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# Adolescent Iron Deficiency Anemia Incidence in Kahramanmaras

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## Abstract

World Health Organization defined adolescence as 10-19 years of age. The adolescence is known as a period of rapid physical growth along with sexual, biological, psychological and social changes. Iron deficiency anemia is prevalent in adolescence. Iron deficiency leads to myelinization disorder in the nerves, axon insufficiency, and impaired brain development, and hemoglobin deficiency disrupts the oxygen transfer to tissues and hypoxia in brain and other tissues, leading to problems in tissue-organ functions and cognitive development. The present study aimed to determine iron deficiency anemia incidence in adolescents in our region**.**

The current study was conducted with 80 male (Group I) and 80 female (Group III)11 ± 16 years old adolescent subjects who applied to Kahramanmaras Necip Fazıl City Hospital, Gynecology and Children supplemental building healthy children outpatient clinic and who were non-smokers without any known previous disease. In the study, iron, hemoglobin, hematocrit and ferritin levels were analyzed.

The anemia incidence was 7.1% in Group I, the anemia incidence was 28.6% in Group II, and the anemia incidence was3.6% in Group I based on ferritin, and the anemia incidence was 21.4% in Group II based on ferritin. Analysis of all groups revealed that the anemia incidence was17.9% based on hemoglobin and 12.5% based on ferritin.

The present study findings suggested that IDA incidence was quite high in our region and these children should apply to health institutions in certain intervals and their iron diet should be regulated.

**Keywords:** Adolescent, Iron Deficiency Anemia, Ferritin, Hemogram, Iron

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## Introduction

According to the World Health Organization (WHO), adolescence is defined as 10-19 years (1). Adolescent period is known as a period of transition from childhood to adulthood with rapid physical growth and sexual, biological, psychological and social changes and constitutes approximately 30% of the world population (2). In Turkey, this ratio is between about 20-25% (3). Iron deficiency also occurs due to physiological changes in

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adolescence, and if this cannot be prevented, it becomes iron deficiency anemia (IDA). IDA, hemoglobin, hemotocrit or erythrocyte value is defined as the normal mean values of age and sex below 2 standard deviations (4).

Iron deficiency anemia is accepted as a public health problem affecting more than 500 million people in the world, especially in low socioeconomic conditions, infants, adolescents and pregnant women (5, 6, 7). According to WHO reports, IDA varies between 8% and 58% (8). The prevalence of IDA was 5.5% in the whole group while it was found to be 6.7% in girls and 4.2% in boys (9).

In a study conducted in Manisa, IDA was found in 18% of children in the 0-14 age group and no significant difference was found between boys and girls (10). Gökcay et al. found that the rate of IDA in adolescents aged 10-13 years was 39% (11). Iron; hemoglobin, cytochrome, nitric oxide synthase, myoglobin, catalase is found in the structure of molecules such as DNA and RNA synthesis is essential element (12, 13).

As a result of iron deficiency, myelinization disorder in the nerves, axon insufficiency, brain development is impaired, oxygen transport to tissues is impaired due to hemoglobin deficiency, hypoxia occurs in the brain and other tissues, then tissue-organ functions and cognitive development are affected (14, 15). In a study, a positive correlation was found between behavioral disorders and weakened cognitive behaviors in children with IDA (16). In another study, it was found that cellular immunity was impaired and the tendency to infection increased in IDA (17). Ferritin is found in all cells in the body, including the liver bone marrow and spleen. A ferritin molecule contains 4000-4500 iron atoms, with a ferritin level below 12 µg / I supports the diagnosis of iron deficiency anemia.

However, since ferritin is an acute phase reactant, it may increase especially in the presence of inflammation and infection (18, 19). In this study, we aimed to determine the incidence of iron deficiency anemia and to investigate hemoglobin, hematocrit, ferritin and iron levels in order to regulate the diet and eliminate the negative effects of the adolescents in Kahramanmaras.

## Material and Methods

Our study was conducted on 80 male (Group I), 80 female (Group II), 11 ± 16 years old, non-smokers, who did not have any known illness before, who applied to the outpatient clinic of Kahramanmaras Necip Fazıl City Hospital Gynecology and Childhood building. Venous blood samples were taken from the patients following fasting for 12 hours. As iron deficiency anemia criterion; hemoglobin (Hb) value in males and 12.5 g/dl in girls is below 12 g/dl (7). In this study, iron, hemoglobin, hemotocrit and ferritin levels were evaluated. The following methods were used in the analysis of the samples. Iron levels; The Roche Hitachi Cobas C501 autoanalyser was calorimetrically measured and the ferritin levels were measured by electrochemiluminescence immunoassay method on the Roche Hitachi Cobas e 600 autoanalyser, and hemoglobin and hematocrit levels were measured by fluorescence flow cytometry with Sysmex XN-1000.

**Statistical Analysis:** Statistical analysis was performed using SPSS for Windows

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version 22.0 (SPSS Inc., Chicago, IL, USA). Shapiro-Wilk test was used to determine the normality of the distribution. Continuous variables were expressed as mean ± standard deviation and categorical variables were expressed as percentages. Chi-square test was used to compare differences between groups for categorical variables. According to the distribution, the differences between the groups for numerical parameters were compared with Student's t-test and Mann-Whitney U test. P <0.05 was considered significant

## Result

Hemoglobin levels (gr/dl), Group I: 14.35 ± 1.40, Group II: 12.45 ± 1.86, Total group: 13.40 ± 1.89, Hematocrit levels (%): Group I: 42.38 ± 3.97, Group II: 38.48 ± 4.38, Total Group: 40.43 ± 4.58, Iron levels (µg / dl): Group I: median 66.50 (49.00-93.50), Group II: median 70.50 (42.50-99.50), Ferritin levels (µg /L): Group I: median 45.69 ( Group II: median 19.96 (13.55-35.63) ( Table 1). Anemia rate in Group I based on hemoglobin; 7.1%, 28.6% in Group II, and the rate of anemia in Group I based on ferritin; 3.6% in Group II and 21.4% in Group II. When all groups were evaluated, the rate of anemia based on hemoglobin; 17.9% and 12.5% based on ferritin (Table2). When the parameters of adolescent groups were compared; In terms of hemoglobin; Group I levels were significantly higher than group II (p <0.05).
In terms of hematocrit; Group I levels were significantly higher than group II (p <0.05).
In terms of iron; There was no statistically significant difference between group I and group II levels (p> 0.05).
In terms of ferritin; Group I levels were significantly higher than group II (p <0.05).

**Table 1: Parameter levels and comparisons in groups**

| Parameters | Group I (n=80) | Group II (n=80) | t-MW-U/$X^2$ | P value |
|---|---|---|---|---|
| **Hemoglobin (gr/dL)** | 14.35 ± 1.40 | 12.45 ± 1.86 | <0.001 | **<0.001*** |
| **Hematocrit (%)** | 42.38 ± 3.97 | 38.48 ± 4.38 | 0.003 | **0.001*** |
| **Iron, (ug/dL) (median) (Q1-Q3)** | 66.50 | 70.50 | 271.000[a] | **0.057*** |
| **Ferritin (ug/L) (median) (Q1-Q3)** | 45.69 | 19.96 | 202.000[a] | **0.002*** |
| **Anemia Ferritin (<12), n (%)** | % 3.6 | % 21.4 | 4.082[b] | **0.043*** |
| **Anemia (E: Hbg<12.5, K:Hbg<12), n (%)** | % 7.1 | % 28.6 | 4.383[b] | **0.036*** |

Independent samples t test; [a] Mann-Whitney U test; [b] Chi-square test, * The difference was statistically significant;

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**Table 2: Anemia levels in groups**

| Anemi | Hemoglobin -gr/dl | Ferritin-µg/L |
|---|---|---|
| **Group I** | % 28.6 | % 21.6 |
| **Group II** | % 7.1 | % 3.6 |
| **Total Group** | % 17.9 | % 12.5 |

## Discussion

IDA continues to be a very important public health problem in our country as in the whole world. According to the WHO, iron deficiency anemia varies between 8% and 58% and affects more than 500 million people world wide (5, 8). When the childhood period is examined, the most common period in infancy; especially between the ages of 6-24 months, the second most frequently seen in school age and pre-adolescent period (20, 21). Different results have been obtained in studies conducted in various countries around the world. In the study conducted in 885 adolescents aged 11-19 in India; anemia was found in 96.7% of the girls and 87.2% of the boys, and the majority of these were reported to be IDA (22). In Australia, 8.7-11.5% of girls and 1.4% of boys (23), 29.6% of girls and 24% of boys were found in Kuwait (24). Studies have been conducted in various regions in the adolescent group in our country and in Sivas region; 4.2% in boys, 6.7% in girls, 5.5% in total (9), 18% (10) in the Manisa region with no significant difference between boys and girls (10). In children aged 12-16 years, 8.3% in girls, 1.6% in boys (24), 10.3% in girls and 4.6% in boys (25) in the Izmit region, 25% of the children had IDA. Physiological causes of IDA in adolescence include; in this period, there is an increase in blood volume, menstruation bleeding, increase in muscle mass (26). Other reasons include; parasitosis, inadequate and unbalanced nutrition, polyp, diverticulum, colitis, gastrointestinal diseases such as peptic ulcer, bone marrow diseases, obesity are considered (27, 28, 29, 30). In iron deficiency, the structure and functions of iron-containing proteins such as hemoglobin, myoglobin catalase, nitricocyte synthase, cytochrome p-450 are impaired, as a result of these, in growth-development, motor mental functions, brain development and behavioral development, myelinization, immune system development, negativity occurs (14, 15, 17, 31, 32). In another study, it was reported that hyperactivity and attention deficit may develop as a result of IDA (33). In our study, IDA was found to be 28.6% in girls and 7.1% in boys.

The rates of anemia in our study were significantly higher than those of other regions. The reason for this is the low

socioeconomic conditions in our region, inadequate and improper eating habits, especially reducing the iron absorption, tea, phytate, phosphate, coffee, such as the consumption of large amounts of food, hospital or health institutions at the rate of admission changes, depending on the difference in education level and the density of foreign immigrants we think. On the other hand, we think that the use of iron medication is not adequately explained and that these drugs cause nausea-vomiting and irritation as a side effect. As a result; In our region, the rate of IDA in adolescents is quite high, some of the causes of IDA in children in this period; Considering that there are serious diseases such as peptic ulcer, diverticulitis and bone marrow infitations, we think that these children should be brought to health institutions with certain periods and their diets should be regulated in terms of iron.

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