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INFANTILE IRON DEFICIENCY ANEMIA: RETROSPECTIVE EVALUATION OF ANEMIA IN 9-24 MONTH-OLD CHILDREN

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Abstract

Objective: Iron deficiency is the most common cause of anemia from the first 4 months to 2 years of life. In our country, iron supplementation has been provided free of charge by the Ministry of Health to children from 4 months of age. However, iron deficiency still remains a public health problem. This study aims to reveal the frequency of iron deficiency in children receiving iron support between 9-24 months of age.

Methods: This retrospective descriptive study was conducted by analyzing the data of a total of 107 children, including 59 boys and 48 girls in Türkiye. In addition to anthropometric measurements of the children under follow-up, screening tests such as complete blood count and ferritin levels required for the diagnosis of anemia were also included in the study. Patients with anemia in the 9th month were given iron at a treatment dose, and those without anemia were started on prophylactic dose medication. At the 24th month, the patients under follow-up were re-evaluated to control the development of iron deficiency anemia. Additionally, the demographic characteristics of the parents were also included in the study.

Results: At the controls performed after the first 4 months, the frequency of anemia due to iron deficiency was recorded as 42.6% in patients who had been given prophylaxis. At the control performed when the patients reached 2 years of age and iron intake was stopped after the first year, the frequency of anemia was 31%. Half of the patients who were found to be anemic at the age of 2 were also found to be anemic in the controls performed six months ago.

Conclusion: Iron deficiency anemia is the most common nutrition deficiency disease in childhood and can negatively affect the physical and mental development of children in the long term. Therefore, childhood iron deficiency anemia control programs should be implemented by health authorities, and parents should participate in these programs and ensure that their children receive regular check-ups and, if necessary, receive iron support. In addition, increasing the amount of iron in milk formulas or complementary foods instead of breast milk is an important factor in preventing iron deficiency anemia. Therefore, it is also crucial for parents to provide their children with a healthy and balanced diet. To prevent iron deficiency anemia, which continues to be a public health problem, awareness should be raised about nutrition deficiency and iron deficiency anemia through joint efforts of all stakeholders.

Keywords: Iron deficiency anemia, iron prophylaxis, iron deficiency treatment

1. Introduction

Iron deficiency anemia (IDA) is a prevalent type of anemia worldwide, especially among children aged 4-24 months. The prevalence of anemia is notably high, with rates of 46.8% in preschool children, 41.9% in pregnant women, and 30.3% in non-pregnant women.[1] Various factors contribute to the rapid depletion of iron stores, such as inadequate iron content in complementary foods, parasite infections, increased iron requirements due to rapid growth and erythropoiesis, and inadequate iron stores resulting from low birth weight or prematurity. IDA, when coupled with impaired structural and metabolic development of the central nervous system, can lead to irreversible cognitive development. Prevention and treatment of IDA should be adapted to local conditions, etiology, and prevalence.[2] The program raises awareness of iron deficiency, encourages exclusive breastfeeding for the first six months of life, introduces appropriate complementary foods at the end of the sixth month, and recommends breastfeeding until the age of two. Moreover, every baby aged 4-12 months receives prophylaxis for at least five months under this program. In conclusion, IDA is a prevalent type of anemia that can lead to irreversible cognitive development if not prevented or treated appropriately. The "Turkey Like Iron" program is an effective way to tackle dietary iron deficiency anemia and raise awareness of the importance of adequate iron intake. The objective of this study is to determine the incidence of iron deficiency anemia at month 9 in children attending the Healthy Child Follow-up Outpatient Clinic who were administered iron prophylaxis at month 4. The Ministry of Health's "Turkey Like Iron" program recommends initiating 10 mg/day of iron supplementation once daily for 5 months in term babies aged 4 to 12 months who do not exhibit palmar pallor. [3]It is further recommended to reassess the child for anemia at month 9 and continue administering the same dose of the drug for at least 5 months until the end of month 12 if no anemia is detected. In order to evaluate the effectiveness of the program and determine the prevalence of anemia in 12-23 month-old children, the General Directorate of Maternal-Child Health and Family Planning (MCHSP) of the Ministry of Health commissioned a scientific research group to prepare a research report on iron consumption in children aged 12-23 months. The study concluded that the "Turkey Like Iron" program was successfully implemented, resulting in a prevalence rate of 7.8% of anemia in 12-23 month-old children. Therefore, this study seeks to build upon these findings by examining the incidence of iron deficiency anemia at month 9 in children who have received iron prophylaxis as per the "Turkey Like Iron" program. By assessing the effectiveness of this intervention at an earlier time point, this study can provide further insights into the efficacy of the program and inform future recommendations for iron supplementation in children.

2. Material and Methods

Our study was designed to investigate the incidence of iron deficiency anemia in infants who received iron prophylaxis at four months of age and attended follow-up appointments at participating hospitals' outpatient clinics. The children were monitored regularly for anemia by undergoing routine blood tests, and were provided with appropriate nutritional counseling, with exclusive breastfeeding encouraged for the first six months of life. The study was retrospective and descriptive in nature, and excluded infants with growth retardation, chronic illnesses, and prematurity. The physical health of the infants was confirmed before administering prophylaxis at

four months, and the study received approval from an ethics committee. During the study, infants were administered a once-daily dose of 10mg of iron supplementation for five months, and in the ninth month, blood tests were conducted to determine levels of hemoglobin, hematocrit, mean red cell volume, red cell distribution width, iron, iron-binding capacity, and ferritin. Infants diagnosed with iron deficiency anemia were administered iron treatment at a dose of 3mg/kg/day for three months, if their hemoglobin was below 11.0 g/dL, ferritin was below 15µg/L, or their mean red cell volume was below 70 fL and their red cell distribution width was above 14.5%. The same dose of iron supplementation was continued for at least five months, until the end of month 12, for infants who did not develop anemia during the follow-up period. Prior to treatment, families were provided with information regarding potential side effects such as darkened stools, darkened teeth, diarrhea, constipation, restlessness, vomiting, and aversion to the taste of the drug. None of the participants in our study discontinued the iron supplement due to these possible effects. Hemoglobin, hematocrit (Htc), mean red cell volume (MCV), and red cell distribution width (RDW) were measured automatically using the ABX Petra120 device, following the collection of 2 ccs of venous blood into a K3 EDTA tube from children aged 9 to 24 months. Biochemical parameters, including iron, iron-binding capacity, and ferritin, were analyzed using original Roche Cobas 8000 Autoanalyzer kits from serum samples that were separated by centrifugation from blood collected in an apartment gel tube. For statistical analysis of the study data, the Number Cruncher Statistical System (NCSS) 2007 program from Kaysville, Utah, USA, was utilized. Descriptive statistical methods including mean, standard deviation, median, frequency, and ratio were employed. The paired-samples t-test was used for comparisons of parameters with normal distribution, whereas the Wilcoxon sign test was selected for comparing parameters without normal distribution. Correlations between differences were analyzed using Spearman correlation analysis. Results were analyzed at a 95% confidence interval, and statistical significance was set at $p < 0.05$.

3. Results

Among the study participants, 54 (56.2%) were male and 42 (43.8%) were female. The mean birth weight and length were found to be 3.31±0.44 kg and 49.91±2.19 cm, respectively. In the ninth month, the mean weight was 8.93±1.04 kg, while at the age of 2 years, it was 12.53±1.62 kg. The weight values at two years of age were significantly higher than those at the ninth month ($p < 0.01$). Regarding the maternal educational status, 24% (n=23) had attended elementary school, 14.6% (n=14) had attended secondary school, 18.8% (n=18) had attended high school, and 42.6% (n=41) had a college degree. Among fathers, 16.7% (n=16) had attended elementary school, 12.5% (n=12) had attended secondary school, 36.5% (n=35) had attended high school, and 34.3% '(n=33) had a college degree. The frequency of iron deficiency anemia (IDA) at the ninth month was observed in 44.8% of the study participants. Forty-three children diagnosed with iron deficiency anemia (IDA) received iron treatment for three months and discontinued after 12 months with blood count control. Fifty-three children without anemia received prophylaxis for an additional three months, and iron prophylaxis was discontinued at the age of one year. The prevalence of IDA was found to be 33% at two years of age. The hemoglobin (Hb), hematocrit (Htc), and mean red cell volume distribution width (DBK) values of the two-year-old children were significantly higher than those of the 9-month-old children (p:0.001; $p < 0.01$). However, no significant difference was observed between

the mean corpuscular volume (MCV) and iron levels at two years of age and those at 9 months of age (p:0.094; p > 0.05). The mean red cell distribution width (RDW) values of the children included in the study were 14.57±1.65 at 9 months of age and ranged from 12.3 to 20.1 percent. At 2 years of age, RDW values ranged from 11.1 to 18.6 and were 14.08±1.78. A statistically significant decrease was observed in RDW values at two years of age compared to those at 9 months of age (p:0.022; p < 0.05). Moreover, ferritin levels at two years of age were significantly lower than those at 9 months of age (p:0.001; p < 0.01). (Table 1).

Tablo 1. Comparing 9 months and 24 months results

		9 months		**24 months**	
	Min/Max	**Median±ss**	**Min/Max.**	**Median±ss**	**p**
Hb	8.9/13.4	11.14±0.92	10/14.2	-0.63±0.93	[a]0.001**
Htc	27.7/40.5	33.77±2.46	29.6/42	-1.72±2.63	[a]0.001**
MCV	63/87	77.76±4.56	63/86.2	-0.67±3.86	[a]0.094
RDW	12.3/20.1	14.57±1.65	11.1/18.6	0.49±2.07	[a]0.022*
İron	6/125	57.52±2.09	7/136	-5.12±36.07	[b]0.090
uıbc	124/430	271.70±57.5	155/423	-23.44±68.54	[a]0.001**
Ferritin	4.6/98.7	30.31±21.36	2.2/53.6	12.96±23.38	[b]0.001**

[a]Paired Samples Test, [b]Wilcoxon Rank Test

**p<0.05, **p<0.01*

Eighteen (56.3%) of the 32 cases found to be anemic at two years of age were also anemic at 9 months of age, and 14 (43.7%) became anemic while not anemic at 9 months of age. When the relationships between iron deficiency anemia at 9 months and 2 years of age were evaluated, no statistically significant relationship was found between the two groups (p=0.1104)

4. Discussion

The present study investigated the prevalence of iron deficiency anemia (IDA) in healthy children at 9 months and 24 months of age, and the relationship between anemia and various hematological parameters. The findings showed that the frequency of IDA was 44.8% after 9 months and decreased to 33% after 24 months.[4] Moreover, 56.3% of children with anemia at the age of two years had also been anemic at the ninth month. Notably, the Hb and Htc levels were significantly higher at 24 months than at 9 months, indicating a lower incidence of anemia at 24 months of age. On the other hand, the RDW value was significantly higher at month 9 compared with month 24, which supports the incidence of iron deficiency at month 9. Additionally, the ferritin value was significantly lower at month 24 than at month 9, which may reflect the success of iron prophylaxis in replenishing iron stores and the decline in iron stores due to increased iron requirements in children. A meta-analysis examining the benefits and safety of daily iron supplementation in children aged four to twenty-four months showed that iron supplementation decreased the incidence of IDA in this age group.[5] In Turkey, the Like Iron program aims to reduce the incidence of iron deficiency in children to 10%. Previous studies have emphasized the relationship between the educational level of mothers, iron intake, and IDA. Specifically, the incidence of anemia is higher in groups with low socioeconomic levels and low education. In this study, the mother's educational level was mostly college level, and the father's educational level was high school and college level, suggesting that the study was conducted at a high socioeconomic level.[6] Nevertheless, the reasons for the high incidence of anemia in this group of healthy children should be further investigated. The finding that 56.3% of children with anemia at two years of age had also been anemic at the 9th month highlights the importance of informing parents that iron deficiency may recur, and that children should be fed breast milk up to the age of two and beyond, and offered iron-rich foods as part of complementary feeding.[7] Overall, this study adds to the growing body of evidence supporting the use of iron prophylaxis in preventing IDA in children.

5. Conclusion

In conclusion, the findings of our study suggest that iron deficiency anemia remains a significant health concern for children from high socioeconomic status families who receive regular medical care at the Healthy Child Follow-up Outpatient Clinic. The high incidence of anemia observed in our study group, despite their favorable socioeconomic background, highlights the importance of continued monitoring and intervention for iron deficiency in children. Furthermore, our study highlights the potential usefulness of screening children with iron deficiency anemia at 9 months of age for iron deficiency at 24 months. This approach may help to identify children who are at risk of recurrent iron deficiency and may benefit from continued iron supplementation or dietary interventions. Future research should investigate the underlying factors contributing to the high incidence of iron deficiency anemia in this population, despite their favorable socioeconomic background. Additionally, efforts should be made to increase awareness and education among parents and caregivers about the importance of

adequate iron intake for children, particularly through breastfeeding and introduction of iron-rich foods as part of complementary feeding.

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CONFLİCT OF INTEREST

The authors declare no competing interest.

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