The frequency and etiology of anemia among children 6-16 years of age in the southeast region of Turkey

Ahmet Koç[1], Mustafa Kösecik[1], Hüseyin Vural[2], Özcan Erel[2], Ali Ataş[1], M. Mansur Tatlı[2]

[1]Department of Pediatrics, and [2]Department of Biochemistry, Harran University Faculty of Medicine, Şanlıurfa, Turkey

SUMMARY: Koç A, Kösecik M, Vural H, Erel Ö, Ataş A, Tatlı MM. The frequency and etiology of anemia among children 6-16 years of age in the southeast region of Turkey. Turk J Pediatr 2000; 42: 91-95.

The frequency and etiology of anemia were investigated in 2,913 children between six and 16 years of age in Şanlıurfa, in the southeast region of Turkey. Anemia was found in 142 (7.8%) children in the 6-11 years of age group, and in 16 (1.5%) in the 12-16 years of age group; in total, in 158 (5.4%) children. Causes were iron deficiency in 93 (58.9%) children, β-thalassemia heterozygosity in 10 (6.3%) children, chronic disease that causes anemia of inflammation in 30 (19.0%) children, and intestinal parasitic infections in 17 (10.8%) children. In eight (5.1%) children, the cause of anemia could not be determined. The study's results showed that iron deficiency anemia and chronic and parasitic disease are important problems in schoolchildren of Şanlıurfa, while β-thalassemia and hemoglobinopathies have less importance.

Key words: anemia, iron deficiency, inflammation, β-thalassemia trait, parasitic disease.

Anemia is a common problem in the world, and iron deficiency (ID) is the most common cause of childhood anemia in both developing and developed countries[1-5]. Recent studies have indicated a decline in the prevalence of childhood anemia in developed countries, probably due to improvements in iron nutrition during infancy and childhood[6,7]. But there has been little change in the worldwide prevalence[5,8,9]. Although iron deficiency anemia (IDA) is most frequenctly seen in infancy, it also been detected in school-age children and in adolescence and correlated with socioeconomic conditions[8,10,11]. Anemia of inflammation has also been shown frequently in childhood[7,12-14].

In this study, we investigated the prevalence and causes of anemia among 6-16 year-old children living in the province of Şanlıurfa, in the southeast region of Turkey.

Material and Methods

A cross-sectional study was performed in April and May of 1996, in Şanlıurfa. Subjects were selected using group sampling method from seven primary and six secondary schools in six different regions of the city. Two pediatricians first examined the students. Children with any acute illness were excluded because these diseases can affect the hematological status of children[7,12-14]. Capillary blood samples were taken from fingers and hematocrit (Hct) values were determined using the standard centrifugation technique. The following age specific values for Hct were used to define anemia: Hct < 35% for childtren six to 11 years of age; Hct < 36% for girls 12 to 16 years of age; and Hct < 37% for boys 12 to 16 years of age[15].

In the second step, children with anemia were investigated for its etiology. Complete blood counts were performed with automatic analyzer. Serum iron and iron binding capacity measurements were made with a commercial kit (Teca) with colorimetric methods, and transferrin saturation was calculated. Iron deficiency anemia was diagnosed if mean corpuscular volume (MCV) was lower than two standard deviations for ages (MCV < 77 fl for children 6-11 years of age, and MCV < 78 fl for children 12-16 years of age) and transferrin saturation was lower than 16 percent[15]. The remaining children were accepted as non-IDA (NIDA). Hemoglobin electrophoresis was done

with cellulose acetate electrophoresis method if MCV was lower than two standard deviations for ages[15]. Urine analyses and urine cultures for infection and renal diseases, stool examinations for ova and cysts of intestinal parasites, and benzidine tests for occult bleeding were done. Radiological, ultrasonographic and microbiologic investigations for determination of chronic infections were performed if needed. Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were measured to determine undetectable infection or inflammation.

In the non-IDA group, children who had an infectious or inflammatory disease without other causes of anemia were diagnosed anemia of inflammation. If CRP and ESR were high even without any detectable infectious or inflammatory disease, these cases were also accepted as anemia of inflammation.

Statistical analyses were performed using the SPSS computer programs. Mean Hct values of different groups were compared using t test for unpaired samples; anemia rates were compared with chi-square test.

Results

A total of 2,913 children were investigated. The distribution of children and mean Hct values according to age and sex are presented in Table I. Anemia was present in 142 (7.8%) children in the 6-11 years of age group, and in 16 (1.5%) in the 12-16 years of age group; in total, in 158 (5.4%) children. While there were no important differences in mean Hct values and anemia frequency between girls and boys ($p > 0.05$ and $p > 0.05$), the differences between the two age groups were statistically important ($p < 0.001$ and $p < 0.001$).

Anemia was microcytic in 108 (68.4%), and normocytic in 50 (31.7%) children. IDA was the most common cause of anemia (58.9% of anemia cases). Heterozygous β-thalassemia was found in 10 (6.3%) anemic children. This rate constituted 0.4% of all children. Other hemoglobinopathies such as Hb S were not found (Table II).

Tablo II. Definable Causes of Anemia in Children

Disorders	Number of cases	Percentage (%)
Iron deficiency anemia	93	58.86
B-thalassemia trait	10	6.33
Chronic diseases	30	18.99
UTI	11	6.96
URI	8	5.06
LRI	1	0.63
Bronchial asthma	2	1.27
Cutaneous leishmaniasis	4	2.53
Unknown cause (ESR and CRP high)	4	2.53
Intestinal parasitic infections (without IDA)	17	10.76
Unknown origin	8	5.06
Total number	158	100

UTI: Urinary tract infection. URI: Upper respiratory tract infection. LRI: Lower respiratory tract infection. ESR: Erythrocyte sedimentation rate. CRP: C reactive protein. IDA: Iron deficiency anemia.

Occult blood was positive in the stool of 12 (7.6%) children with anemia (9 were IDA). Intestinal parasites were found in the stool examination of 34 (36.6%) children with IDA, and in 17 (26.2%) non-IDA children (Table III). Recurrent or chronic urinary tract infection (UTI) in 11 (7%) (8 girls, 3 boys) and chronic upper respiratory tract infection (URI) in 8 (5.1%) children were defined. Two children had asthma bronchiole and four children had cutaneous leishmaniasis (Table II).

Table I. Mean Hematocrit (Hct) Values of Children According to Age and Sex

Age	Total number	Mean Hct of girls (n)	Mean Hct of boys (n)	p value
6-11 years	1809	37.99±2.56 %(701)	38.0.2±2.35 %(1108)	p>0.05
12-16 years	1104	40.12±2.75 %(178)	40.54±3.05 %(926)	p>0.05
	2913	p<0.001	p>0.001	P value

Table III. Intestinal Parasites in Children with Anemia

Parasites	Parasite numbers in anemia groups IDA*	NIDA	Total	Percentage (%)
Ascaris lumbricoides	14	6	20	37.04
Trichuris trichiura	10	2	12	22.22
Hymenolepis nana	4	0	4	6.90
Entamoeba histolytica	5	7	12	22.22
Giardia intestinalis	4	2	6	11.11
Total	37 (68.52%)	17 (31.48%)	54	100

* Parasite number higher than number of children with parasitic diseases because of polyparasitism.

IDA : Iron deficiency anemia.
NIDA: Non iron deficiency anemia.

Discussion

Although the prevalence of iron deficiency anemia in childhood is lower in developed countries[6,7], it continues to be an important problem in other regions of the world[2,4,5,9,16]. Iron deficiency, with or without anemia, is the most common specific nutritional deficiency in infancy and childhood, even in some developed countries[3,4,17-19]. The results from many studies from Turkey also showed iron deficiency as the most important cause of anemia among preschool and schoolchildren in geographically and economically different regions[20-24]. Iron deficiency with or without anemia may cause impairment in growth, in mental and motor development and in cognitive function in infants and preschoolers, and can affect the attention span, learning and educational performance of schoolchildren[25-30]. It may also cause a deficit in work performance in adolescents and adults[2,31]. These alterations can be reversed with iron treatment[25,27,28].

Inadequate intake of iron is the most important causative factor, particularly when the body is in need of more iron than usual (e.g. during infancy, early childhood, adolescence)[8,17,24,29,32]. High fiber in diets may increase the incidence of iron deficiency anemia because its content of phytate and other inositol phosphates decreases the absorption of iron[29,33,34]. Hallberg et al.[35,36] reported that a high calcium content in meals inhibits the absorption of iron by interfering with the transport of iron through the mucosal cell.

Although IDA is most frequently seen in infancy, our results showed that it is also an important problem for the 6-11 years of age group. We think it is particularly associated with an inadequate intake of iron-rich food, and also with the high consumption rate of high fiber foods, such as eggplant, in this region. It is reported that the inhibitory effect of the phytate in food was overcome by adding different amounts of an ascorbic acid-rich vegetable to the meals[37]. So, this method, together with an increased consumption of iron rich or iron-fortified foods, can be used to prevent iron deficiency[38].

Numerous disease states such as acute and chronic infections, collagen vascular diseases, and traumatic and neoplastic illness can produce the anemia of inflammation[7,13,14,39]. Nineteen percent of children in this study had anemia of inflammation. The most frequent diseases were UTI, URI, and cutaneous leishmaniasis. Possible causes of the anemia of inflammation include decreased red cell life span, impaired reutilization of hemoglobin iron, relative erythropoietin deficiency or impaired responsiveness of bone marrow to erythropoietin, and ineffective erythropoiesis[13,39].

We found intestinal parasitic infection in 51 (32.3%) children with anemia (36.6% in IDA group, and 26.2% in NIDA group). Trichuris trichiura and Hymenolepis nana were especially more frequent in the IDA group than in the NIDA group (Table II). Many studies have shown that intestinal parasitic infections can affect the absorption of trace elements and can be causes of anemia[8,16,40,41]. The study results showed that parasitic infestations are important problems in the region.

The prevalence of β-thalassemia and hemoglobin S (Hb S) is high in the southern region of Turkey[5,42]. Although Şanlıurfa is geographically close to this region, Hb S was not detected, and the rate of β-thalassemia was lower, in only 6.33 percent of anemia cases. Alperin et al.[43] reported that Hb A_2 levels may be decreased in patients with thalassemia trait and IDA, in the case of severe IDA, but they also reported that the mean Hb A_2 levels of these patients were significantly greater than the mean percentage of Hb A_2 for normal subjects. Therefore, the probability of the rate of β-thalassemia trait having been altered by IDA in this study is small. Kılınc et al.[44] found that heterozygous β-thalassemia incidence was 0.6 percent in Şanlıurfa. Thus, the previous and present studies' results have shown that the Şanlıurfa region resembles East Anatolian cities

such as Erzurum[45] and Elazığ[46], rather than South Anatolian cities, for β-thalassemia heterozygosity and hemoglobinopathies.

Şanlıurfa has a low socio-economic condition, but the city is at the center of the Southeast Anatolia Project, Turkey's biggest agriculture and energy project. It is thus expected that important socioeconomic development will occur in the next ten years.

In conclusion, iron deficiency anemia and chronic and parasitic diseases are important problems in schoolchildren in the Southeast region of Turkey, but β-thalassemia and hemoglobinopathies have not been shown as significant problems.

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