

# Prevalence of Anemia Among Children in a Single University Hospital

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## Bir Üniversite Hastanesinde Çocuklarda Anemi Prevalansı

### ABSTRACT

**Objective:** Anemia is a common public health issue, causing an increase in mortality and morbidity, especially in pregnant women and children. WHO reported the prevalence of anemia in preschool children as 47.4%, and incidence of anemia is gradually increasing. Iron deficiency is responsible for approximately 50% of cases with anemia. This study aims to determine the prevalence of anemia and the underlying causes of anemia in pediatric patients who were admitted to a reference hospital.

**Method:** This cross-sectional study was planned retrospectively and children between 0.5-15 years of age who were admitted to our hospital for any indication between July 2017-July 2018 were included. Sampling Among these patients with anemia, those with hemoglobin values less than 11 g/dl were included in the study.

**Results:** The incidence of anemia was detected as 8.2% (n=4655). The median age of anemic children was three years, and 54.4% of them were male. Anemia was more common among 2-5 year-old-children (50.8%). The prevalence of anemia was higher in boys between ages of 0.5-1 and 2-5 years, while it was higher in girls between ages of 10-12 and 13-15 years with a statistically significant difference. The median hemoglobin value was 10.2 (min-max: 2.8-10.9) g/dl, and MCV was 74.5 (min-max: 46.9-126.8) fl.

**Conclusion:** The incidence of anemia in a reference centre in Black Sea region of Turkey in children between 0.5-15 years of age is 8%. The laboratory parameters were consistent with a probable diagnosis of iron deficiency anemia. The majority of patients (64%) had mild anemia. Collaboration between physicians and parents in the prevention and treatment of anemia is critical in protecting children from anemia, which is the cause of preventable mental retardation.

**Keywords:** Anemia, pediatrics, public health

### ÖZ

**Amaç:** Anemi özellikle gebelerde ve çocuklarda mortalite ve morbidite artışına yol açan yaygın bir halk sağlığı sorunudur. Dünya Sağlık Örgütü, dünya genelinde okul öncesi çocuklarda anemi prevalansını %47,4 olarak bildirmiştir ve anemi insidansı giderek artmaktadır. Anemisi olan olguların yaklaşık %50'sinden demir eksikliği sorumludur. Bu çalışmada, referans hastaneye başvuran pediatrik hastalarda anemi prevalansı ve nedenlerinin belirlenmesi amaçlanmıştır.

**Yöntem:** Bu kesitsel çalışma retrospektif olarak planlanmış olup, evrenini Temmuz 2017 ile Temmuz 2018 tarihleri arasında, hastanemize herhangi bir nedenle başvuran ve tam kan sayımı yapılan 6 ay-15 yaş arasındaki çocuklar oluşturmuştur. Örneklem bu hastalardan anemik olanlar, yani hemoglobin değeri 11 g/dl'den küçük olanlar dahil edilmiştir.

**Bulgular:** Anemi insidansı %8,2 (n=4655) saptanmıştır. Anemik çocukların ortanca yaşı 3 yıl olup, %54,4'ü erkektir. Yaş gruplarına göre dağılımları incelendiğinde, en sık 2-5 yaş arası (%50,8) çocuklarda anemi olduğu belirlenmiştir. 0,5-1 yaş ve 2-5 yaş gruplarında erkek çocuklarında anemi sıklığı daha yüksekken, 10-12 ve 13-15 yaş gruplarında ise kız çocuklarında daha yüksektir ve bu fark istatistiksel olarak anlamlıdır. Anemik çocukların ortanca hemoglobin değeri 10,2 (min-max: 2,8-10,9) g/dl ve MCV 74,5 (min-max: 46,9-126,8) fl saptanmıştır.

**Sonuç:** Karadeniz bölgesinde bir referans hastanede 0,5-15 yaş aralığında anemi sıklığını %8 saptanmış olup, laboratuvar bulguları olası bir demir eksikliği anemisi tanısı ile uyumlu olarak değerlendirildi. Hastaların büyük çoğunluğunda (%64) hafif anemi saptandı. Hekimlerin anemiyi önleme ve tedavi etme konusunda hasta ailesiyle işbirliği içinde çalışması ve aileleri bilinçlendirmesi, çocuklarda önenebilir bir zeka geriliği nedeni olan anemiden korunmada çok büyük önem göstermektedir.

**Anahtar kelimeler:** Anemi, pediatri, halk sağlığı

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## INTRODUCTION

According to the World Health Organization (WHO) data, anemia is a common public health issue, causing an increase in mortality and morbidity, especially in pregnant women and children. Anemia affects 2.5 billion people on a worldwide basis. WHO reported that the prevalence of anemia in preschool children is 47.4%<sup>(1)</sup> and the incidence of anemia has increased<sup>(1,2)</sup>. Iron deficiency is responsible for approximately 50% of the cases with anemia<sup>(1,2)</sup>. Iron deficiency anemia in infancy and early childhood has negative consequences on growth and development if not treated.

Regular follow-up of children has a vital role in the diagnosis and treatment of anemia. In 2004, in order to reduce the incidence of iron deficiency anemia in Turkey, Ministry of Health launched a project named "Iron-like Turkey"<sup>(3)</sup>. In this project, it is aimed to provide prophylactic iron support to children between 4-12 months of age and to detect and treat anemia at an early period of life, between 12-23 months of age<sup>(3)</sup>. However, in our country where iron-rich diet has found a limited use, iron deficiency anemia is still an important public health problem despite the health policies implemented.

According to the data of the World Health Organization (WHO) the prevalence of anemia in childhood is 30 percent<sup>(2)</sup>. Anemia prevalence studies were performed in different provinces of Turkey. In prevalence studies performed in different parts of our country such as Istanbul, Sivas, Trabzon, Denizli<sup>(4-7)</sup>, the frequency of anemia has been reported to range between 6-46 percent. In a study in Samsun, involving school-age children (7-14 years), the prevalence rates of anemia, and iron deficiency have been reported as 9%, and 26%, respectively<sup>(8)</sup>.

This study was performed in a university hospital which is an important reference center that undertakes treatment of many patients. This study aims to determine the prevalence of anemia and the underlying causes of anemia in pediatric patients who were admitted to the reference hospital.

## MATERIALS and METHODS

This cross-sectional study was planned retrospectively and children between ages of 6 months to 15 years who were admitted to our hospital for any indication and their complete blood counts were evaluated between July 2017 and July 2018 were included in the study. Patients aged between 6 months, and 2 years with hemoglobin levels below 10.5 g/dl, and older children with hemoglobin values less than 11 g/dl were included in the study. Repetitive data were excluded, and the results at the first admission date were taken into consideration. Data of patients, such as age, gender, complete blood count values, comorbidities, were obtained from patients' hospital records. The diagnosis was based on the international classification of diseases (ICD-10).

According to WHO's definition of anemia, hemoglobin values less than 11 g/dl were considered as anemia<sup>(9)</sup>. Patients with hemoglobin values of 10.0-11.0 g/dl, 9.9-7.0 g/dl, and <6.9 g/dl were classified in categories of mild, moderate, and severe anemia<sup>(9)</sup>.

Ethics committee approval and institution permissions were obtained. As the study had a retrospective (archive screening) design, it was not seen necessary to obtain consent from the patients and their relatives.

After the data obtained from the research were coded, it was transferred to SPSS (Version 22 for Windows, SPSS Inc., Chicago, IL, USA) package program and analyzed. When data were evaluated, parametric variables were expressed by the mean  $\pm$  standard deviation, while the non-parametric variables were expressed in median (minimum and maximum) (min-max) values. Frequency data were expressed by numbers and percentage (%). In statistical analysis, the chi-square test was used to compare frequency data. The Kolmogorov-Smirnov test examined the suitability of the variables to the normal distribution. For data with non-normal distribution, the paired comparisons were performed using the Mann Whitney U test. The statistical significance level for all tests was accepted as  $p < 0.05$ .

**RESULTS**

A total of 56713 patients between the ages of six months and 15 years were admitted to our hospital during the twelve month-period specified in the study. The female/male ratio was 30833 (54.3%) /25880 (45.7%). All patients (n=4655; 8.2%) with anemia were included in the study. The median age of anemic children was three years (min-max: 0-15), and 54.4% of them were male. Anemia was most commonly (50.8%). encountered in the age group of 2-5-years The comparison of age groups by gender is shown in Table 1.

The prevalence of anemia was higher in boys in the age group of 0.5-1 years and 2-5 years, while it was higher in girls between 10-12 and 13-15 years of age, and the difference was statistically significant (p<0.00001).

The median hemoglobin value of anemic children was 10.2 (min-max: 2.8-10.9) g/dl and the mean erythrocyte volume (MCV) was 74.5 (min-max: 46.9-126.8) fl (Table 2).

When the age groups of the patients were classi-

**Table 1. Distribution of ages of children with anemia according to gender.**

	Total n(%)*	Male n (%)	Female n (%)
6 months- 1 year old	929 (20.0)	529 (56.9)	400 (43.1)
2-5 years old	2367 (50.8)	1355 (57.2)	1012 (42.8)
6- 9 years old	681 (14.6)	353 (51.8)	328 (48.2)
10-12 years old	313 (6.7)	150 (47.9)	163 (52.1)
13-15 years old	365 (7.8)	143 (39.2)	222 (60.8)
Total	4655 (100.0)	2530 (54.4)	2125 (45.6)

\*Percent of columns

**Table 2. Complete blood count parameters of children with anemia.**

	Median (min-max)
Hemoglobin (g/dl)	10.2 (2.8-10.9)
WBC count (thousands/ul)	9.0 (0.10-236.80)
PLT (thousands/ul)	334.0 (100.0-3694.0)
MCV (fl)	74.5 (46.9-126.8)
RBC (millions/ul)	4.3 (0.88-7.15)
MCHC (g/dl)	33.0 (22.9-39.6)

fied according to hemoglobin levels, the most common hemoglobin values measured were between 10-11 g/dl (mild anemic) in all age groups. However, there was no statistically significant difference between age groups regarding anemia (p=0.18) (Table 3).

Patients had received diagnoses of iron deficiency anemia (n=1298; 28%), acute leukemia (n=1182; 3%), hemolytic anemia (n=179; 3.4%) and aplastic anemia (n=23; 0.4%). A total of 3037 (65%) of the patients who were anemic according to laboratory results did not have any ICD-10 diagnosis for anemia. These 3037 children, (n=2023) had hemoglobin values between 10-11 g/d (n=2023; 66.6%), 7-9 g/dl (n=925; 30.5%) and below 7 g/dl (n=89; 2.9%), respectively .

A total number of 262 (5.6%) patients had severe anemia (<7.0 g/dl), and 56.9% of these patients were male, but no statistically significant difference was found between genders among non-severe anemic

**Table 3. Distribution of level of anemia according to the age of children.**

	Hemoglobin level			p
	10.0-11.0 g/dl n (%)*	9.9-7.0 g/dl n (%)*	<7.0 g/dl n (%)*	
6 months-1 year old	577** (62.1)	307 (33.0)	45 (4.8)	0.18
2- 5 years old	1536 (64.9)	706 (29.8)	125 (5.3)	
6- 9 years old	448 (65.8)	190 (27.9)	43 (6.3)	
10-12 years old	195 (62.3)	98 (31.3)	20 (6.4)	
13-15 years old	230 (63.0)	106 (29.0)	29 (7.9)	
Total	2986 (64.1)	1407 (30.2)	262 (5.6)	

\*Percent of row

\*\*Hemoglobin level is 10.0-10.5 for this group

**Table 4. Distribution of age groups of children with severe anemia according to gender.**

	Total	Male	Female	p
	n (%)*	n (%)	n (%)	
6 months-1 year old	45 (17.2)	27 (60.0)	18 (40.0)	0.19
2-5 years old	125 (47.7)	73 (58.4)	52 (41.6)	
6-9 years old	43 (16.4)	19 (44.2)	24 (55.8)	
10-12 years old	20 (7.6)	15 (75.0)	5 (25.0)	
13-15 years old	29 (11.1)	15 (51.7)	14 (48.3)	
Total	262 (100.0)	149 (56.9)	113 (43.1)	

\*Percent of column

patients ( $p>0.05$ ). The median age of the severely anemic patients was four years (min-max: 0-15), which was significantly higher than the mean age of all patients with anemia ( $p=0.02$ ). There was no statistically significant difference in patients with severe anemia as for age groups.

When the patients diagnosed with severe anemia were evaluated according to the diagnoses defined in ICD-10, the indicated number of patients were in the categories of "anemia, unspecified" ( $n=35$ ; 13.4%), "aplastic anemia", ( $n=10$ ; 3.8%), and "iron deficiency anemia" ( $n=21$ ; 8.0%), "hemolytic anemia" ( $n=20$ ; 7.6%), and "megaloblastic anemia ( $n=6$ ; 2.3%). Other diagnoses were as follows in order of decreasing frequency; chronic diseases in 77 (29.4%), malignancies in 49 (18.7%), trauma (accidents and intoxications) in 22 (8.4%) and infectious diseases in 22 (8.4%) patients. Patients with severe anemia and chronic disease ( $n=77$ ) had neurological diseases ( $n=28$ ; 36.6%), cardiovascular disease ( $n=10$ ; 13.0%) endocrinological disease, ( $n=7$ ; 9.1%) and metabolic disease ( $n=6$ ; 7.8%). Of 49 patients with malignancy), 20 (40.8%) patients had acute lymphoblastic leukemia, and 19 (38.7%) had solid tumors.

## DISCUSSION

Anemia is common in children and is still considered to be a public health issue in our country. The incidence of anemia varies according to age, socio-economic conditions. In this study, we aimed to find the frequency of anemia among patients who were admitted to a reference university hospital in the Black Sea Region. The incidence of anemia among children admitted to Children's Hospital in one year was found as 8.2%. Prevalence rates of anemia in our country have been reported to range between 4 and 7 percent. We think that iron prophylaxis, which is accepted for the prevention of anemia worldwide, and free iron preparations to be given to infants within the scope of the project "Iron-like Turkey" <sup>(3)</sup> especially in our country, had a significant contribution to the reduction of the prevalence of anemia.

Median hemoglobin value of the patients included in the study was 10.2 g/dl, and median MCV

value was 74.5 fl, which are consistent with a probable diagnosis of iron deficiency anemia. The majority of patients (64%) had mild anemia. The low frequency of anemia and the fact that the majority of anemic patients have mild anemia can be considered as positive findings.

In this study, anemic patients were most frequently aged between 2-5 ( $n=2367$ , 50.8%) and 0.5-1 years ( $n=929$ , 20.0%), respectively. As anticipated, anemia is seen more frequently in the preschool period where faster growth rates are seen. Besides, in this age group, children depend on adults for their nutrition, and experience frequent infections in kindergarten which also contributes to anemia. In his thesis in 2008, Eren et al. <sup>(10)</sup> found that anemia was most common in the preschool period and age of 0-1 years.

Anemia was statistically significantly more frequent in girls during adolescence period (10 years and older) in our study. It is expected that iron deficiency anemia is a consequence of failure to meet the increasing need for iron in both genders during the adolescent period, and especially in this period, the preference of "fast food" consumption leads to inadequate iron intake. Also, anemia can be seen more frequently in girls due to the menarche and irregular menstrual bleeding.

When patients were classified according to the ICD-10 diagnostic codes, 65% had no anemia-related diagnosis, and the majority (66%) of these patients had mild anemia. In other words, the rate of anemia is very high in patients who were admitted to our hospital for any indication and who did not have a hematological disease. Considering the adverse effects of anemia on growth and development, the diagnosis and treatment of even mild anemia has a vital importance.

Severe anemia was found in 5.6% of the patients. Chronic anemia (29.4%) and malignancy (18.7%) were the most common diagnoses of patients with severe anemia. Half of the patients with severe anemia were between 2-5 years of age. The age interval between 2-5 years, which is also called preschool age is a period where anemia is seen more frequently due to the fast growth, dependency on adults

regarding nutrition and increased incidence of childhood cancers.

To sum up, anemia is a significant health problem during childhood. Collaboration between physicians and parents in the prevention and treatment of anemia is critical in protecting children from anemia, which is a reason of preventable mental retardation. The incidence of anemia in a reference centre in Black Sea region of Turkey is 8% among patients between 0.5-15 years of age.

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**Ethics Committee Approval:** Ondokuz Mayıs University Ethics Committee approval was obtained (2018/355 - 26.07.2018).

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