

# Prevalence of anaemia in 2–12-year-old Iranian children

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انتشار فقر الدم بين الأطفال الإيرانيين بين الثانية والثانية عشرة من العمر  
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**الخلاصة:** استخدم مستوى الهيموغلوبين لتقدير مدى انتشار فقر الدم في الأطفال الذين تتراوح أعمارهم بين عامين واثني عشر عاماً في جمهورية إيران الإسلامية. وكانت هذه الدراسة جزءاً من المسح الوطني المعني بالصحة والأمراض الذي أجري عام 1999، واستخدمت فيه عينة عنقودية بلغت واحداً من كل 1000 من السكان الإيرانيين. فمن إجمالي 4170 طفلاً تراوحت أعمارهم بين عامين وستة أعوام، كان 7.3٪ منهم مصابين بفقر دم خفيف، و2.5٪ بفقر دم متوسط، و1٪ بفقر دم شديد (وفق تعريفات منظمة الصحة العالمية). وكان 10.9٪ من إجمالي 8461 من الأطفال الذين تتراوح أعمارهم بين سبعة أعوام واثني عشر عاماً، مصابين بفقر دم خفيف، و3٪ منهم مصابين بفقر دم متوسط، و1.1٪ بفقر دم شديد. وكان انتشار فقر الدم ملحوظاً بصورة كبيرة في الأماكن الريفية أكثر منه في الأماكن الحضرية.

**ABSTRACT** Haemoglobin levels were used to estimate the prevalence of anaemia in children 2–12 years old in the Islamic Republic of Iran. The study was part of the National Health and Disease Survey in 1999 that used a cluster sample of 1 in 1000 of the Iranian population. Of 4170 children aged 2–6 years, 7.3% were diagnosed with mild anaemia, 2.5% moderate anaemia and 1.0% severe anaemia (WHO definitions). Of 8461 children aged 7–12 years, 10.9% were diagnosed with mild anaemia, 3.0% moderate anaemia and 1.1% severe anaemia. The prevalence of anaemia was significantly higher in rural than urban areas.

## Prévalence de l'anémie chez des enfants iraniens âgés de 2 à 12 ans

**RÉSUMÉ** Le taux d'hémoglobine a été utilisé pour estimer la prévalence de l'anémie chez des enfants âgés de 2 à 12 ans en République islamique d'Iran. L'étude s'inscrivait dans le cadre de l'enquête nationale sur la santé et la morbidité de 1999 qui a utilisé un échantillon en grappe de 1 pour 1000 de la population iranienne. Sur les 4170 enfants âgés de 2 à 6 ans, 7,3 % ont eu un diagnostic d'anémie légère, 2,5 % d'anémie modérée et 1,0 % d'anémie sévère (définitions de l'OMS). Sur les 8461 enfants âgés de 7 à 12 ans, 10,9 % ont eu un diagnostic d'anémie légère, 3,0 % d'anémie modérée et 1,1 % d'anémie sévère. La prévalence de l'anémie était significativement plus élevée en milieu urbain qu'en milieu rural.

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## Introduction

According to the latest data, more than 3 billion people throughout the world have some form of anaemia, ranging from deficiency in iron resources without symptoms of anaemia to iron-deficiency anaemia [1]. Iron deficiency in infancy and adolescence causes mental retardation and damages the immune system, predisposing children to a wide range of disorders [2,3]. Different studies in Costa Rica [4], Guatemala [5], Indonesia [6,7], Egypt [8], India [9], Thailand [10] and the United States [11] have shown that iron-deficiency anaemia in children under 5 years old and primary-school students is accompanied by psychomotor retardation, low intelligence and decreased learning capability. These findings have been confirmed in longitudinal studies in Chile. Children without a past medical history of anaemia in infancy have greater learning capabilities and higher intelligence [12]. A study in Thailand has shown that the effects of anaemia on intelligence could not be compensated for [10]. One of the most dangerous consequences is the higher risk of poisoning with heavy elements, since the absorption of these elements increases in cases of iron deficiency [13]. Recently it has been reported that preschool children have the highest prevalence of anaemia, nearly 50% across developing countries, compared with pregnant and non-pregnant women [14].

To estimate the magnitude of this problem in the Islamic Republic of Iran, a national survey of blood haemoglobin (Hb) levels was performed to evaluate the frequency of anaemia in children aged 2–12 years old in rural and urban areas covered by the National Survey of Health and Disease in 1999.

## Methods

This study was performed using data from the National Health and Disease Survey which was conducted on a cluster sample of 1 in 1000 of the Iranian population. Each cluster contained 8 families. The minimum number of clusters in each province was designated to be 22. A total of 1097 clusters in urban areas (8776 households) and 590 clusters in rural areas (4719 households) including 13 495 rural and urban families were selected as the study population.

Venous blood samples were obtained from 4170 children in the 2–6 year old age group (2221 urban and 1949 rural) and 8461 children in the 7–12 year old age group (4917 urban and 3544 rural). Blood samples were transferred to the laboratory in ice bags within 3 hours for measurement of Hb levels. Anaemia was classified as mild, moderate and severe. Haemoglobin cut-off values for anaemia for children < 6 years were: mild 10.0–10.9 g/dL, moderate 9.0–9.9 g/dL and severe < 9.0 g/dL. Haemoglobin cut-offs for anaemia for children 6–12 years old were: mild 11.0–11.9 g/dL, moderate 10.0–10.9 g/dL and severe < 10.0 g/dL [15].

Data bank and analysis were performed using *SPSS* for Windows, Microsoft *Excel* and *Access* and *Epi-Info*.

## Results

Table 1 represents the status of anaemia based on Hb levels measured in 2–6-year-old children in rural and urban areas. Severe anaemia was seen in 0.8% of urban children and 1.3% of rural children. Moderate anaemia was present in 2.4% of urban children

**Table 1 Prevalence of anaemia based on the haemoglobin levels in children aged 2–6 years and 7–12 years in rural and urban areas of the Islamic Republic of Iran**

Age group/ Severity of anaemia	Urban		Rural		Total	
	No.	%	No.	%	No.	%
<i>2–6 years<sup>a</sup></i>						
Severe	17	0.8	26	1.3	43	1.0
Moderate	54	2.4	50	2.6	104	2.5
Mild	142	6.4	164	8.4	306	7.3
Normal	2008	90.5	1709	87.7	3717	89.1
Total	2221	100.0	1949	100.0	4170	100.0
<i>7–12 years<sup>b</sup></i>						
Severe	52	1.1	43	1.2	95	1.1
Moderate	134	2.7	119	3.4	253	3.0
Mild	462	9.4	457	12.9	919	10.9
Normal	4269	86.8	2925	82.5	7194	85.0
Total	4917	100.0	3544	100.0	8461	100.0

<sup>a</sup>Severe anaemia < 9.0 g/dL; moderate anaemia 9.0–9.9 g/dL; mild anaemia 10.0–10.9 g/dL.

<sup>b</sup>Severe anaemia < 10.0 g/dL; moderate anaemia 10.0–10.9 g/dL; mild anaemia 11.0–11.9 g/dL.

and 2.6% of rural ones, a total of 2.5%. Mild anaemia was present in 6.3% of urban and 8.4% of rural children, a total of 7.4%. The overall prevalence of anaemia was significantly higher in children living in rural areas ( $P < 0.001$ ).

Table 1 also depicts the status of anaemia, based on Hb levels, in children 7–12 years old in rural and urban areas. Severe anaemia was seen in 1.1% of urban and 1.2% of rural children. Moderate anaemia was present in 2.7% of urban and 3.4% of rural children, with a total of 3.0%. Mild anaemia was present in 9.4% of urban and 12.9% of rural children ( $P < 0.001$ ), with an overall prevalence of 10.9%.

## Discussion

This study shows that anaemia should be considered as a major health problem in

Iranian children. In total, 7.3% of 2–6 year old children and 10.9% of 7–12-year-old children suffered from anaemia ( $Hb \leq 11.0$  g/dL). According to the World Health Organization classification, if 5%–25% of the population have anaemia or abnormal Hb, the degree of population anaemia is graded mild [3].

A study in the United States (US) in 1976–80 showed the rate of anaemia to be around 6% in 2–6-year-old children [16]. The rate is 2–3 times higher in the Islamic Republic of Iran. This could be explained by the better nutritional status of American children compared with our community. Anaemia is present in 27% of 1–6-year-old children in the Philippines, 27%–44% in 3–5-year-old children in India, and 24% in 2–5-year-old children in Romania [17]. Another report showed that Asian children suffer from micronutrient deficiencies es-

pecially iron-deficiency anaemia and the prevalence of iodine-deficiency anaemia was 40%–50% in preschool and primary-school children [18]. In the Islamic Republic of Iran, the rate is lower than those in the above-mentioned countries. The prevalence of anaemia is very much higher in Uzbekistan than in the Islamic Republic of Iran: 84% for children under 5 years old [19].

There are many causes of anaemia but iron deficiency is the predominant nutritional deficiency and is present even when other causes of anaemia are recognized. Data collected in US surveys revealed that 30%–40% of children under 5 years of age, and women of childbearing age who had evidence of iron deficiency, were also anaemic [15]. This relationship has provided a basis for estimating the prevalence of iron-deficiency anaemia. Based on research evidence from the Third National Health and Nutrition Examination Survey (NHANES III) [16,20], it has been suggested that the prevalence of iron-deficiency anaemia will be about 2.5 times more than the prevalence of anaemia in a population [3]. Screening for programmatic purposes should be considered for anaemia prevalence between 5% and 20% [3]. Based on this hypothesis,

we can conclude that the prevalence of iron deficiency would be around 16% and 21% in Iranian children 2–6 years old in urban and rural areas respectively. The figures would be 23.5% and 32.0% in 7–12-year-old Iranian children.

The World Health Organization has proposed that if the prevalence of anaemia in a region is between 5% and 20%, appropriate interventions based on food diversification, food fortification, iron supplementation and controlling infectious diseases should be considered [3]. Weekly iron supplementation for schoolchildren that already is being implemented for highschool girls in Islamic Republic of Iran should also be considered for primary schools. Fortification of foods (such as iron fortification of biscuits) is another strategy which could be considered for preventing iron deficiency among Iranian schoolchildren.

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