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Prevalence of Anemia among School-Age Children

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ABSTRACT

To determine the prevalence of micronutrient deficiency in school-age children. A total of 400 children, including 227 girls and 173 boys, were included in the study, which was completed by their parents on a purely voluntary basis and had a written consent form, which applied to the General Outpatient Clinic of Ibn Al Atheer Teaching Hospital in City of Mosul between January and September 2021. Blood was taken from the children included in the study to tubes suitable for full blood count, iron, ferritin, folate and vitamin B12 level. The tube with EDTA was used for the full blood count internal, and the flat tube without anticoagulants was used for other parameters. The lower limit of hemoglobin was 11.5 g/dl for the 6-12 age range, 12 g/dl for girls and 13 g/dl for boys for the 12-14 age range. The number of WBC was considered 5000-14500 cells/mm3 for6-8years and 4500-13500 cells/mm 3 for 8-14 years. The lower limit of ferritin was determined as 12 ng/dl and the lower limit of iron was 70 µg/dl. The lower value for Vitamin B_{12} is 200 pg/ml, vitamin B_{12} is set at 200-300 pg/ml, the lower value of folate is3 ng/ml, and the inadequacy limit for folate is 3-5 ng/ml. Anemia in 60.5% of the 392 children included in the study, anemia in 13.5%, IDA in 11.5%, Vitamin B_{12} deficiency was found in 33.4% and folate deficiency was found in 0.5%. Also, when vitamin B_{12} and folate deficiency are assessed, respectively It was found to be 33.9% and 7.1%. There was no statistically significant difference between the presence of iron deficiency and vitamin B_{12} levels ($p>0.05$). Folate levels were found to be incomplete and inadequate in 10.1% of those with iron deficiency and statistically significant difference was found ($p=0.037$). There was no statistically significant difference between vitamin B_{12} deficiency and folat levels ($p>0.05$). There was no statistically significant difference between the presence of ane. The education levels of mothers who have an important role in child nutrition and education should be raised.

1. INTRODUCTION

Micronutrient deficiency, contrary to popular belief, is a globalized public health problem not only in developing societies but also in developed industrialized societies. Iron deficiency (ID) is the most common micronutrient deficiency all over the world [1]. Since most of the iron in the body is used for hemoglobin (Hb) synthesis, the most common finding of ID is anemia [2], [3]. In addition to ID, anemia is also seen due to folate and vitamin B_{12} deficiencies that should be taken externally in societies with low socioeconomic

levels and cannot be synthesized in the body. The prevalence of vitamin B_{12} and folate studies are not as clear as ID [4- 7].

Iron, folate, vitamin B_{12} are responsible for the growth and differentiation of cells. Anemia is frequently seen in its deficiencies, and in addition, all other systems are affected. Due to anemia; complaints of palhality, weakness, rapid fatigue, in the gastrointestinal tract; vomiting, diarrhea, constipation, loss of appetite, due to the affection of the nervous system; inadequacy of neurocognitive functions, mental and motor activity [8], [9]. It is known that 20-30% of patients have neurological symptoms before anemia clinic occurs in vitamin B_{12} deficiency [10]. The evidence showing the negative effects of iron deficiency on neuromotor development, especially in children under 2 years of age, is unclear [11]. There have been studies showing that iron deficiency anemia (IDA) in school-age children affects the development of cognitive functions and impairs motor activity and school performance [12], [13]. Studies have been carried out on folic acid supplementation for pregnant women due to folate deficiencies increasing the risk of neural tube defects (NTD) [14], [15]. Folate treatment reduces the risk of NTD but does not eliminate it completely. Low serum vitamin B_{12} level is also a potential risk factor for NTD [16]. Micronutrients are important for the fulfillment of cellular functions due to the rapid growth and development in childhood. Our study therefore aimed to determine the prevalence of micronutrient deficiency in school-age children with a public health problem. We thought that our research could be a guide for prevalence, since the current studies do not include children in large age ranges such as 6-14 years of age and do not include ID, folate and vitamin B12 together.

2. MATERIAL AND METHOD

A total of 400 children, including 227 girls and 173 boys, were included in the study, which was completed by their parents on a purely voluntary basis and had a written consent form, which applied to the General Outpatient Clinic of Ibn Al Atheer Teaching Hospital in City of Mosul between January and September 2021. Approval was received from the hospital ethics committee. Those with chronic diseases, those who had constant drug use, those who used iron and vitamin B Complex in the last 6 months, those who had an infection that had been passed in the last two weeks, those whose white sphere value by age was not within the normal range were not included in the study. The questionnaire was filled out face-to-face with the parents of the children who participated in the study.

The questionnaire: A questionnaire asked about nutritional characteristics, socioeconomic status and clinical symptoms that would affect iron, vitamin B 12 and folate status was prepared. Anthropometric measurements of the children who participated in the study were made by the same person using the same measurement materials that were regularly calibrated for each child.

Blood was taken from the children included in the study to tubes suitable for full blood count, iron, ferritin, folate and vitamin B_{12} level. The tube with EDTA was used for the full blood count internal, and the flat tube without anticoagulants was used for other parameters. The lower limit of hemoglobin was 11.5 g/dl for the 6-12 age range, 12 g/dl for girls and 13 g/dl for boys for the 12-14 age range. The number of WBC was considered 5000-14500 cells/mm3 for6-8years and 4500-13500 cells/mm 3 for 8-14 years. The lower limit of ferritin was determined as 12 ng/dl and the lower limit of iron was 70 µg/dl (11). The lower value for Vitamin B_{12} is 200 pg/ml, vitamin B_{12} is set at 200-300 pg/ml, the lower value of folate is3 ng/ml, and the inadequacy limit for folate is 3-5 ng/ml (12,13).

2.1 Statistical Analysis

Statistical analyses of the study were carried out via SPSS 24.0 package program. Descriptive statistics of the categorical variables in the study were given with the values of frequency and percentage and continuous

variables with median, minimum and maximum values. Mann Whitney U test was used in 2 group comparisons of variables that did not show normal distribution, Kruskal-Wallis test was used in 3 group comparisons. Pearson Chi-square tests were used in cross-group comparisons of categorical variables. In all statistical analyses in the study, comparisons below p value 0.05 were considered statistically significant.

3. RESULTS

A total of 400 children aged 6-14 were included in the study. Girls accounted for 56.9% of all cases and boys accounted for 43.1%. The children who participated in the study gender, age groups and anthropometric measurements are presented in (Table-1).

Anemia in 60.5% of the 392 children included in the study, anemia in 13.5%, IDA in 11.5%, Vitamin B12 deficiency was found in 33.4% and folate deficiency was found in 0.5%. Also, when vitamin B12 and folate deficiency are assessed, respectively It was found to be 33.9% and 7.1%.

There was no statistically significant difference between the presence of iron deficiency and vitamin B12 levels (p>0.05). Folate levels were found to be incomplete and inadequate in 10.1% of those with iron deficiency and statistically significant difference was found (p=0.037). There was no statistically significant difference between vitamin B_{12} deficiency and folat levels (p>0.05).

There was no statistically significant difference between the presence of anemia and vitamin B12 and folate levels (p>0.05). Iron deficiency Anemia was found in 18.1% of 60.5% cases and IDA was found in 11.5%. There was a statistically significant relationship between anemia and ID (p=0.002).

When the cases were examined as 6-10 years old and 11-14 years old, there was no significant difference between the age groups in terms of ID and folate deficiency(p>0.05). Vitamin B_{12} deficiency was found to be higher in the 11-14 age range and was found to be statistically significant (p<0,001) (Table-2). Also, height and weight percentile There was no significant difference between those 50 and below and those over 50 in terms of iron, vitamin B_{12} and folate deficiency (p>0.05).

The level of parental education and occupations of the cases, monthly income, the settlement where they lived, the characteristics of their homes and the number of individuals in the house were questioned. There was no statistically significant relationship between socioeconomic status characteristics and iron and folate levels. There was a statistically significant relationship between the parents' education level and vitamin B12 (p <0,001 and 0.001, respectively). There was a statistically significant relationship between the monthly income level and vitamin B_{12} (p=0.002), and the decrease in vitamin B_{12} levels was statistically significant as the number of people in the household increased (p=0.038).

Cases were evaluated according to eating habits (milk, meat, dry pulses, eggs, tea, fish, green yaprmind vegetables). Vitamin B_{12} deficiency compared to red meat consumption; consumption is statistically significantly higher in those with lower consumption, vitamin B_{12} deficiency compared to those with excess(p=0.006). Statistically significant difference between green leafy vegetable consumption and folate deficiency and incidence of inadequacy (p=0.007). There was no statistically significant difference between other groups and eating habits. The symptoms of the cases were questioned. There was no statistically significant association between vitamin B_{12} and DE/non-paleness and fatigue (p>0.05) but a statistically significant association was found with folate deficiency (p=0.008). There wasa statistically significant difference in appetite loss and forgetfulness in iron deficiency/non-iron cases (p=0.046 and p=0.001, respectively). With headaches 20.9% maturity; Vitamin B 12 deficiency in$_{28.2\%,}$ It was also found in 24.9%.

This ratio was found to be statistically significant for vitamin B_{12} and DE (p values p=0.039 and p=0.017 respectively) (Table-3).

Table-1. Demographic characteristics of the patients who participated in the study.

Characteristic		n	%
Gender	**Female**	223	56,9
	Male	169	43,1
Age groups (year)	**6-10**	211	53,8
	11-14	181	46,2
Male	**50p and below**	159	40,6
	Over 50p	233	59,4
Female	**50p and below**	185	47,2
	Over 50p	207	52,8

Table-2. Iron deficiency vitamin B12 deficiency, folate deficiency prevalence by age and gender.

		Iron deficiency	**p**	**Vitamin B12 deficiency**	**p**	**Folate deficiency**	**p**
Gender	Female	132 (%59,2)	>0,05	71 (%31,8)	>0,05	1 (%0,4)	>0,05
	Male	105 (%62,1)		60 (%33,5)		1 (%0,6)	
Age (year)	6-10	132 (%62,6)	>0,05	52 (%24,6)	**<0,001**	1 (%0,5)	>0,05
	11-14	105 (%58)		79 (%43,6)		1 (%0,6)	

Table-3. Association of clinical symptoms of cases with iron, vitamin B12 and folate deficiency.

	Those with iron deficiency N (%)	**Those who lack** Vitamin B**12 N (%)**	**Those with folate deficiency and inadequacy N (%)**
Tooth decay	90 (%38)	37(%28,2)	11(%36,7)
Lack of appetite	67(%28,3) *	28(%21,4)	9(%30)
Forgetfulness	69(%29,1) *	34(%26)	6(%20)
Paleness, weakness	56(%23,6)	32(%24,4)	13(%43,3) *
Headache	59(%24,9) *	37(%28,2) *	9(%30)
Weight loss, difficulty gaining weight	47(%19,9)	16(%12,2)	7 (%23,3)
Wound in the mouth, aft	36(%15,2)	21(%16)	5(%16,7)
Hair breakage	29(%12,2)	18(%13,7)	2(%6,7)
Nail disorder	33(%13,9)*	14(%10,7)	4(%13,3)
History of parasites	25(%10,5)	16(%12,2)	6(%20)
Gastrointestinal problems	23(%9,7)	9(%6,9)	5(%16,7)
Psychiatric problems	25(%10,5)*	8(%6,1)	3(%10)
Deformity	13(%5,5)	7(5,3)	3(%10)

Tremors in the hands	10(%4,2)	9(%6,9)	3(%10)
Pika story	7(%3)	4(%3,1)	3(%10)*

* the difference between those with and without deficiencies is p<0.05

4. Discussion

Iron is the most common micronutrient deficiency in the world. According to the World Health Organization (WHO), it is known that ID affects 1 billion people in the world and 1 billion people have IDA [17]. In developing countries, 40-50% of children under 5 years old, 48% of children 5-14 years old, and 42% of pregnant women have anemia. According to WHO, the prevalence of anemia is considered mild between 5-19%, moderate to 20-39%, and > 40% as a severe public health problem [18]. In the studies conducted for the childhood age group in our country, DEA was reported between15.2% and 62.5% (15). In a study was conducted in Baghdad City found that About 91% had iron deficiency anemia of which 40% had mild anemia (mean Hb=9.7 g/dL), 40% had moderate anemia (mean Hb=8.3 g/dL) while 20% had severe anemia (mean Hgb=6.5 g/dL). About 45% had iron-folic acid tablet once a day. Most of those females had tea with breakfast or after meals. For dietary pattern, there was a poor intake of meat; less than half had an average intake of milk products, and most of them had rice & bread daily. There was a poor intake of vegetables, fresh & dry fruits. [19] Another study was conducted in Kurdistan region of Iraq was found that iron deficiency was noted in 51.9% and 48.1% according to serum iron and transferrin saturation respectively. Male have more risk to have lower TS<16% as compared with female (OR 0.400, 95% CI 0.182-0.879) Age and tea ingestion were significant independent predictor of iron deficiency, family income associated significantly with low serum iron while pica, frequency of meat ingestion, number of sibling and weight percentile have non-significant relation with neither low serum iron nor low transferrin saturation [20]. Additionally, “a cross-sectional study carried out in the Children’s Teaching Hospital Laboratory Department in Karbala, Iraq, from 1 July 2019 until 1 September 2019. The prevalence of anemia among children aged 0–14 years in Karbala was 9.9%. There was no significant relationship between the type of anemia diagnosed and age or sex. However, there was a significantly positive relationship between the type of anemia diagnosed and each ferritin level, mean corpuscular volume, and mean corpuscular hemoglobin (p<0.0001). The study participant skull diameter and length in relation to sex were compared to the WHO reference values for child growth standards, and the study values were less than the normal range for children below 5 years of age” [21]. In Turkey, [22] in their study involving a total of 500 healthy children between the ages of 1 and 16 with low socioeconomic levels in Bursa; ID 12%, IDA 7.4% he's found it. In the study of 848 children between the ages of 7 and 11 in Manisa between 2004 and 2005; ID was 24.7% and IDA 1.4% (18). [23] Found de prevalence by 28.5% and DEA prevalence by 9.4% in 403 healthy children between the ages of 7 and 14 in Samsun.

In Basra City, a study amid to identify potential risk factors for IDA among the study community and to assess the prevalence of Iron Deficiency Anemia (IDA) among children in Al-Madinah district. The results showed that 20% of the children had IDA (70% male and 30% female). The highest prevalence of iron-deficiency anemia was at the age of 9 to 23 months. Also, the study showed that residence in rural areas is among the most important risk factors for developing an IDA. In conclusion, this study concluded that 20% of them in the study sample suffer from IDA, which greatly affects children’s development. Regarding risk factors, ages 9 to 30 months are most susceptible to IDA, and HG. And ages 60 to 71 months are most susceptible to Serum ferritin deficiency, residence in rural areas is an important factor in raising the rate of iron deficiency anemia [24].

In our study, vitamin B deficiency between the ages of 6 and $_{10}$ was 24.6% compared to 11- It was found to be 79% among 14-year-olds and considered statistically significant (p<0,001). Vitamin B_{12} deficiency is more common in the Adelson group due to increased irregular and unbalanced eating habits with age. When the

causes of micro nuance deficiencies are investigated, it is often mentioned in bad socioeconomic conditions. In our survey, we questioned the income status of the family, the educational status of the parents, the profession and the number of people living at home in order to determine the etiology. In our study, de and folate deficiency and the educational status of your parents and statistically significant relationship with their profession were not determined ($p>0.05$). However, as the level of education of parents increased, it was observed that the incidence of vitamin B_{12} deficiency decreased. The statistically significant difference we found in our study is similar to the conclusions of [25], [26]. In our study, the incidence of vitamin B_{12} deficiency decreased as income level increased and this difference was statistically significant ($p=0.02$). This difference is thought to be due to the fact that the variety of children's meals is associated with accessibility to food. Vitamin B_{12} deficiency was 33.4% (n=131) in our study. There was a statistically significant relationship between red meat consumption and vitamin B_{12} ($p=0.06$) and decreased vitamin B_{12} deficiency as red meat consumption increased [27]. In vegetarian children, they also found vitamin B_{12} deficiency compared to children who also fed meat and emphasized the importance of nutrition. In a study conducted in Karachi, Pakistan, low levels of vitamin B_{12} were statistically significant in young vegetarians and neurological problems were more common in this group [28]. It is thought that the amount and frequency of nutrients when consuming them, as well as where they are obtained and the way they are prepared, are extremely important. In our study, 31.6% of DE people had vitamin B_{12}and10.1% had folate deficiency and deficiency. Although this difference is not statistically significant, the high vitamin B_{12} and folate deficiency indicates the flatness of eating habits. Serum iron was normal and low, compared to the average Hb level, and Hb levels were lower in those with low serum iron. However, there was no statistically significant corral between HB level and vitamin B_{12} level. However, when clinicians notice the symptoms of vitamin B_{12} deficiency, patients should look at vitamin B_{12} levels, even if they do not have anemia [29]. They emphasized that neurological findings can be seen without megaloblastic anemia and neurological symptoms may be more severe in patients with vitamin B_{12} and folate deficiency.

5. Conclusion

The education levels of mothers who have an important role in child nutrition and education should be raised. We It is the duty of physicians to recognize deficiencies without clinical symptoms, to make regular anthropometric measurements in patients who apply to the clinic, to question the nutritional history in follow-up. Nutritional elements should be given importance, especially when the effect on neurocognitive functions in children is considered. It is a fact that the cost spent in terms of recognition of iron, vitamin B_{12} and folate deficiencies is lower than the cost spent on treatment.

Conflict of interest: There is no conflict of interest between authors.

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