Iron status and socioeconomic determinants of the quantity and quality of dietary iron in a group of rural Iranian women

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الحديد والمحدِّدات الاجتماعية الاقتصادية لكمية الحديد الغذائي وجودته في مجموعة من الريفيات الإيرانيات

أبو القاسم جزايري، علي كشافارز، فرزانه أنصاري ومحمود محمودي فرهاني

الخلاصة: تم استقصاء مدخول الحديد وحالته الراهنة في 471 من الأمهات تتراوح أعمارهن بين 16 و53 سنة، من المناطق الريفية في خرَّم أباد بجمهورية إيران الإسلامية. وعلى الرغم من أنه تبيَّن أن إجمالي متوسط مدخول الحديد كان مقبولاً، فإن نسبة النسوة اللاتي كُنَّ يستمددن ما لا يقل عن 4% من إجمالي مدخولهن من الحديد من مصدر حيواني لم تَرِد على 6.4%. وكان متوسط مدخولي الطاقة والبروتين غير كاف. كما لوحظ انخفاض مستويات الحديد في ما يتراوح بين 8.2% و28.7% من هؤلاء النساء، وذلك وفقاً للمتثابت (البارامتر) المستخدَم، مع إصابة 28.3% بفقر الدم بعَوَز الحديد. وقد تبيَّن ارتفاع مداخيل الحديد الحيواني بصورة ملموسة بين الملمَّات بالقراءة والكتابة وبين النساء العاملات والنساء اللائي يقل عدد أفراد أسرهن عن ستة أشخاص، عنها بين غيرهن. وتخلص من ذلك إلى أن زيادة فرص توظيف النساء، ومستويات دخولهن ومعدلات معرفتهن القراءة والكتابة يؤدي إلى زيادة مدخول الحديد وتحسُّن مستوياته، ومن ثَمَّ ينبغي إيلاء اهتمام خاص له في التخطيط على الصعيد الوطني.

ABSTRACT Iron intake and status were investigated in 471 mothers (age range: 16–53 years) from rural areas in Khorramabad, Islamic Republic of Iran. Although average total iron intake was acceptable, only 6.4% of women derived at least 4% of their total intake from animal iron. Average energy and protein intakes were inadequate. Low iron status was seen in 8.2%–28.7%, depending on the parameter used, with 28.3% experiencing iron-deficiency anaemia. Significantly higher animal iron intakes were found in literate or employed women, or those of family size fewer than six people. Increasing employment opportunities, income levels and literacy rates for women will result in better iron intake and status and should receive particular attention in national planning.

Le statut en fer et les déterminants socio-économiques de la quantité et la qualité du fer alimentaire dans un groupe de femmes iraniennes vivant en zone rurale

RESUME L'apport et le statut en fer ont été examinés chez 471 mères (âge compris entre 16 et 53 ans) originaires de zones rurales de Khorramabad (République islamique d'Iran). Bien qu'on ait trouvé que l'apport en fer total moyen était acceptable, 6,4 % des femmes seulement tiraient au minimum 4 % de leur apport total du fer animal. Les apports moyens en énergie et en protéines étaient insuffisants. On a observé un faible statut en fer chez 8,2 %–28,7 %, selon le paramètre utilisé, 28,3 % ayant une anémie ferriprive. Des apports considérablement plus importants de fer animal ont été trouvés chez les femmes instruites ou chez les employées, ou celles ayant une famille dont la taille était inférieure à six personnes.

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Introduction

Anaemia, particularly iron-deficiency anaemia (IDA), is a common public health and nutritional problem throughout the world [*1,2*]. Studies have shown low iron status and IDA to be similarly prevalent in Islamic Republic of Iran, particularly among women, adolescents and children [*3–7*]. Strategic planning and implementing of programmes to promote iron status in a community requires a detailed knowledge of the magnitude of the problem, and of its causes and contributing factors: dietary, environmental, cultural and socioeconomic.

Lorestan Province, situated in western Islamic Republic of Iran, is a province of medium-to-low socioeconomic status. Although very few nutritional studies have been conducted in the province, there are currently plans to improve public health and nutrition. This study was conducted to determine iron status and socioeconomic factors influencing haem and plant iron intakes of mothers in the rural areas of Khorramabad, the provincial capital, where 26% of the total population of Lorestan lives. A low intake of animal iron seems to be a problem in many parts of the Islamic Republic of Iran [*3,4*]. It is hoped that the findings of this study will assist the authorities in designing suitable programmes to combat anaemia.

Methods

A total of 471 women (age range: 16–53 years) who had at least one child of age ≤ 5 years, were selected by a two-stage cluster sampling [*8*]. The purpose of the study was explained to the women and their consent obtained. A questionnaire was completed for each participant to obtain demographic data, including socioeconomic information. In addition, blood samples were taken, prepared and frozen for later biochemical iron status measurement, using standard laboratory methods [*9–11*]. The cut-off points for haematological iron status parameters were those suggested by Williams et al. [*11*], for an altitude of 1250 m above sea level (Figure 1). Anaemia was defined on the basis of haemoglobin and haematocrit.

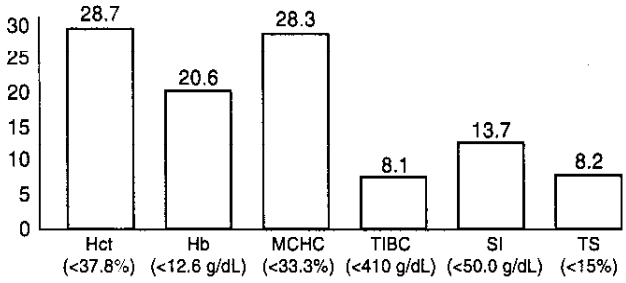

Figure 1 **Proportions (%) of the samples with a low iron status (below indicated cut-off points)**
Hct = haematocrit Hb = haemoglobin MCHC = mean corpusular haemoglobin concentration
TIBC = total iron-binding capacity SI = serum iron TS = transferrin saturation

Table 1 **Absolute and relative frequency distribution of daily energy, protein and iron intake**

Parameter	No. (n = 470)	%
Energy (kcal)		
RDA > 100%	150	33.2
RDA < 100%	314	66.8
Protein (g)		
RDA > 75%	302	64.3
RDA < 75%	168	35.7
Total iron (mg)		
RDA > 75%	297	63.2
RDA < 75%	173	36.8
Animal iron (mg)		
RDA > 4%	30	6.4
RDA < 4%	440	93.6
Plant iron (mg)		
RDA > 20%	102	21.7
RDA < 20%	368	78.3

RDA = recommended dietary allowance.

To determine the daily intake of iron (total, plant and animal iron), the 24 hour dietary recall method was used. Energy and protein intakes were also calculated to obtain a better understanding of the women's overall nutrition. All intakes were compared with the 1989 United States of America Food and Nutrition Board of the Commission on Life Sciences of the National Research Council recommended dietary allowances (RDAs). In the case of total dietary iron, as well as total dietary protein, the proportions of the sample with intakes below 75% of the RDA are reported. As suggested by McLaren [*12*], if at least 20% of a community has an intake below 75% RDA, then the deficiency of that nutrient should be considered a public health problem in that community.

Results and discussion

Table 1 shows the participants' daily energy, protein and iron intakes. The energy and protein intakes suggest the general nutrition of the women to be unsatisfactory. This situation is much the same as in some the other parts of Islamic Republic of Iran where studies have been conducted [*7,13*].

Dietary iron intake should be considered with caution. Although total intake may be sufficient, it is important to distinguish the proportion of total iron obtained from animal food sources. In our study, while 63.2% of subjects had a total iron intake of more than 75% of the RDA, only 6.4% (i.e. 30 women) had an iron intake from animal foods equivalent to at least 4% of their total intake, whereas 21.7% obtained at least 20% of their total intake from plants. Thus, individuals with similar total iron intake may well differ in the extent to which they may be at risk of anaemia. Table 1 shows the proportion of the sample with at least 4% and 20% of their dietary iron obtained from animal and plant sources respectively.

The logic behind selecting these cut-off points is based on the difference in the absorbability of plant (non-haem) and animal (haem) iron. While 5%–10% of dietary iron is generally haem iron (with 25% absorbability), the remainder is non-haem, mostly of plant origin (with only 5% absorbability) [*14*].

The iron status of the women is presented in Figure 1. The average values of the haematological parameters were, in all cases, acceptable, i.e. above the respective cut-off points. However, depending on the parameter, the proportion of women with low iron status ranged between 8.2% and 28.7%, with those suffering from IDA constituting 28.3% of the sample.

Few studies have been conducted in Islamic Republic of Iran on the type of iron

Table 2 **Daily iron intake distribution according to independent socioeconomic variables**

Socio-economic variable	Iron intake (mg/day) Total Mean ± *s*	Animal Mean ± *s*	Plant Mean ± *s*
Literacy			
Literate	17.3 ± 9.7	1.6 ± 1.9	15.7 ± 9.3
Illiterate	14.5 ± 6.7	1.0 ± 1.3	13.4 ± 9.5
P-value	< 0.0010	< 0.0002	< 0.0010
Occupation			
Employed	15.8 ± 7.6	2.4 ± 3.0	13.4 ± 6.4
Housewife	15.9 ± 9.9	1.2 ± 1.6	14.6 ± 9.6
P-value	NS	< 0.01	NS
Family size			
< 6	19.5 ± 10.3	1.8 ± 1.8	17.7 ± 10.3
> 6	14.6 ± 9.3	1.1 ± 1.6	13.5 ± 8.9
P-value	< 0.0001	< 0.0002	< 0.0001

s = *standard deviation.*
NS = not significant.

intake or iron status of women. A joint national survey in 1994–95 by the Ministry of Health and Medical Education and United Nations Children's Fund [*6*] showed that the prevalence of iron-deficiency, anaemia, and IDA among women aged 15–49 years was 34.5% , 33.4%, and 16.6% respectively. Djazayery et al. also reported low iron status (12.8%) and anaemia (13.8%) in Teheran adolescent girls [*3*]. Other investigators have reported iron deficiency to be more prevalent in some communities than IDA [*15*]. Some of these discrepancies may be due to different cut-off points or measurement techniques, or both. Other investigators have also reported the major part of dietary iron among adolescent girls and young women in Teheran [*3*] and in the south-west of Islamic Republic of Iran [*4*] to be of plant origin.

Our study showed that both iron deficiency and IDA are prevalent among mothers in rural areas of Khorramabad. We also investigated the effects of certain socioeconomic factors on the quantity and quality of dietary iron intake among the women. We found that literate or employed women, or women whose families had fewer than six members, had a statistically higher animal iron intake than those who were illiterate, unemployed (i.e. women not engaged in paid employment, but who carry out domestic work in the home), or who belonged to families with six or more members (Table 2).

Studies elsewhere in the Islamic Republic of Iran have shown that women's education and family income have a positive impact on the consumption of foods rich in iron, such as meat and pulses [*16,17*]. Total and plant iron intakes were also found to be affected by literacy and family size, although not by occupation (Table 2). The data also show that a woman with a family of fewer members is more likely to have a higher intake of total iron than a literate woman (19.5 ± 10.3 mg/day versus 17.3 ± 9.7 mg/day respectively; $P < 0.01$).

When occupation is taken as an indicator of income, it is shown to affect only intake of iron from foods of animal origin, which are generally more expensive than plant foods. Rahmanifar and Bond [*17*] also found a positive correlation between income and women's meat consumption in central Islamic Republic of Iran. They reported an inverse correlation between meat consumption and family size. Table 2 shows the total iron intake of employed and unemployed women to be almost identical (15.8 mg/day and 15.9 mg/day). Plant iron intake was also very similar (13.4 mg/day versus 14.6 mg/day), i.e. not significantly different. Animal iron intake of employed women, however, was twice that of unemployed women (2.4 mg/day versus 1.2 mg/

day) ($P < 0.01$). Employed women are obviously more likely to be better able to afford more expensive animal food products, but they are also perhaps more likely, directly or indirectly, to be exposed to information about food and nutrition than women not engaged in paid employment.

Conclusion

From the demographic and nutritional data obtained from 471 mothers in the rural areas of Khorramabad, we conclude that income, literacy and family size affect total iron intake. These factors in turn have all been closely linked with educational status. Any programme aimed at long-term improvement in the nutritional status of mothers (particularly in reducing the prevalence of IDA) will therefore require a strategy to improve the educational and literacy status of women and girls, and at the same time increase the employment opportunities available to them. Such a strategy should receive particular attention in national economic and health planning.

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Fortification of flour to control micronutrient deficiencies in the Eastern Mediterranean, Middle East and North Africa: report of a joint WHO/UNICEF/MI/ILSO workshop, Beirut, Lebanon, 13–16 June 1998

Iron deficiency anaemia is a serious public health problem in all countries of the Eastern Mediterranean Region of WHO, the Middle East and North Africa. Fortification of flour with iron is an effective means to tackle the problem. This report reviews progress made in the region in flour fortification since 1996. The report discusses the potential for flour fortification, gives the regional achievements in the area, discusses the technical, regulatory, communication and economic issues of flour fortification, outlines country plans of action and ends with recommendations to encourage flour fortification. There are also several annexes with data on iron deficiency anaemia, suggested reading, and information about millers in the region and premix manufacturers. The document can be obtained from the World Health Organization Regional Office for the Eastern Mediterranean, PO Box 7608, Nasr City, Cairo 11371, Egypt. It is also available free on the Internet at: http://whqlibdoc.who.int/hq/1999/WHO-EM_NUT_203_E_L.pdf