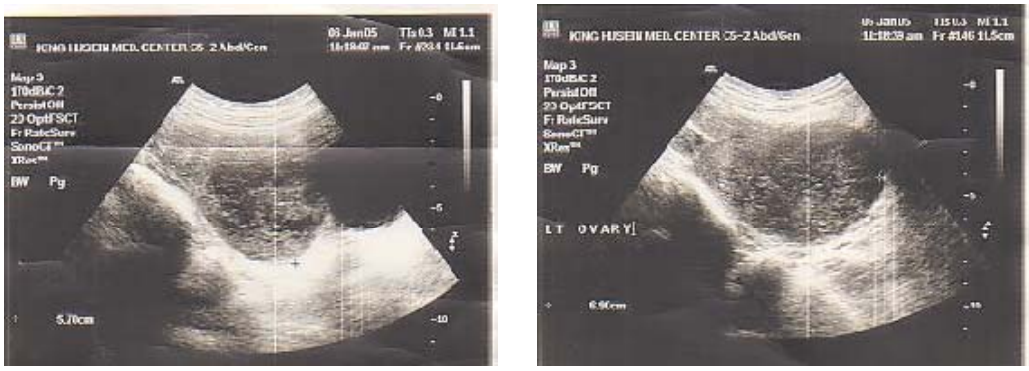

Figure 1 **Two-dimensional ultrasound showing large left ovarian hypoechoic homogenous solid mass lesion, 6.9 × 5.7 cm**

Discussion

Massive solid enlargement of the ovary is a tumour-like condition occurring in young women [*1*], considered to be the result of torsion of the ovary to the extent that it interferes with venous and lymphatic drainage but is insufficient to cause necrosis [*4,5*]. However, few case studies have described any histopathological evidence of haematoma, which is usual with even partial torsion [*5*]. Most authors suggest that partial torsion is a likely explanation for this perplexing disorder [5] and it may be a variant of polycystic ovary syndrome [*6*]. Marked enlargement of the ovary occurs and the patient usually presents with adnexal mass. If torsion occurs acute abdominal pain is prominent. Menstrual irregularities, infertility and abdominal distension are found in the majority of cases [*5*].

Masculanization is a common feature of many adult cases [*4–7*], precocious puberty was the presenting symptom in some prepubertal girls [*8,9*], and other cases presented with vaginal bleeding or masculanization associated with low serum levels of gonadotropins, indicating autonomous ovarian hormone production [*10,11*]. This hormone production is due to stromal luteinization as suggested by Chervenak [*10*]. Kalstone suggested that the luteinization might be caused by the mechanical stimulus of stretching the stroma by oedema fluid [*1*]. Another explanation for the oedema and abnormal hormone production is a derangement of a local paracrine factor, such as insulin-like growth factor, epidermal growth factor or cytokines [*5*]. Massive ovarian oedema due to permeation of the ovarian lymphatics by metastatic carcinoma is rare, with a few cases reported to date [*3*].

From a Medline review of the world literature, it seems that the group most commonly affected is young postmenarchal women. Some cases have been described in prepubertal girls [*4,10*] and 1 menopausal woman [*12*], another in a girl aged 6 months [*8*].

The ultrasounic findings have been reported to be a solid tumour-like hypo-echoic homogenic mass or as a solid mass containing a cystic component. Umesaki et al. suggest that the ultrasound detection of multiple peripheral ovarian follicles in a solid ovarian tumour-like mass may make the preoperative diagnosis of massive ovarian oedema possible by ultrasound alone [*13*]. Recent reports using magnetic resonance imaging (MRI) have demonstrated that multiple ovarian follicles situated around the periphery of the cortex of the enlarged ovary are the most important indicator of massive ovarian oedema [*13*]. A potential role of MRI in preoperative diagnosis of the condition is suggested although diagnosis is possible by ultrasound alone [*13–16*].

Morphological recognition of the lesion is fairly simple. The cut surface of the specimen appears grey in colour, wet and soft and the oedema fluid oozes out with a bulge after cutting with a knife due to the pressure of the oedema.

Histopathology features

The ovarian stromal cells are widely separated by copious oedema fluid and atretic follicles may at times be recognized. The tunica albuginea and superficial cortical zone are characteristically uninvolved [*4*]. A thin rim of compressed cortical stroma is recognized at the periphery of the mass. Necrosis and haemorrhage are unusual.

Focal stromal leutinization has been noted in some of the studied cases, and is thought to be a mechanical process induced by stretching of the stromal cells [*9*].

In a case studied by electron microscopy, Ratel et al. reported that the principal finding was the presence of both fibroblasts

and myofibroblasts in the oedematous stroma [*4*]. The increased number of myofibroblasts may be a response to the oedema.

The great majority of cases are unilateral and the most common treatment is unilateral salpingo-oopherectomy [*16*], as the lesions are mistaken for primary ovarian neoplasms at laparotomy. Conservative treatment must be the rule [*17*], especially since the disorder is benign. After extensive review of the literature, Geist et al. concluded that most cases were over-treated, and this entity should be suspected in women in the fertile age range with solid enlargement of the ovary, and definite treatment should be undertaken only after confirmed pathological diagnosis. Conservative treatment is feasible and should be the rule in these cases, where preservation of fertility is mandatory [*2*].

However, when the condition of ovarian oedema is suspected at surgery the appropriate treatment is wedge resection, removing 30% or more of the ovary to exclude secondary causes of the condition. Frozen section is valuable at the time of surgery. We emphasize wedge resection with fixation of the ovary to the uterus to prevent further torsion. Laparoscopic conservation of the ovaries in cases with massive ovarian oedema has been reported [*18*]. With the laparoscope it is possible to diagnose the enlarged ovary, grey in colour with twisted pedicle and intact capsule, and to untwist the ovary, fix it to the posterior wall of the uterus and to take a biopsy from the ovary.

In our case, when the condition of ovarian oedema was suspected prior to surgery due to our previous experience with a case [*16*], the treatment at surgery was wedge resection of the ovary and frozen sectioning to exclude secondary causes of ovarian oedema [*19*]. Fixation of the ovary to the uterus was done to prevent torsion, as some authors suggested [*5,16*].

In summary, massive ovarian oedema can occur as a primary or secondary oedema:

- Primary oedema occurs when the ovary is not diseased and when there is torsion or twisting of the ovarian pedicle to the extent that it interferes with the venous blood supply leading to oedema and does not affect the arterial blood flow. Incomplete or intermittent torsion can occur.
- Secondary massive ovarian oedema can occur secondary to a diseased ovary, such as when there is:
  - Ovarian mass and cyst.
  - Malignancy. There are reports of lymphatic permeation by metastatic carcinoma from the uterine cervix [*3*], with mature cystic teratoma [*20*], gastric carcinoma [*21*], ovarian fibrothecoma [*22*], lymphangitis carcinomatosa [*23*] and Meig syndrome [*24*].
  - Fibromatosis. Fibromatosis and massive oedema of the ovary are possibly related entities, as discussed in a report of 14 cases of fibromatosis and 11 cases of massive oedema [*25*]. The similar age range and clinical manifestations of these 2 processes and the overlap in their histological features suggest that they are closely related and may reflect differing morphologic expressions of the same underlying disorder. Some of the cases of massive oedema, however, may result from the development of stromal oedema in ovaries involved by hyperthecosis.
  - Polycystic ovary [*26*].
  - Drugs for induction of ovulation [*27*].

In summary, massive ovarian oedema is a rare cause of ovarian mass. The appropriate therapy in most cases is wedge resection with fixation of the ovary to the uterus. Ovarian oedema could occur as a primary condition with twisted ovarian pedicle or secondary to a diseased ovary.

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Letter to the Editor

Prevalence of glucose-6-phosphate dehydrogenase deficiency among schoolboys in Kermanshah, Islamic Republic of Iran

Sir

Glucose-6-phosphate dehydrogenase [G6PD] deficiency is a common X-linked recessive disorder affecting around 400 million people worldwide. Males are more affected than females and the condition is common in malaria-endemic regions [*1,2*]. The clinical manifestations of G6PD deficiency vary from no symptoms to acute haemolytic anaemia or severe chronic haemolytic anaemia [*3*].

This enzymopathy is very frequent in African, Mediterranean and Middle Eastern populations [*1,4,5*]. In Turkey, the frequency of G6PD deficiency among students was 1.2% [*1*], in Oman, the prevalence was 25% in males and 10% in females [*5*], while in Pakistan it was 1.8% [*6*] and in Iraq 6.1% [*7*]. A study of G6PD deficiency in male blood donors from different ethnic groups living in Kuwait revealed a wide range in the frequency of G6PD deficiency from 1% for Egyptians to 11.55% for Iranians [*8*]. The incidence of G6PD deficiency in Fars province, Islamic Republic of Iran, was estimated to be around 12% in males and 0.9% in females [*9*].

We studied 1000 randomly selected boys, aged 14–18 years, from 6 high schools in different areas of Kermanshah (a city in western Islamic Republic of Iran) to find the prevalence of G6PD deficiency. A questionnaire was prepared to ascertain the boys' place of origin, ethnicity, and history of favism and anaemia. Whole blood samples were obtained from all individuals and enzyme activity was determined using the fluorescent spot test [*10*]. The screening test was classified and interpreted as absence of fluorescence (severe G6PD deficiency), weak fluorescence (partial G6PD deficiency) and bright fluorescence (sufficient G6PD activity). There were 53 out of 1000 subjects with G6PD deficiency, a frequency of 5.3%. All had severe G6PD deficiency. The frequency ranged from 2.2% to 9.0% among the schools.

Our study indicates a moderately high prevalence of G6PD deficiency in Kermanshah (5.3%), which suggests all newborns should be screened for G6PD deficiency to prevent neonatal jaundice and subsequent kernicterus.

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6. The title of the paper should be as concise as possible, preferably around 10 words, and should be placed on a separate sheet, together with the full name(s) of the author(s), institutional affiliations(s) and highest scientific degrees obtained. The mailing address, as well as any other contact information (email address, fax, telephone) of the corresponding author should be provided. The number of authors should not exceed five. All authors should have made material contribution to either the design, analysis or writing of the study and have approved the final version submitted. Authors may be asked to verify their contribution. Other names may be included in the acknowledgements.

7. To facilitate the translation of abstracts and authors' names, authors whose mother tongue is written in Arabic characters and writing in English or French should supply their full names in Arabic script and provide transliterations.

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.

10. Review articles should contain sections dealing with objectives, sources, methods of selection, compilation and interpretation of data and conclusions.

11. In-text citations of published works should be limited to essential up-to-date references. Apart from review articles, a maximum of 25 references is advisable. They should be numbered separately as they occur in the text with sequential Arabic numerals in parentheses [square brackets]. These references should appear in a numbered list on a separate page at the end of the paper. They should contain the following elements of information as appropriate: name(s) and initial(s) of author(s); title of paper or book in its original language plus translation; complete name of journal plus volume number and page range; name of publisher (commercial or institutional) and place of publication (city and country); and date of publication. Papers with inadequate references or references not arranged according to these principles will be returned to the author for correction. The following are examples of the Journal's preferred style:

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).

12. Figures and tables with appropriate captions should each be on a separate sheet, numbered sequentially with arabic numerals and attached to the end of the paper. Each figure and table should be referred to in the text and its placement in the text should be clearly indicated where appropriate. Where appropriate, sources should be given for each figure or table. If any figures, tables or other materials have been copied from other sources, authors have the sole responsibility for securing the necessary permission. In order to avoid layout problems in final production tables and figures should be limited as far as possible. Not more than one table or figure per 1000 words is preferable. Figures derived from data must be accompanied by those data to enable redrawing if necessary.

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14. On publication the authors will receive one copy each of the issue in which the article appears and the principal author will receive 50 reprints. Requests for further reprints and pricing information may be obtained from the Editor-in-chief.

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. كما يمكن تسليم الورقات بالبريد الإلكتروني على العنوان EMHJ@emro.who.int. 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 (٥٤٠٠ 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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4. Chaque manuscrit doit être fourni en trois exemplaires. Le texte, avec les tableaux et les figures qui l'accompagnent, ne devrait pas dépasser 15 pages, format A4, dactylographiées ou imprimées en double interligne (4500 mots) et devrait être imprimé sur le recto seulement. Lorsque le manuscrit est accepté, avec ou sans conditions, l'auteur doit soumettre une disquette informatique de 3,5 pouces, contenant le texte, les tableaux, les graphiques et les illustrations. Pour les articles en anglais et en français, à la demande de l'éditeur, le texte devra être fourni en format traitement de texte (de préférence Microsoft Word pour PC, mais la plupart des autres formats peuvent être convertis) et sauvegardé également dans un fichier texte ASCII. Les articles soumis en arabe devraient suivre les mêmes directives que les articles rédigés en anglais ou en français. Si l'article est une traduction, dans son intégralité ou en partie, d'un autre document non publié, une copie de ce document dans la langue d'origine devrait également être soumise. Si possible, les graphiques devraient être fournis en format Harvard Graphics pour Windows ou Excel, et les illustrations et photographies devraient être en format EPS ou TIFF. Toutefois, il est nécessaire de fournir trois jeux des photographies et figures d'origine avec les données de base. Si les photographies comportent un texte ou lettrage, un jeu supplémentaire doit être fourni sans ce texte/lettrage.

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6. Le titre de l'article devrait être aussi concis que possible, de préférence 10 mots environ, et devrait être mis sur une page séparée, avec le nom complet de l'auteur (ou des auteurs), l'organisme (ou les organismes) d'appartenance et le diplôme scientifique le plus élevé obtenu. L'adresse pour la cor-respondance, ainsi que toute autre information nécessaire (adresse courriel, télécopie, téléphone) pour contacter l'auteur correspondant devraient être fournies. Le nombre des auteurs ne devrait pas dépasser cinq. Tous les auteurs devraient avoir apporté une contribution matérielle à la conception, à l'analyse ou à la rédaction de l'étude et avoir approuvé la version finale soumise. Une vérification de cette contribution peut être demandée aux auteurs. Les noms d'autres personnes peuvent être inclus dans les remerciements.

7. Afin de faciliter la traduction des résumés et du nom des auteurs, les auteurs dont la langue maternelle s'écrit en caractères arabes et qui rédigent en anglais ou en français doivent fournir leur nom complet en écriture arabe ainsi qu'une transcription.

8. Les articles présentant des résultats de recherche originale devront suivre le format IMRAD: introduction, matériel (sujets) et méthodes; résultats; analyse; et discussion. Un résumé de 100 mots maximum sera fourni, mentionnant clairement les objectifs, le contexte, les résultats et les conclusions.

9. Les auteurs devront vérifier, le cas échéant, que toutes les personnes sur lesquelles la recherche porte ont donné leur consentement éclairé, et lorsque des participants (vivants ou décédés) n'ont pas pu donner ce consentement, qu'un consentement de substitution a été obtenu.

10. Les articles d'analyse devront comporter des sections portant sur les objectifs, les sources, les méthodes de sélection, la compilation et l'interprétation des données et des conclusions.

11. Les citations dans le texte de travaux publiés devraient être limitées aux références essentielles récentes. Hormis les articles d'analyse, il est conseillé de ne pas dépasser 25 références. Elles devraient être numérotées en chiffres arabes placés entre parenthèses [crochets] selon l'ordre dans lequel elles apparaissent dans le texte. Ces références devraient figurer sous forme de liste numérotée sur une page séparée à la fin de l'article. Elles devraient contenir les éléments d'information suivants, selon le cas: nom(s) et initiale(s) de l'auteur/des auteurs; titre de l'article ou de l'ouvrage dans sa langue originale ainsi que la traduction; nom complet de la revue ainsi que le numéro du volume et les pages concernées; nom de la maison d'édition (commerciale ou institutionnelle) et lieu de publication (ville et pays); et date de la publication. Les articles comportant des références inadéquates ou dont les références ne sont pas organisées conformément à ces principes seront renvoyés aux auteurs pour correction. Exemples du style préféré de La Revue:

Livre: Al Hamza B, Smith A. *The fifth sign of identity*. Cairo, American University Press, 1990.

Article de Revue: 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).

12. Les figures et les tableaux avec les légendes appropriées devraient être placés chacun(e) sur une feuille séparée, numérotés en chiffres arabes selon l'ordre et joints à la fin du document. Chaque figure et chaque tableau devraient avoir une référence dans le texte et son emplacement dans le texte devrait être indiqué clairement le cas échéant. Au besoin, les sources devraient être mentionnées pour chaque figure ou tableau. Si des figures, tableaux ou d'autres matériels ont été copiés d'autres sources, les auteurs portent l'entière responsabilité d'obtenir l'autorisation nécessaire. Afin d'éviter les problèmes de mise en page lors de la production finale, le nombre de tableaux et figures devrait être limité autant que possible. Il est préférable de ne pas avoir plus d'un tableau ou d'une figure pour 1000 mots. Les figures établies à partir de données doivent être accompagnées de ces données pour permettre une recomposition, le cas échéant.

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WHO sales and discount policy

Objective

Within the financial obligations of the publishing and distribution process, prices of WHO publications are kept as low as possible in order to maximize their dissemination and reach readers for whom they are intended.

The price and discount policies for WHO/EMRO and WHO/HQ publications are as follows:

Price and discount policy for WHO/EMRO publications

- EMRO publications are priced in US dollars.
- Sales agents receive a 40% discount and 30 days credit. Credit limit is US$ 500.00.
- Bulk orders of individual books, i.e. 1000 copies per title, qualify the agent for a 50% discount instead of a 40% discount; however, payment of total value must be made before dispatch of publications is effected.
- Dispatch charges are calculated at 25% of cover prices.
- Present delivery time average is two weeks from date of receipt of firm order.

Price and discount policy for WHO/HQ publications

- WHO/HQ publications and subscriptions are priced in Swiss francs. Clients in developing countries are eligible for a special tariff which in all cases is 30% less than the Swiss francs regular prices.
- Sales agents receive a 40% discount for book orders and 20% for subscription orders. Credit limit is Swiss francs 1000.00.
- Bulk orders qualify the agents for a special higher discount, provided the dispatch of the whole order is done to the same consignee. In this case, a proforma invoice will be issued by WHO/HQ, and the order will be dispatched only upon receipt of payment. No return of books or periodicals will be accepted.
- Payment of invoices may be made in US dollars at the official rate of exchange at the date of payment.
- Present delivery time average is four weeks from date of receipt of orders.

A WHO/EMRO Publications Price List is available on request.t.

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