

# Anaemia and iron-deficiency anaemia in south-east Anatolia

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**Abstract:** *Purpose:* To determine the prevalence of anaemia and iron-deficiency anaemia (IDA) in Kahramanmaraş, a province in the south-eastern Anatolia. *Methods:* The study was performed on 1491 persons of both sexes aged 2–69. All were volunteers. Haematological parameters were determined and haemoglobin (Hb) electrophoresis was carried out in all subjects, and only for those with haemoglobin levels below normal were subsequent measurements of ferritin and Hb A<sub>2</sub> made to detect iron deficiency and rule out  $\beta$ -thalassaemia. *Results:* The means of all the haematological parameters for all age groups and sexes were found to be lower than the reference values given in the literature. Anaemia was found to be present in all age groups, especially in children aged 2–5 yr and women aged 19–40 yr (34.5% and 40.0%, respectively). IDA in the same age groups was 15.5% and 23.8%, respectively. *Conclusion:* The high rate of IDA raises serious concern about nutritional disease risks in the region. An inexpensive oral iron therapy and education as to the importance of iron for their health would help to provide optimal health for the population concerned, especially for mothers-to-be and children.

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Iron-deficiency anaemia (IDA) is an enormous public health problem affecting millions of people in the world. It has been the subject of investigation for many decades. It is the problem of developed industrialised countries as well as developing countries. In developing countries lifestyles, low socio-economic conditions, illiteracy, and a lack of knowledge of good dietary habits are the reasons for IDA (1–4). Previously in an official study carried on pregnant women throughout Turkey, anaemia was investigated using a now obsolete method. Now, the presence of automatic cell-counting apparatus in almost all hospitals makes possible the reliable analysis of haematological parameters. Since anaemia is a reflection of the health of the population and accurate data are not available on the rate of anaemia, especially on IDA, we planned to study the problem in a province of south-eastern Anatolia. The province, Kahramanmaraş, is in a mountainous region with inland plains and has a closed community with a population of one million, 45.6% living in rural areas. The province has nine administrative districts. The textile industry underwent a boom in the past 5 yr that has caused people to relocate from the villages to suburbs with unhealthy living conditions. The illiteracy of women

is 45%. The mean number of children born to women aged 40–49 yr of age is 7.3, and the percentage of deliveries above age 35 yr is about 20–25 in the province (5). Also, dietary habits include high consumption of hot chilli-pepper and tea. The purpose of the study was to determine the extent of anaemia and IDA in this population and compare the results with other parts of Turkey to see if there is a difference among the regions. As there had been no previous studies conducted regarding anaemia in the region, we planned this study to be an example for further studies.

## Materials and methods

### Sampling

In each district, there are a number of health centres administered by the Provincial Health Department, the number varying in accordance with the population. Apparently healthy school children, university personnel and students, and the people in the regions who applied to the regional health centres in response to an announcement of the survey by the local town-hall authorities were taken into the study. All of the applicants were

volunteers. The number of adult male volunteers in the regions was less than that of the women. Some of the men could not leave work and some were reluctant to take part: in this male-dominant society they would not accept the possibility of having any inherited or acquired diseases. The age range of the participants was 2–69 yr. A total of 1491 persons comprised the study: 601 males, 890 females. Blood samples were taken into EDTA and were brought to the laboratory in a cold chain.

#### Analysis

Haematological parameters were measured using a Cell Dyne 1700 instrument (Abbott Diagnostics, USA) within 24 h. Since Kahramanmaraş is in close proximity to Cukurova (Adana, Icel, and Hatay), the southern part of Turkey on the Mediterranean Sea, where a prevalence of sickle-cell trait and  $\beta$ -thalassaemia ( $\beta$ -thal) trait is high, cellulose acetate (CA) and agar gel electrophoresis were done. In cases with  $MCV \leq 80$  fl. haemoglobin A<sub>2</sub> (HbA<sub>2</sub>) has been determined. HbA<sub>2</sub>  $\geq 3.5\%$  using column chromatography was designated as  $\beta$ -thal. CA was done according to Kohn (6) and agar gel measurements were performed by Sebia (Sebia Diagnostics, France). HbA<sub>2</sub> was determined by column chromatography (Isolab). Ferritin was measured using a Elecsys 1010 instrument by chemiluminescence (Roche Diagnostics, Germany).

The Epi Info 6.0 computer program was used to calculate the descriptive statistics and correlation coefficients of the variables.

#### Criteria for anaemia

The age distribution was 2–5, 6–12, 13–18, 19–40, and over 40 yr, and the lower level of normal values (mean  $- 2 \times SD$ ) of haemoglobin (Hb) and mean corpuscular volume (MCV) for each age group were used for the criteria of anaemia (7, 8). The lower level of normal values for Hb and MCV for the different age groups is shown below:

Age	Sex	Hb (g dL <sup>-1</sup> )	MCV (fL)
2–6	M & F	$\leq 10.5$	$\leq 75$
6–12	M & F	$\leq 11.5$	$\leq 77$
12–18	F	$\leq 12.0$	$\leq 78$
12–18	M	$\leq 13.0$	$\leq 78$
18–45	F	$\leq 12.0$	$\leq 80$
18–45	M	$\leq 13.5$	$\leq 80$

These cases were further studied for ferritin levels. Those with ferritin levels  $\leq 16 \mu\text{g L}^{-1}$  were classified as having IDA (9).

#### Results

The mean age and SD for 1491 subjects representing the region were  $23.32 \pm 16.82$  yr (range 2–69 yr), for males ( $n = 601$ )  $23.65 \pm 15.82$  yr and for females ( $n = 890$ )  $22.91 \pm 18.08$  yr. In the survey seven cases of  $\beta$ -thal trait, three cases of Hb D trait, and one case of Hb O Arab trait were detected.

In Table 1, the rate of anaemia and IDA is presented. As seen from the table, anaemia is present at a considerable high rate in all age groups, especially in 2–5-yr-olds and women of reproductive age, 18–40 yr. IDA seems to be prevalent in the same age groups as above. The rate of anaemia as compared to normal values is presented in Fig. 1. The distribution of Hb levels according to age groups and sexes is shown in Table 2.

A positive correlation was found between haemoglobin and ferritin levels ( $r = 0.46$ ),  $p < 0.001$ , and a negative correlation was observed among RDW values and ferritin values ( $r = 0.30$ ),  $p < 0.05$ .

#### Discussion

IDA seems to be a world-wide health problem. However, the rate of anaemia varies in different

Table 1 Rate of anaemia and iron-deficiency anaemia (IDA) with respect to age and sex

Age (yr)	Sex	<i>n</i>	Anaemia (%)	IDA (%)
2–5	M & F	84	34.5	15.5
6–12	M & F	295	24.7	12.5
13–18	M	116	4.3	1.7
>40	M	87	6.9	2.3
>40	F	136	25.7	8.8
Total	M & F	1491	24.3	13.1

For ages 2–5 yr of both sexes, the lower level of Hb was taken as  $10.5 \text{ g dL}^{-1}$ , for 6–12 yr as  $11.5 \text{ g dL}^{-1}$  and for ages 12–18 and 19–40 yr for females as  $12.0 \text{ g dL}^{-1}$  and for males as  $13.0$  and  $13.5 \text{ g dL}^{-1}$ , respectively. These cases were further studied for ferritin levels. Those with ferritin levels  $\leq 16 \mu\text{g L}^{-1}$  were classified as iron deficiency anaemia (IDA).

Table 2 Distribution of haemoglobin levels with respect to age and sex

Age (yr)	Sex	<i>n</i>	Hb values (g dL <sup>-1</sup> )				
			$\leq 7.0$	7.0–9.0	9.0–10.5	10.5–12.0	$\geq 12.0$
2–5	M & F	84	1.20%	5.95%	27.38%	36.90%	28.57%
6–12	M & F	295	–	0.34%	2.03%	22.37%	75.26%
13–18	M	116	–	–	0.86%	3.45%	95.69%
13–18	F	154	1.95%	1.95%	7.14%	9.09%	79.87%
19–40	M	180	–	0.60%	1.67%	2.22%	95.51%
19–40	F	439	3.19%	2.96%	6.60%	27.33%	59.92%
>40	M	87	–	–	–	6.90%	93.10%
>40	F	136	–	1.47%	2.20%	22.06%	74.27%

*n*, number of subjects; F, female, M, male, Hb, haemoglobin.

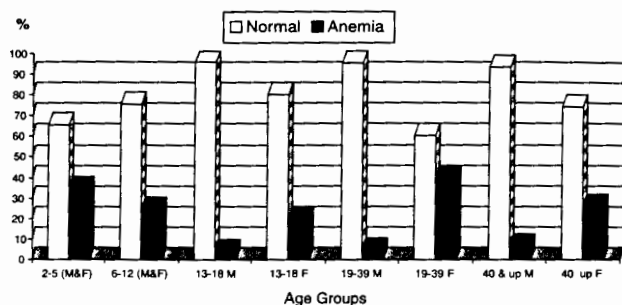


Fig. 1. Distribution of percentage anaemia with respect to age and sex.

parts of the world showing a high rate in developing countries (1-4). With the availability of electronic cell counters in our country, accurate measurements of red cell indices became possible. In this study we used the lower level of normal values (mean - 2SD) of haemoglobin and MCV for each age group and sex as the criteria of anaemia, and for IDA a cut-off value of ferritin  $\leq 16 \mu\text{g L}^{-1}$  was used (7-9). Comparison of our haematological results with normal values for the various age groups given in the literature showed that the mean Hb levels for the age groups of 13-18, 19-40, and >40 yr in females and 6-12 yr in M & F were significantly lower than the levels given for each age group. The values for Hct, MCV, and MCH were low for all age groups in males and females except for the age group 2-5 yr. Also the haematological values in the region were lower than the means for western Turkey (Izmir) in the adolescent age group (14-18 yr), i.e. Hb values  $12.9 \pm 1.3$  vs.  $13.8 \pm 0.8$  in females (10).

Anaemia and IDA seems to be a public health problem in Turkey. Koçak *et al.* reported the rate of anaemia and iron deficiency as 16.9% and 17.2%, respectively, in infants, children aged 3-14 yr and adult males and females in the south of Turkey (11). In a study done in the village of Havutlu, Adana (a province in south Turkey), iron deficiency was reported as 33% for all cases, 36% in HbAA subjects and 24% in HbAS subjects. This area is noted for the high prevalence (31%) of sickle-cell trait (12). IDA was found to be 13.6% in a survey done in the southern part of Turkey in Cukurova, comprising Adana, Icel, and Hatay provinces, on the Mediterranean Sea, where the prevalence of  $\beta$ -thalassaemia and sickle-cell anaemia are high. This survey included 1016 subjects aged 1-69 yr (13, 14). However, in Izmir in western Turkey, the prevalence of iron deficiency was only 6.5% among the adolescent age group (10). In our study, the overall rate of anaemia in Kahramanmaraş was 24.3%. The highest rate of anaemia was found in children aged between 2 and 5 yr (M & F) and in reproductive women aged between 19 and

40 yr, being 34.5% and 40%, respectively. Also, the rate of IDA was highest in children aged 2-5 yr and in females aged 19-40 yr, being 15.5% and 23.8%, respectively. The reason for the high prevalence of anaemia and IDA observed in the region is manifold. Kahramanmaraş is a closed community with a rural population of 45.6%. Although about 10% of the population have been relocated to the urban centres due to a boom in the textile industry, these people have kept their rural lifestyle. The habitual diet of the rural population is rich in carbohydrates and fat. Bread is made at home. Boiled and pounded cracked wheat cooked in fat is eaten with yogurt. Dry peas, beans, lentils, chick peas and seasonal vegetables used to be cooked in fat with meat in a chilli-pepper sauce. However, now meat can rarely be afforded. For breakfast, even the children drink tea. Also, with the advent of industrialisation, lifestyles changed for the worse. With the profuse bombardment of advertising, even village populations consume a great deal of carbonated drinks and snacks.

Attitudes towards women with regard to food consumption have not changed. As a reflection of traditional behavior, males always have priority; they are served first and given the best food. While the children and the women are at home eating carbohydrates, the men at work usually eat kebab (meat cooked on skewers and served on bread). Thus, the high rate of anaemia observed in the region could be due to primarily to low socioeconomic status, discriminative attitudes towards women and children, and a lack of knowledge on health and nutrition. Vitamin B<sub>12</sub> deficiency seems not to be rare in Turkey. The additional causes may be listed as follows: the presence of parasitic infestations, chronic diseases, and inflammations, malnutrition of the young and of women with high fertility. Koç *et al.* reported 14.7% anaemia in Sanliurfa, a neighbouring province to Kahramanmaraş. The causes were iron deficiency 58.9%,  $\beta$ -thal trait 6.3%, chronic disease 19%, parasitic infestation 10.8%, and the rest of unknown aetiology (15).

IDA has been reported to be low in most European countries: 5% in women aged 20-49 yr in the Netherlands (16); 2.2% in Danish women aged 18-30 yr (17); and 4.7% at 16-17 yr and 1.3% at 22-23 yr in Danish women (18). Also, IDA seems to be low in the United States too. In a survey study done by the National Health and Nutrition Survey between 1988 and 1994, IDA was found to be 3.0%, 2.0%, and 5.0% in toddlers, adolescents, and women of child-bearing age, respectively (19). However, Adakile *et al.* reported 32.4% prevalence of IDA in blacks and 33.4% among whites (20). Thus, there are loci of IDA even in developed countries.

Although the government undertook to investigate anaemia in pregnant women and gave iron supplementation therapy, the project was discontinued because iron supplementation was too expensive. For better results, continuous education must be instigated before therapy. The population at large must be enlightened on the importance of iron, and dieticians should prescribe menus using local foods. The Ministry of Health could organise a project in collaboration with universities and non-governmental organisations for an education program along with screening and therapy.

In conclusion, for a healthy population, anaemia as well as IDA should be investigated, and the government must consider it as a national health problem.

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