



## Iron Deficiency Anaemia Among Students of Two Primary Schools at Different Socioeconomic Conditions in Malatya, Turkey\*

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Iron deficiency is the most common nutritional disorder in the world. To determine the prevalence of iron deficiency anaemia (IDA) and associated social and nutritional factors, two primary school students from different socioeconomic status in Malatya province center, in Turkey, were evaluated by using hematocrit and peripheral blood smears. Total of 1633 students of two primary schools -Hanımınçiftliği and Gazi Primary Schools- were studied.

Prevalence of iron deficiency anaemia was 4.2 % among the students of the urban school and 13.8 % among the students of the shunty town school ( $p<0.001$ ). For the urban school students, there was a statistically significant difference among anaemia and age group, maternal education, health insurance and milk consumption. For the shunty town school students, only statistical significance was established between anaemia and age group. These students in the age group 11-18 years showed 2.74 times higher estimated risk of IDA compared to the ones 10 years of age or less. The estimated risk of IDA increased significantly with low levels of maternal education (O.R=2.99). Students with low family income had a 1.75 times greater risk of IDA than those with high family income.

The wide-scale nutrition education should target mothers and young adolescents in shunty town and rural areas. These education programmes should focus on good eating habits.

We suggest that an important factor for preventing and treating anaemia and other nutritional diseases is improving the socioeconomic status.

**Key Words:** Iron deficiency anaemia, Children, Socioeconomic status, Nutrition, Primary school.

### Malatya İl Merkezinde Farklı Sosyoekonomik Düzeydeki İki İlköğretim Okulunda Demir Eksikliği Anemisi Yaygınlığı

Demir eksikliği dünyadaki en yaygın beslenme bozukluğudur. Malatya kent merkezinin farklı sosyoekonomik koşullara sahip iki bölgesindeki ilköğretim okulu öğrencilerinde demir eksikliği anemisi (DEA) yaygınlığının ve ilişkili sosyal ve beslenme faktörlerinin saptanması amacıyla hematokrit ölçümü ve periferik kan yayması kullanılarak değerlendirme yapılmıştır. Çalışmaya, Gazi (GİO) ve Hanımınçiftliği İlköğretim Okulu'ndan (HÇİO) toplam 1633 öğrenci alınmıştır.

DEA yaygınlığı GİO'da %4.2, HÇİO'da %13.8 bulunmuştur ( $p<0.001$ ). GİO'da anemi yaygınlığı ile yaş grubu, annenin eğitim düzeyi, sağlık güvencesi durumu ve süt tüketimi arasında anlamlı farklılık varken, HÇİO'da yalnızca yaş grubu açısından farklılık saptanmıştır. 11-18 yaş grubundaki öğrenciler 10 yaş ve altında olanlara göre 2.74 kat daha yüksek DEA riski taşımaktadır. DEA riski annenin eğitim düzeyi düşüklüğü ile artmaktadır (OR=2.99). Aile geliri düşük olan öğrenciler yüksek gelirli olanlara göre 1.75 kat daha fazla DEA riski taşımaktadır.

Hem kentsel hem de kırsal alanda anne ve genç ergenlere yönelik geniş kapsamlı beslenme eğitimi programlarına gereksinim vardır. Bu programlar sağlıklı beslenme alışkanlıklarını geliştirmeye odaklanmalıdır. Anemi ve diğer beslenme bozukluklarının önlenmesi ve tedavisi için sosyoekonomik koşulların iyileştirilmesi en önemli etmenlerden biridir.

**Anahtar Kelimeler:** Demir eksikliği anemisi, Çocuk, Sosyoekonomik koşullar, Beslenme, İlkokul.

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In developing countries, nearly half of the pregnant women and 40 % of children are estimated to be anaemic and its main cause is iron deficiency.<sup>1, 2</sup> In developed countries such as Canada and United States of America <1-6 % of people suffer from anaemia, compared with a prevalence between 32-78 % in developing countries.<sup>2-6</sup>

Infants and adolescents are more vulnerable to develop anaemia. It results from inadequate iron intake, reduced bioavailability of dietary iron, increased need for iron, chronic blood loss and parasitic infections. In developing countries, malaria, helminthic infections and malnutrition are also common causal factors. Possible causal factors in developed countries are introduction of unmodified cow's milk and defective absorption.<sup>3, 5, 7, 8</sup> In infants and children, anaemia is the leading cause of prematurity, low birth weight, immune deficiencies with high sensitivity to infection and increased risk of death. It is associated with depressed mental and motor development with lower school performance in the late childhood.<sup>1, 6, 9, 10</sup>

This study evaluated the prevalence of anaemia assessed by using hematocrit and peripheral blood smears and associated social and nutritional factors at two primary school students from different socioeconomic status in Malatya province center, in Turkey.

## MATERIALS AND METHODS

### Study design

This is a cross-sectional study. Total of 1633 students of two primary schools which have different socioeconomic characteristics were studied. First school; "Haniminciftligi" Primary School is at the shunty town region and majority of this region's residents are immigrants from Southeastern and Eastern Anatolia. This regions' municipal services are not sufficient. Majority of residents are occupied on farming and their economic, cultural and social status is low. Other school; "Gazi" Primary School is an urban school at Malatya city center. Majority of this region's residents have high socioeconomic status. This region has modern city characteristics.

844 students were from the urban school and 789 students were from the shunty town school. 76.1 % of students ( $n=1243$ ) were evaluated.

### Data collection

A specially designed sociodemographic questionnaire was used to collect data regarding age, sex, maternal education, family income, social insurance and some nutritional and health characteristics. Hematocrit levels were determined using the Electro-Mag M-19 Microhaematocrit Centrifuge. These were obtained using a finger tip puncture. Hematocrit is more practical and viable method for field studies due to the small amount of blood sample required and it is a costeffective method.<sup>4,11</sup> Hematocrit levels were considered by the cut off points for the diagnosis of anaemia as recommended by U.S. Department of Health and Human Services-1998 by age and sex<sup>4</sup> (Table I). Peripheral blood smear was obtained by fingertip puncture and Giemsa stain was applied. Morphology of the blood cells were studied by a hematologist. Erythrocyte morphology was evaluated from the points of anisocytosis, poikilocytosis, hypochromia and microcytosis. Anaemia was determined on the basis of the hematocrit (Hct) levels and peripheral blood smears (PBS) of students.

**Table I.** Cut off points of hematocrit for anaemia<sup>1</sup>

Age groups	Hct (<%)
5-7	34.5
8-11	35.4
<b>Male</b>	
12-14	37.3
15-17	39.7
18 +	39.9
<b>Female</b>	
12-14	35.7
15-17	35.9
18 +	35.7

<sup>1</sup> U.S. Department of Health and Human Services (1998)

### Statistical analysis

Data were coded and analysed using SPSS 10.0. Data from the students of the shunty town school were compared with those from the urban school. Baseline and anaemia characteristics for each group were compared by using chi-square test. For all students, a logistic regression model (Backward stepwise-WALD) was used to estimate the independent effect of each relevant factor. Each relevant factor was determined by using chi-square test in predicting IDA. Statistical significance was defined as  $p < 0.05$ .

## RESULTS

### Sociodemographic characteristics of students

The students from the urban school were 51.6 % of study sample. Sociodemographic characteristics are shown in Table II.

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Table II. Sociodemographic characteristics of students (Malatya, 2001)

Variables	Urban school		Shunty town school		Total		$\chi^2$	p
	n	%	n	%	n	%		
<b>Sex (n:1243)</b>								
Male	321	50.0	345	57.4	666	53.6	6.5	0.011
Female	321	50.0	256	42.6	577	46.4		
<b>Age group (n:1243)</b>								
6-10	475	74.0	229	38.1	704	56.6	161.2	0.000
11-18	167	26.0	372	61.9	539	43.4		
<b>Maternal education (n:1089)</b>								
Low <sup>1</sup>	154	29.4	542	95.8	696	63.9	515.4	0.000
High <sup>2</sup>	369	70.6	24	4.2	393	36.1		
<b>Family's income for a month (n:922)</b>								
Low <sup>3</sup>	77	16.9	241	51.7	318	34.5	123.7	0.000
High <sup>4</sup>	379	83.1	225	48.3	604	65.5		
<b>Health insurance (n:1015)</b>								
Yes	413	90.6	354	63.3	767	75.6	99.4	0.000
No	43	9.4	205	36.7	248	24.4		

<sup>1</sup> Less than five years of school attendance <sup>2</sup> More than five years of school attendance  
<sup>3</sup> Less than minimum wage for Turkey <sup>4</sup> More than minimum wage for Turkey

According to maternal reports, 6.5 % of the urban school students and 8.5 % of the shunty town school students had symptoms of parasitic infection as anal itching and increased excretion of saliva at the time of study (p=0.216), and 0.8 % of the urban school students and 1,6 % of the shunty town school students had pica (p=0.204).

There was a statistically significant difference between students' habits of drinking tea (p<0.001), 47.0 % of the urban school students and 75.1 % of the shunty town school students reported daily tea consumption. According to students' self reports, 49.1 % of the urban school students and 24.6 % of the shunty town school students were consuming milk everyday (p<0.001).

Consumption of foods rich in iron, vitamin B12 and folic acid such as meat, broad bean and dried fruits everyday was reported by 0.2 % of both school students.

**Prevalence of anaemia**

It was indicated that 12.9 % of all students' Hct levels were low. According to Hct cut-off points for anaemia (Table I), 5.6 % of the urban school students and 20.0 % of the shunty town school students were anaemic (p<0.001) (Table III).

According to Hct levels and PBSs of students, 4.2 % of the urban school and 13.8 % of the shunty town school students had iron deficiency anaemia (p<0.001) (Table IV).

For the urban school students, there were any statistical significance among IDA and sex (p=0.555),

family income (p=0.160), tea consumption (p=0.466), symptoms of parasitic infection (p=0.519), chronic disease (p=0.295), pica (p=1.000) and consuming foods rich in iron (p=1.000). Iron deficiency anaemia prevalence was 2.5 % for the age group 6-10 years and 9.0 % for 11-18 years (p<0.001). Iron deficiency anaemia prevalence was 2.7 % for the students whose maternal education was higher and 6.5 % for those with lower maternal education (p=0.040). For the urban school, 3.1 % of students who had health insurance and 9.3 % of students who did not have insurance were anaemic (p=0.043). Iron deficiency anaemia prevalence was 1.9 % for students consuming milk everyday and 5.6 % for students consuming milk less frequently (p=0.028).

Table III. Hct levels of students (Malatya, 2001)

Hct	Urban school		Shunty town school		Total	
	n	%	n	%	n	%
Low	36	5.6	120	20.0	156	12.6
Normal	606	94.4	481	80.0	1087	87.4
Total	642	100.0	601	100.0	1243	100.0

$\chi^2=57.1$  p<0.001

Table IV. Prevalence (percentage) of IDA according to hematocrit level and peripheral blood smears evaluation (Malatya, 2001)

Iron Deficiency Anaemia	Urban school		Shunty town school		Total	
	n	%	n	%	n	%
Anaemic	27	4.2	83	13.8	110	8.8
Non-anaemic	615	95.8	518	86.2	1133	91.2
Total	642	100.	601	100.	1243	100.
		0		0		0

$\chi^2=34.3$  p<0.001

For the shunty town school students, there was only statistically significant difference between the age group 11-18 years and IDA ( $p=0.005$ ). IDA was significantly higher among 11-18 age group than that of  $\leq 10$  years.

For all students, it was observed that there was statistically significant differences among IDA and the age group ( $p<0.001$ ), family income ( $p=0.001$ ), health insurance ( $p=0.009$ ), maternal education ( $p<0.001$ ), tea consumption ( $p=0.019$ ) and milk consumption ( $p=0.022$ ) (Table V).

Backward stepwise-WALD logistic regression analysis of factors associated with anaemia which was determined by using chi-square test among all students revealed that three variables were statistically associated with IDA (Table VI). Students in the age group 11-18 years showed 2.74 times higher estimated risk of IDA compared to those with age 10 years and less. The estimated risk of IDA increased significantly with low levels of maternal education (O.R=2.99). Students with low family income had 1.75 times greater risk of IDA than those with high family income.

**Table V.** Prevalence (percentage) of IDA according to demographic and nutritional characteristics for all students (Malatya, 2001)

Variables	IDA				$\chi^2$	P
	+		-			
	n	%	n	%		
<b>Sex (n:1243)</b>						
Male	67	10.1	599	89.9	2.2	0.130
Female	43	7.5	534	92.5		
<b>Age groups (n: 1243)</b>						
6-10 years	32	4.5	672	95.5	36.0	0.000
11-18 years	78	14.5	461	85.5		
<b>Family income(n: 922)</b>						
Low <sup>1</sup>	44	13.8	274	86.2	15.4	0.001
High <sup>2</sup>	37	6.1	567	93.9		
<b>Health insurance (n: 1015)</b>						
Yes	60	7.8	707	92.2	6.7	0.009
No	33	13.3	215	86.7		
<b>Mothers education (n: 1089)</b>						
Low <sup>3</sup>	86	12.4	610	87.6	27.1	0.000
High <sup>4</sup>	11	2.8	382	97.2		
<b>Drinking tea (n: 1083)</b>						
Everyday	71	10.6	596	89.4	5.5	0.019
Less frequently than everyday	26	6.2	390	93.8		
<b>Drinking milk (n: 1087)</b>						
Everyday	25	6.3	371	93.7	5.2	0.022
Less frequently than everyday	72	10.4	619	89.6		
<b>Symptoms of parasitic infection (n:1087)</b>						
Yes	12	14.6	70	85.4	2.8	0.920
No	85	8.5	920	91.5		
<b>Chronic disease (n:1087)</b>						
Yes	6	5.4	105	94.6	1.3	0.244
No	90	9.2	886	90.8		
<b>Pica (n: 1086)</b>						
Yes	-	-	13	100.0		0.619 <sup>a</sup>
No	95	8.9	978	91.1		
<b>Consuming foods rich in iron (n: 1079)</b>						
Everyday	-	-	2	100.0		1.000 <sup>a</sup>
Less frequently than everyday	97	9.0	980	91.0		

<sup>a</sup>Fisher's exact test

<sup>1</sup> Less than minimum wage for Turkey    <sup>2</sup> More than minimum wage for Turkey

<sup>3</sup> Less than five years of school attendance    <sup>4</sup> More than five years of school attendance

**Table VI.** Stepwise logistic regression analysis of anaemia among student sample (Malatya, 2001)

Variables	B	S.E	O.R	%95 C.I	p
Age group <sup>1</sup>	1.01	0.25	2.74	1.65-4.56	0.000
Maternal education <sup>2</sup>	1.09	0.36	2.99	1.46-6.10	0.003
Family income <sup>3</sup>	0.56	0.24	1.75	1.07-2.85	0.023

<sup>1</sup> Age group=11-18 years    <sup>2</sup> Maternal education=Low (Less than five years of school attendance)

<sup>3</sup> Family income=Low (Less than minimum wage for Turkey)

## DISCUSSION

The results of this study indicate that the shunty town school students have lower socioeconomic level than urban school students as expected.

The prevalence of anaemia according to hct level among all students was 12.6 %. Different studies from Turkey have previously shown that the prevalence of anaemia among schoolchildren according to haemoglobin (Hb) concentration was between 16.3 % and 61.1 %.<sup>12-14</sup> High rates of anaemia have been found among children and adolescents in other developing countries, such as Indonesia, Brazil, Egypt and India varying within the range of 24 %-60 %.<sup>1, 5, 16-18</sup> In certain countries of Eastern Mediterranean Region of WHO, anaemia prevalence values range from 8 %-95 % in United Arab Emirates, 32 % in Bahrain, 40-67 % in Palestine, 55.1 % in Saudi Arabia (girls), to 78 % in Oman.<sup>5</sup> Our results showed that the prevalence of anaemia is lower than other rates, both in Turkey and other countries. These lower rates were probably due to using Hct level instead of Hb. Anjali Devi (2000)<sup>15</sup> suggest that by using Hct, anaemia is underdiagnosed by 1 to 10 percent. On the other hand Hb test might have detected all of these cases. Therefore, Hb estimation is more reliable and should be preferred for screening large populations. Using Hct levels is the main limitation of our study.

According to Hct cut-off points for anaemia 5.6 % of urban school students and 20 % of shunty town school students were anaemic ( $p=0.000$ ). According to IDA determined on the basis of the Hct levels and PBSs of students who had microcytosis and hypochromia, 4.2 % of urban school and 13.8 % of shunty town school students had iron deficiency anaemia ( $p=0.000$ ). Shunty town school student's low socioeconomic conditions and related nutrition habits (for example; consuming tea or milk) may explain their higher rates of anaemia. Sapci et al. (1999) found that only factor among family characteristics which was decreasing the prevalence of anaemia significantly among primary school students in Tokat, Turkey was high family income.<sup>14</sup> In Egypt, the anaemia prevalence was higher among adolescents in the lowest socioeconomic status (52.2 %) and adolescents from the low socioeconomic status had a 1.4 times greater risk of anaemia than those from the high status.<sup>5</sup> It was previously demonstrated that the low socioeconomic status is a risk factor for IDA.<sup>15, 19</sup> Although for each school, there was not a statistically significant difference between family income and

IDA, the difference was significant for the entire sample (O.R=1.75 %95, CI=1.07-2.85). This may be attributed to the fact that all student sample is homogeneous according to family income levels and each school student sample is heterogeneous for other.

For urban school students, significant differences among maternal education, health insurance and IDA suggest that these socioeconomic characteristics are important for the development of anaemia. Lower rates of IDA among students consuming milk everyday indicated that the urban school students have more healthy nutrition habits and higher socioeconomic level. For shunty town school students, significant difference can only be established between age group with IDA among other variables. Essentially their positive nutrition habits (for example consuming foods rich in iron, consuming milk), maternal education and family income levels are very low.

All students in the age group 11-18 years revealed a higher prevalence of anaemia compared to those at 6-10 years ( $p<0.001$ ). Studies in the preschool and schoolchildren groups showed that the adolescents and higher age groups have higher prevalence of anaemia.<sup>15, 20</sup> This may be attributed to increased needs for iron due to rapid growth and menarche.

The high prevalence of anaemia among students consuming tea everyday showed that iron absorption inhibiting factors (such as tannin) is important. In Egypt, it was demonstrated that anaemia was more prevalent among children consuming tea soon after a meal and those children had 1.8 times greater risk of anaemia.<sup>19</sup> In Turkey, tea is a highly consumed drink soon after meals and even with meals among people from low socioeconomic level because of the low cost.

The level of maternal education effects both iron status and mental development. Maternal education is a well-known factor for children health.<sup>9</sup> Students who had low levels of maternal education had 2.99 times greater risk of IDA. Low level of education of mothers may effect childrens' nutrition habits negatively.

The results of this student sample survey show that anaemia, especially IDA, is a common health problem among students who have low socioeconomic status, that is low level of mothers'

education, low family income, no health insurance, no healthy nutritional habits and older age.

In developed countries, different fortified foods have been used for the control of IDA such as cereals, flours and milk. If implemented successfully these interventions are likely to prevent anaemia.<sup>1, 4, 21, 22</sup> Promotion of a diet with a wider variety of naturally iron-containing foods and fortification of foods targeting infants and children might be recommended for prevention from anaemia.

Screening for anaemia and parasitic infections in children from certain age groups has been recommended in Costa Rica, a developing country.<sup>23</sup>

The wide-scale nutrition education should target mothers and young adolescents in shunty town and rural areas. These education programmes should focus on good eating habits.

We suggest that an important factor for preventing and treating anaemia and other nutritional diseases is improving the socioeconomic status.

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