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ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2023;12(2):458-61

Serum vitamin B12 levels in children applying to pediatrics outpatient clinics by age and gender

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Received 06 March 2023; Accepted 04 May 2023
Available online 08.05.2023 with doi: 10.5455/medscience.2023.03.033

Abstract

The aim of this study is to assess the prevalence of vitamin B12 insufficiency in children applying to pediatric outpatient clinics according to gender and age groups. The study included kids aged 0 to 18 whose blood vitamin B12 levels were assessed in pediatric outpatient clinics. Serum vitamin B12 levels of children were measured by hospital automation and values below 200 pg/mL were considered insufficient, values above 200–300 pg/mL were considered normal, and values above 300 pg/mL were considered normal. 6707 children's data were examined. The gender split among the kids was 54.9% female and 45.1% male. The age was 6.8±5.2 years on average. For women, the median level was 341.5 pg/mL while for males, it was 349.8 pg/mL. Patients aged 0 to 6 years had a median level of vitamin B12 (n=3108) of 392.9 pg/mL. Between the ages of 7 and 12, the median level of vitamin B12 was found to be 339.1 pg/mL (n=2271). Among patients aged 13 to 18 years, the median level of vitamin B12 (n=1328) was found to be 284.6 pg/mL. According to age groups, vitamin B12 insufficiency occurred less often. The age group of 13 to 18 years old had the greatest prevalence of blood vitamin B12 deficiency, at 19.4%. Children who applied to pediatric outpatient clinics' blood vitamin B12 levels were examined in this study, and results were broken down by age and gender. It was revealed that deficiencies were more prevalent, particularly in adolescence. Also, it was shown that women require more vitamin B12 than men do.

Keywords: B12, child, age, gender

Introduction

Cobalamin, often known as vitamin B12, is a water-soluble vitamin founding in foods including dairy, eggs, and red meat. The synthesis of nucleic acids and proteins, in addition to the metabolism of carbohydrates and lipids, mitochondrial processes, erythroid serial development, and myelination of nerve fibers, are all significantly influenced by vitamin B12. A glycoprotein called intrinsic factor, produced by parietal cells in the stomach, is necessary to B12 absorption in the terminal ileum. After absorption, B12 is utilized as a cofactor by enzymes that create DNA, fatty acids, and myelin [1-3]. While vitamin B12 deficiency's the most common cause is malabsorption in developed countries, inadequate dietary intake of vitamin B12 is due to socioeconomic reasons in developing countries. Today, due to changes in lifestyle and eating habits, it has become a global problem and has become a common problem in children and young adults [4]. Since vitamin B12 is important to cellular division and growth, its deficiency or prolonged borderline deficiencies can have adverse effects on physical growth and development of the nervous system in children. Vitamin B12 deficiency mostly causes anemia in children and complete recovery is observed with treatment [5]. However, since vitamin B12 has an important role in the development of the nervous system, its long-term deficiency is known to cause permanent neurological damage [6]. Briefly, Vitamin B12 deficiency is a common cause of macrocytic anemia and has been associated with a number of neuropsychiatric disorders [7]. For this reason,

CITATION
Tahiroglu V. Serum vitamin B12 levels in children applying to pediatrics outpatient clinics by age and gender. Med Science. 2023;12(2):458-61.

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DOI: 10.5455/medscience.2023.03.033

early detection and early treatment of deficiency is extremely important especially for children in rapid growth periods such as infancy and adolescence. As B12 deficiency is a preventable cause of neurological morbidity, it becomes critical to determine the prevalence of B12 deficiency and to reveal the risk factors, especially in children in developing countries. Especially determining risky periods according to gender and age groups and taking measures accordingly will eliminate the negative effects of deficiency in children. In this study, it was aimed to evaluate vitamin B12 in children who applied to pediatric outpatient clinics according to gender and age groups.

Material and Methods

The study was retrospectively and descriptively designed by accessing the laboratory records of the outpatients who applied to Şırnak State Hospital Pediatrics and Pediatrics Polyclinics between 11/2021 and 11/2022. Ethics Committee approval (28.11.2022-53114) was obtained at a state university to conduct the study and access laboratory records. Children between the ages of 0 and 18 who applied to pediatric outpatient clinics were included in the study. Age groups were divided into 3 groups (0-6, 7-12, 13-18) according to their level of development. Post-treatment vitamin B12 levels of those who received vitamin B12 treatment, and vitamin B12 data of those followed in sub-branch outpatient clinics and those with any chronic disease were not included in the study. Serum vitamin B12 levels were analyzed using the electrochemiluminescence method, with Cobas 601 immunoassay analyzers (Roche Diagnostics). A serum vitamin B12 level of <200 pg/mL was accepted as deficiency, between 200-300 pg/mL was considered the limit value, and >300 was considered normal [8].

Statistical analysis

The statistical analysis was performed using the SPSS 21.0 package program (SPSS, Version 21.0. Armonk, NY: IBM USA). The Kolmogorov-Smirnov test was used to determine if the data were in accordance with a normal distribution. Due to the fact that it did not fit the normal distribution, non-parametric tests were used. To ascertain whether there was a gender difference in children's Vitamin B12 levels, the Mann-Whitney test was employed. The significance of the difference in mean ages was assessed using the Kruskal Wallis test. Chi-square analysis was employed to determine group differences. In descriptive statistics, frequency distributions, numbers, medians, minimum and maximum values were provided. A value of P<0.05 was considered significant.

Results

Descriptive statistics, chi-square, median, minunum and maximum values were given in tables by dividing the patients who came to the Şırnak state hospital into groups according to their age and gender. The demographic information of the patients and the median levels of vitamin B12 levels are given in Table 1. Considering the gender of the patients; It is seen that this study consisted of 3682 female and 3025 male. When the median vitamin B12 level of the patients was evaluated as a total, it was found 341.5 pg/mL in female and 349.8 pg/mL in male. Vitamin B12 levels were found statistically p>0.05 in female compared to male (Table 1).

Table 1. Median levels of vitamin B12 (pg/mL) by gender of the patients

Gender	n (%)	Median	Min-Max	p
Female	3682 (54.9)	341.5	50.2-1983	P>0.05
Male	3025 (45.1)	349.8	50-1781	

Data are given as median and minimum-maximum

The levels of vitamin B12 deficiency according to the gender of the patients are given in Table 2. 10.8% of the female and 9.6% of the male were found to be 200 pg/mL deficient. 26.1% of female and 27.2% of male were seen as borderline 200-300 pg/mL. 63.1% of the female and 63.3% of the male were found to be at a normal level and statistically p>0.05 was found (Table 2).

Table 2. Serum vitamin B12 levels of the patients by gender

	Female n:3682	Male n:3025	Total n:6707	p
Group 1	396 (10.8)	289 (9.6)	685 (10.2)	
Group 2	961 (26.1)	822 (27.2)	1783 (26.6)	P>0.05
Group 3	2325 (63.1)	1914 (63.3)	4239 (63.2)	

Group 1: <200 (pg/ mL) deficiency, Group 2: 200-300 (pg/ mL) limit, Group 3: >300 (pg/ mL) normal

The mean age of the patients was 6.8±5.2. The median levels of vitamin B12 according to the age of the patients are given in Table 3. The median level of vitamin B12 (n=3108) was found to be 392.9 pg/mL in patients aged 0-6 years. The median vitamin B12 level (n=2271) between the ages of 7 and 12 was found to be 339.1 pg/mL. The median level of vitamin B12 (n=1328) was found to be 284.6 pg/mL in patients aged 13-18 years. As a variable of age, the p value was found to be statistically significant (p<0.05) as a result of regression analysis. It can be said that the median levels of vitamin B12 value change with increasing age (Table 3).

Table 3. Median serum vitamin B12 (pg/mL) levels by age groups of patients

Age Group	n (%)	Median	Min-Max	p
Group 1	3108 (46.3)	392.9	50-1898	Group 1-2, p<0.01
Group 2	2271 (33.9)	339.1	50-1983	Group 1-3, p<0.01
Group 3	1328 (19.8)	284.6	50-1814	Group 2-3, p<0.01

Data are given as median and minimum-maximum
Group 1: 0-6 years, Group 2: 7-12 years, Group 3: 13-18 years

The levels of vitamin B12 deficiency according to the age groups of the patients are given in Table 4. It was determined that 7.8% of children aged 0-6 years, 8.2% of children aged 7-12 years, and 19.4% of children aged 13-18 years were below 200 pg/mL. In addition, 20.6% of the 0-6 age group, 29% of the 7-12 age group, and 36.4% of the 13-18 age group were found to be at the limit of 200-300 pg/mL, and statistically significant p<0.01 found (Table 4).

Table 4. Serum vitamin B12 levels according to age groups of patients

Age Group	0-6 age n:3108	7-12 age n:2271	13-18 age n:1328	Total n:6707	p
Group 1	241 (7.8)	186 (8.2)	258 (19.4)	685 (10.2)	
Group 2	641 (20.6)	659 (29)	483 (36.4)	1783 (26.6)	P<0.01
Group 3	2226 (71.6)	1426 (62.8)	587 (44.2)	4239 (63.2)	

Group 1: <200 (pg/ mL)) deficiency, Group 2: 200-300 (pg/ mL) limit, Group 3: >300 (pg/ mL) normal

DOI: 10.5455/medscience.2023.03.033

Discussion

Vitamin B12 deficiency is an essential health problem all over the world, especially in people of European or African descent [9]. Untreated vitamin B12 deficiency in infants is known to cause growth retardation. In addition, it has been reported that the demand for B12 is high during childhood and adolescence and that vitamin B12 undergoes significant changes during rapid growth periods [10,11]. This study found that the overall prevalence of serum vitamin B12 deficiency in children was 10.2% in all age groups. Nearly one in five children had borderline serum vitamin B12 levels. In addition, according to the study, it is noteworthy that serum vitamin B12 deficiency, especially with increasing age, decreases in vitamin B12 levels. Many studies define B12 below 200 pg/ml as deficiency [12,13]. In this study, vitamin B12 levels of patients admitted to Şırnak State Hospital were retrospectively analyzed. In this study, vitamin B12 levels of patients admitted to Şırnak State Hospital were retrospectively analyzed. The median vitamin B12 value of women was found to be lower than that of men (Table 1). In addition, vitamin B12 deficiency was found to be higher in women than in men (Table 2). In a study conducted by Varkal, it is reported that vitamin B12 deficiency is 3% in female and 5.2% in male. Again in the same study, it is reported that 17.9% of female are borderline and 18.9% of male [4]. In our study, we found that B12 deficiency was 10.8% in female and 9.6% in male. In our study, female were found to have more deficiency than male. We think that this may be due to the patient population. Kerr et al. In a study conducted between the ages of 4-18, they reported that they found the median value of 480 pg/ml [14]. In our study, we found a median value of 392.9 pg/ml in the 0-6 age group, 339.1 pg/ml in the 7-12 age group, and 284.6 pg/ml in the 13-18 age group (Table 3). The reason for this decrease in our study may be the age range and dietary B12 deficiency. In a study of 6910 children aged 5-12 years in Colombia, B12 deficiency was found to be 2.8% (<200 pg/ml) [15]. In a study conducted in Venezuela between the ages of 0-7, B12 deficiency was found to be 11.4% (<200 pg/ml) [16]. In a study conducted in Turkey, it was reported that 23.3% of 404 children aged 1-5 years had B12 deficiency (<200 pg/ml) [17]. B12 deficiency (<200 pg/ml) was observed in 39.8% of 211 children aged 6-12 months in Turkey [18]. In our study, we found B12 deficiency to be 7.8% in the 0-6 age group, 8.2% in the 7-12 age group, and 19.4% in the 13-18 age group in the province of Şırnak, located in the east of Turkey. We found a total of 10.2% (<200 pg/ml) B12 deficiency in children aged 0-18 years (Table 4). As can be seen, it shows that B12 deficiency has different results from country to country, even in the same country. This may be due to various factors such as the development level of countries, socioeconomic conditions, and age.

Limitations of the study

It is not known whether children are breastfed or formula fed in their early years. In addition, the indefinite delay time between blood collection and analysis are all disadvantages, as our study was a retrospective design. If the prospective study method had been used, different results could have been obtained.

Conclusion

Vitamin B12 is a vitamin having an active role in growth, development and neurological processes in children. Therefore, children are very susceptible to vitamin B12 deficiency. In this study, a more pronounced serum vitamin B12 deficiency was observed in children of certain age groups.It is observed that the deficiency is especially high during adolescence. The results are important for identifying the risky group and taking precautions. In addition, according to our study, it was determined that women's need for vitamin B12 is higher than men. Multicenter prospective studies are required in this regard to ascertain the prevalence and root causes of insufficiency across a larger geographic area.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
Ethics Committee approval (28.11.2022-53114) was obtained at a state university to conduct the study and access laboratory records.

References

1. O'Leary F, Samman S. Vitamin B12 in health and disease. Nutrients. 2010;2:299-316.
2. Ankar A, Kumar A. Vitamin B12 Deficiency. 2022 Oct 22. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan–. PMID: 28722952.
3. Carmel R. Mild transcobalamin I (haptocorrin) deficiency and low serum cobalamin concentrations. Clin Chem. 2003;49:1367-74.
4. Varkal MA. Vitamin B12 deficiency in general pediatric outpatient cases. J Child. 2022;22:15-20.
5. Stabler SP. Clinical practice. Vitamin B12 deficiency. N Engl J Med. 2013;368:149-60.
6. Demir N, Koc A, Ustyol L, et al. Clinical and neurological findings of severe vitamin B12 deficiency in infancy and importance of early diagnosis and treatment. J Paediatr Child Health. 2013;49:820-4.
7. Oh R, Brown DL. Vitamin B12 deficiency. Am Fam Physician. 2003;67:979-86.
8. Allen LH. How common is vitamin B12 deficiency? Am J Clin Nutr. 2009;89:693-6.
9. Stabler SP, Allen RH. Vitamin B12 deficiency as a worldwide problem. Annu Rev Nutr. 2004;24:299-326.
10. Tangeraas T, Ljungblad UW, Lutvica E, et al. Vitamin B12 deficiency (un-)detected using newborn screening in norway. Int J Neonatal Screen. 2023;9:3.
11. Green R, Allen LH, Bjørke-Monsen AL, et al. Vitamin B12 deficiency. Nat Rev Dis Primers. 2017;3:17040.
12. Allen LH, Rosenberg IH, Oakley GP, et al. Considering the case for vitamin B12 fortification of flour. Food Nutr Bull. 2010;31:36-46.
13. Langan RC, Zawistoski KJ. Update on vitamin B12 deficiency. Am Fam Physician. 2011;83:1425–30.

DOI: 10.5455/medscience.2023.03.033

14. Kerr MA, Livingstone B, Bates CJ, et al. Folate, related B vitamins, and homocysteine in childhood and adolescence: potential implications for disease risk in later life. Pediatrics [Internet]. 2009;123:627-35.

15. Ramírez-Vélez R, Correa-Bautista JE, Martínez-Torres J, et al. Vitamin B12 concentration and its association with sociodemographic factors in colombian children: findings from the 2010 national nutrition survey. Nutrition. 2016;32:255-9.

16. García-Casal MN, Osorio C, Landaeta M, et al. High prevalence of folic acid and vitamin B12 deficiencies in infants, children, adolescents and pregnant women in Venezuela. Eur J Clin Nutr. 2005;59:1064-70.

17. Aydogdu Colak A, Anli M, Toprak B, et al. B12 vitamin level in children and its relationship with complete blood count parameters. J Dr Behcet Uz Child Hosp. 2013;2:75-9.

18. Ertaş T, Koç A, Koçyiğit A, et al. The effects of vitamin B12 deficiency on the neuro-motor, social and physical development of infants. JChild Health Dis. 2011;54:62-9.