

Original research article

A Study of Serum Ferritin Level in Vitamin B12 Deficiency: A Cross-sectional Study

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Abstract

Background: Vitamin B12 deficiency is common and clinical manifestations are hematologic and neurological symptoms. Ferritin plays an important role in the storage of intracellular iron. Studies have documented serum ferritin and vitamin B12 deficiencies to be the major causes of nutritional anemia.

Objectives: To find out and correlate the levels of serum ferritin in vitamin B12 deficiency cases as compared to normal control group

Materials and Methods: A cross sectional study was carried out in Civil Hospital Ahmedabad from August 2017 to January 2018. A total of 120 subjects matched for age (16 to 60 years) and sex were included in this study (60 Vitamin B12 deficient and 60 normal control). Serum ferritin level was assessed in both case and control groups. Data was analyzed using appropriate statistical parameter and significance was considered when $p < 0.05$.

Results: Mean age of the cases involved in this study was 36.15 ± 13.49 years and majority of the cases (46.7%) were belongs to age group of 16-30 years. The mean serum ferritin level in cases (66.7 ± 76.7 pg/ml) was significantly lower than in normal controls (111.45 ± 79.46 pg/ml) (P value < 0.05). The ferritin deficiency in male is not highly significant as seen in females (P value < 0.05).

Conclusion: The data shows that in vitamin B12 deficiency there is a correlated Ferritin deficiency seen both in males and females. It can be concluded that in patients of vitamin B12 deficiency it is advisable to check for Serum Ferritin levels also.

Keywords: Nutritional deficiencies, Serum Ferritin, Vitamin B12

Introduction

Vitamin B12 is essential for the synthesis of sadenosyl methionine and for the metabolism of proteins, phospholipids, and neurotransmitters. Multiple neurological disorders result from its deficiency, and it affects all age groups.[1] Despite the fact that the human body can store vitamin B12 for up to five years, its deficiency is fairly common.

Cobalamin deficiency typically manifests as hematologic and neurological symptoms, even though early symptoms of vitamin B12 deficiency are nonspecific. While it is easy to detect the associated hematologic changes, they often appear later in the condition or are not present at all.[2] The diagnosis is usually based on an abnormally low serum vitamin B12 level or megaloblastic bone marrow or both.[3][4] To date, a universally accepted normal range for vitamin B12 has not been established and the prevalence of B12 deficiency in the general population is unknown.[5][6] Around 3–40% of the adult population is thought to be affected, depending upon the diagnostic criteria.[7]

An insufficient intake of vitamin B12 or malabsorption of the vitamin can result in a deficiency. Vegetarians often have inadequate intake of vitamin B12 and some gastrointestinal conditions cause patients to have malabsorption of vitamin B12.[8] Typically, these conditions are related to decreased or absent gastric intrinsic factor, hypo- and achlorhydria, as seen in patients with destroyed gastric mucosa, either caused by an autoimmune response or by gastric atrophy.[9] Furthermore, a recent study suggests that iron deficiency precedes vitamin B12 deficiency in these cases, and impaired iron absorption is one likely consequence.[10]

It is believed that ferritin plays a vital role in storing iron in cells. Ferritin serves as an iron carrier, supplying iron to cells. Low ferritin levels are indicative of low iron stores in the body. The main causes of nutritional anemia are low serum ferritin and vitamin B12 deficiency.[11] Unfortunately, screening and prevention of iron deficiency are commonly neglected, and clinicians need to be aware of coexisting conditions, specifically iron deficiency.[12] We carried out this study to correlate the levels of serum ferritin in vitamin B12 deficiency.

Materials and Methods

A cross-sectional study was conducted in the Department of Biochemistry of a Tertiary care centre in Gujarat over a period of 6 months from August 2017 to January 2018. A total of 120 subjects registered at Civil hospital, Ahmedabad (60 Vitamin B12 deficient as case and 60 normal as control) were enrolled in the study after informed consent. Data on vitamin B12 level, age and sex was collected. Patients between 16 to 60 years' age group and having serum vitamin b12 level <206 pg/ml were selected as study group. Patients having normal serum vitamin B12 level (206-678 pg/ml)^[11] were selected for control group. The subjects who had history of pernicious anemia, gastrectomy, resection of small bowel malabsorption or recent acute blood loss, and taking vitamin supplements were excluded from the study.

Serum ferritin level was assessed in both case and control groups. Method of testing for serum ferritin is Chemiluminescent Microparticle Immunoassay (CMIA). Normal serum ferritin level is 20-250 pg/ml in male and 10-120 pg/ml in females.[11] The data obtained was entered in an Excel sheet and analyzed using SPSS software, version 20.0. Descriptive statistics were obtained for all variables. Student's t test was applied to find the comparison of serum Vitamin B12 and Ferritin levels between case and control groups. Significance was considered when $p < 0.05$ and interpretations were established accordingly.

Results

Mean age of the cases involved in this study was 36.15 ± 13.49 years. (35.76 ± 12.73 years for males and 36.37 ± 14.67 years for females). Both case and control groups were sex matched with 30 males and 30 females in each groups. Majority of the cases (46.7%) were belongs to age group of 16-30 years. Most of the cases were among 16-30 years' age group (53.3%) and 31-45 years' age group in male. (Figure 1)

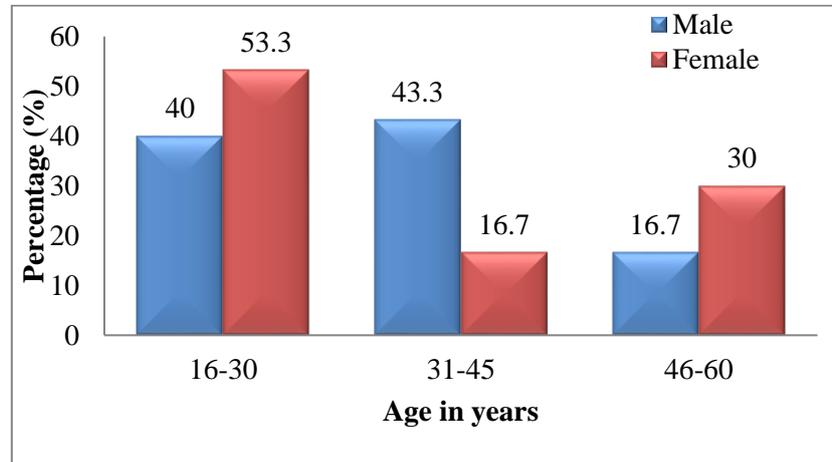


Figure 1: Age group and gender wise distribution of Vitamin B12 deficiency

The mean value of serum Vitamin B12 was significantly higher in cases compared to control. The mean serum ferritin level in vitamin B12 cases was lower than in controls and the difference is statistically significant. ($P < 0.05$) (Table 1)

Table 1: Correlation of serum Vitamin B12 and Ferritin levels of case and control groups

N = 120	Vitamin B12 (pg/ml) Mean \pm SD	Ferritin (pg/ml) Mean \pm SD
Cases	110.78 \pm 50.06	66.70 \pm 76.74
Control	371.33 \pm 143.51	111.45 \pm 79.46
P value	<0.0001	0.03

In males, the mean serum ferritin level in cases was significantly lower than in normal controls. (P value < 0.05). In females, the mean serum ferritin level in cases was lower than in normal controls and the difference was statistically significant. (P value < 0.001) (Table 2)

Table 2: Correlation of serum Ferritin levels of case and control groups in both gender

Gender	Ferritin (pg/ml) Mean \pm SD		P value
	Cases	Control	
Male (N = 60)	98.25 \pm 49.20	127.10 \pm 47.23	0.0241
Female (N = 60)	25.14 \pm 20.79	85.88 \pm 69.95	<0.0001

Discussion

A lack of vitamin B12 or folate impairs DNA synthesis, impairs purine and thymidylate synthesis, and causes erythroblast apoptosis, which results in anaemia caused by ineffective erythropoiesis. Erythroblasts require large amounts of iron for haemoglobin synthesis.[13] Patients with iron and cobalamin deficiencies can be encountered together for a variety of reasons.[9][10][12] The diagnosis of iron deficiency is complicated by cobalamin deficiency. Iron deficiency is a prevalent consequence in individuals with long-term pernicious anaemia, according to Atrah and Davidson^[10], and its diagnosis and treatment are frequently overlooked. Iron deficiency is frequent in individuals with pernicious anaemia, according to Demiroglu and Dundar.[14]

The storage form is ferritin, seen in liver, spleen, intestinal mucosal cells, and bone marrow. Ferritin contains about 23% iron. In iron overload, ferritin levels in the blood are increased. As a result, ferritin levels in the blood serve as a measure of bodily iron reserves. Ferritin levels should be measured to determine the severity of anaemia. Ferritin is created to store iron when iron levels are high, but TfR synthesis is prevented. Ferritin content is lowered in iron deficient anaemia. Iron deficiency is indicated by a ferritin level of less than 100 micrograms per deciliter.[11]

Paudel et al. discovered no significant differences in vitamin B12 levels among age groups, however it was more common in the elderly (55 %).[15] Although the ferritin deficiency in male is not highly significant as seen in females. This could be attributed to the lower stores in females due to physiological loss. This could be due to females having smaller reserves because of physiological loss. In the Al Zoubi MS et al study, roughly 25% of the participants had low ferritin levels, with males having a greater prevalence.[16]

The mean serum ferritin level in vitamin B12 cases was significantly lower than in controls in current study. According to Soner Solmaz et al^[8], serum UIBC, and ferritin levels may be useful for diagnosing an iron deficiency in patients with a combined deficiency, but they did not uncover a significant indicator that might help differentiate between a pure cobalamin deficiency and a combination deficiency.

J. Metz et al. described how vitamin B12 deficiency can coexist with iron shortage, and that, based on the available information, vitamin B12 deficiency contributes insignificantly to the global burden of anaemia.[17] Because serum ferritin levels are positively correlated with body iron reserves, it is increasingly used as a diagnostic tool for determining the physiological condition of iron storage.^[16] Serum ferritin is most commonly used in the diagnosis and treatment of patients with iron deficiency and iron overload.

Conclusion

The data shows that in vitamin B12 deficient cases established correlation with ferritin deficiency is seen in both male and female. It is advisable to check for serum ferritin level in vitamin B12 deficiency cases and also provide treatment for both the deficiencies.

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