

ORIGINAL ARTICLE

Comparison Of Vitamin B12 Level Among Vegetarian And Non Vegetarian Apparently Healthy Individuals In District Tharparkar

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ABSTRACT

Objective: Subjects adopting a vegetarian diet are liable to vitamin B12 deficiency. The current work was undertaken to investigate vitamin B12 status in apparently healthy vegetarians in Mithi, district Tharparkar, Sindh.

Subjects and methods: This cross sectional study was conducted in the department of Biochemistry, BMSI, JPMC Karachi and blood samples were collected from Mithi district Tharparkar, Sindh, during the period of February 2012 to June 2012. One hundred vegetarian (74 males and 26 females) and one hundred non-vegetarians (72 males and 28 females), age ranging from 20-40 years were enrolled for this study. Hemoglobin concentration, mean corpuscular volume and serum vitamin B12 levels were measured, using conventional methods.

Results: Mean serum vitamin B12 level and mean hemoglobin concentration were significantly lower ($p < 0.001$) while mean corpuscular volume (MCV) was significantly higher ($p < 0.001$) in vegetarian as compared to non-vegetarian. In vegetarian group 51(51%) subjects had vitamin B12 level less than cut off value (200 pg/ml), in this group, 38 out of 74 (51.3%) and 13 out of 26 (50%) were males and females respectively. In non vegetarian group 21(21%) subjects had vitamin B12 deficiency and 09 out of 72 (12.5%) and 12 out of 28(43%) were males and females respectively.

Conclusion: Vegetarians seems to be more prone to develop vitamin B12 deficiency so they should take vitamin B12 supplement and/or B-12 fortified products to avoid its deficiency consequences.

Key Words: Vitamin B12, Vegetarian, non-vegetarian.

INTRODUCTION

Vitamin B12 is known to be predominantly present in animal tissue and generally absent in plants, with the exception of some seaweeds¹⁻². Therefore, vegetarians who consume less animal source food are considered a risk group for vitamin B12 deficiency; although vitamin B12 is seldom exhausted due to the enterohepatic circulation, and the clinical manifestation of vitamin B12 deficiency rarely occurs, even without intake of vitamin B12 for many years². However, it is also well known that eliminating all animal products from the diet increases the risk of certain nutritional deficiencies. Micronutrients of special concern for the vegetarians include vitamin B12 and D, calcium, long-chain n-3 fatty acids and Zinc³⁻⁴. Vitamin B12 is an essential micronutrient that plays essential role in cell division, in one-carbon metabolism⁵, DNA synthesis, *erythropoiesis* and neurologic function⁶.

Severe clinical symptoms of B12 deficiency which include ataxia, psychoses, paresthesia, disorientation, dementia, mood or motor disturbances, may appear with or without obviously known hematological symptoms (megaloblastic anemia, macrocytosis)⁷. It has been reported that vitamin B12 deficiency is associated with coronary artery disease in Indian population⁸.

The morphological characteristic of folate or vitamin B12 deficiency anemia is generally macrocytic due to immature erythrocytes resulting from defective DNA synthesis⁹.

Vegetarians who avoid all animal products including milk and its products are referred to as vegans¹⁰. Vegetarian are at greater risk of vitamin B12 deficiency than are non-vegetarians because most of the sources of vitamin are meat, fish and eggs. Few studies in Indian have reported high prevalence of vitamin B12 deficiency in vegetarians¹¹⁻¹².

This study was carried out in the population of Mithi, district Tharparkar (Sindh) where a significant proportion of individuals (Hindu community) adhere to a vegetarian diet throughout their lifespan and have never consumed animal products except in the form of milk or milk products due to family conventions or religious doctrines. Thus, this is an ideal population to find out vitamin B12 deficiency, which is only sourced from animal products. The objective of present study was to compare vitamin B12 level among vegetarian and non vegetarian apparently healthy individuals in district Tharparkar, Sindh

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SUBJECTS AND METHODS

This study was conducted in the department of Biochemistry BMSI, JPMC Karachi from February 2012 to June 2012. A total of 200 healthy volunteers, age ranging from 20-40 years were recruited for this study, from the general population of Mithi district Tharparkar, Sindh. Out of 200 subjects, 100 were vegetarian (74 males and 26 females) and 100 non-vegetarians (72 males and 28 females). The vegetarian group had adhered to a vegetarian diet since their childhood and they do not eat beef, poultry, fish, shellfish or animal flesh of any kind, but do eat eggs and dairy products (lacto-ovo-vegetarians). The non-vegetarians were the omnivore taking food from all sources. The participants included were those who were apparently healthy, and had no physician-diagnosed disease (especially inflammatory disease). A detailed questionnaire with all the clinical data was completed for each participant on the day of recruitment. This included information about the participant's blood pressure, smoking habits, height and weight measurements, dietary status, milk consumption, etc. Individuals with following status were excluded from this study, those taking multi vitamins, diabetics, pregnant and lactating females, alcohol users, having gastrointestinal, autoimmune and chronic diseases.

Sample Collection

Five milliliter blood was collected from each volunteer, after an overnight fasting and haematological workup, including haemoglobin (Hb) and mean corpuscular volume (MCV) was done on all the subjects using standard hematological and biochemical techniques. The serum was separated and stored at -70 °C until analyzed

for vitamin B12. Hb and MCV were determined by coulter counter (Sysmex KX-21, Kobe Japan 2009) and vitamin B12 level was measured by the chemiluminescence enzyme immunoassay method by using immulite 1000 (USA 2010). The normal range of vitamin B12 levels was 200 to 900 pg/ml. The biochemically vitamin B12 deficiency was considered at a level below <200 pg/ml in study subjects¹³⁻¹⁴.

All analyses were performed on SPSS version 16. Values of quantitative variable were presented by mean with standard deviation and significance was estimated by Student's t- test.

Results

Table 1 shows that among vegetarian group the vitamin B12 level was significantly lower as compared to non vegetarians (p<0.001) The mean Hb level was significantly lower (p<0.001) while MCV was significantly higher (p<0.001) in vegetarian as compared to non vegetarian groups. Table 2 shows in vegetarian group 51(51%) subjects had vitamin B12 level less than cut off value (200 pg/ml). In vitamin B12 deficient group, 38 out of 74 (51.3%) and 13 out of 26(50%) were males and females respectively and no significant difference in mean value was observed between the two vitamin B12 deficient groups. In non vegetarian group 21(21%) subjects have had vitamin B12 level less than cut off value (200 pg/ml). In this group, 09 out of 72 (12.5%) and 12 out of 28(43%) were men and women respectively and no significant difference in mean value was observed between the two vitamin B12 deficient groups (mean values are not shown in the table).

Table 1 Comparison of serum B12, MCV and Hb vales in vegetarian and non-vegetarian

	Non- vegetarian	Vegetarian	P-Value
Vitamin B12	377.71± 87.28 pg/ml	214.82± 41.12 pg/ml*	0.001
MCV	88.8± 6.97fL	99.4± 4.9 fL*	0.001
HB	13.46± 1.82 g/dL	11.21± 1.7 g/dL*	0.001

Results are shown as Mean ± SD

P<0.05 was considered significant

Table 2 Serum vitamin B12 levels in vegetarian and non-vegetarian subjects according to gender

n= number of subjects

Variables	Total number	B12 deficient (<200pg/ml)		B12 non-deficient (>200pg/ml)	
		Vegetarian n (%)	Non-vegetarian n (%)	Vegetarian n (%)	Non-vegetarian n (%)
Male	146	38(51.3)	09(12.5)	36(48.6)	63(87.5)
Female	54	13(50)	12(42.9)	13(50)	16(57.1)
Total	200	51 (51)	21(21)	49(49)	79(79)

DISCUSSION

Deficiency of vitamin B12 is common because of inadequate dietary intake and/or malabsorption¹⁴. The deficiency state has a very wide presentation and can cause or exacerbate neuropsychiatric and other vague symptoms. It had been observed that vitamin B12 deficiency is far more prevalent than expected and majority of the cases remain undiagnosed. Therefore, early recognition of vitamin B12 deficiency becomes crucial for preventing irreversible damage¹⁴.

The present study found that among vegetarian group the mean value of vitamin B12 level was significantly lower as compared to non vegetarians. Our results had concurred with other studies^{5,12,15-16}. Our results are not in agreement with few studies suggesting that serum vitamin B12 concentrations are not significantly lower in vegetarians compared to omnivores¹⁷⁻¹⁹.

Kumar et al.⁸ found that vegetarians have significantly lower vitamin B12 concentration and almost 50% of the vegetarians in their study population were lacto-vegetarians (individuals who consumed milk).

Our results showed that the mean Hb was significantly lower while MCV was significantly higher in vegetarian as compared to non vegetarian. Change in MCV has accounted by vitamin B12 status. Similar results were found by Obeid et al.²⁰.

A study by Reddy and Sanders¹⁵ observed that Hb, MCV, MCH concentrations were significantly lower in the Indian vegetarians. It could be explained that if iron deficiency leading to microcytosis co-exists with megaloblastosis, macrocytosis may be masked and MCV may not be increased²¹. This may explain the macrocytosis in the present study in vitamin B12 deficiency.

Present results are consistent with the study by Reddy and Sanders¹⁵ that observed markedly lower serum vitamin B12, higher MCV, MCH and lower erythrocyte (RBC) counts in Caucasian vegetarians compared with the Caucasian omnivores.

Our study had been focused on age group ranging 20-40 years, the reason was to limit the effects of increasing age on the vitamin B12 levels. The vitamin B12 deficiency had found 51% in vegetarians and 21% in non vegetarians. These results are consistent with those of Barghouti *et al.*²² and Arora et al,¹⁴ who found that the frequency of vitamin B12 deficiency in the same age group as 42.7% and 35% respectively. These results pointed out that the age seem to offer no substantial risk for developing B12 deficiency. This could be attributed to dietary limitations due to vegetarian dietary habits and lower socio economic status.

Arora et al.¹⁴ have pointed out in their study that vegetarian diet is a considerable risk of developing vitamin B12 deficiency. In our vegetarian group 51% subjects were suffering from vitamin B12. These results are inconsistent with several studies^{12,14,23-24}. Gupta *et al.*,²⁴ found 47% of the Asian Indians had B12 deficiency confirming the high prevalence of this extent in Indians,

though this study had been carried out on south Indians residing in Canada. This prevalence was quite similar to other studies carried out in India and with our study which carried out in Pakistan. This indicates that there are some other factors beyond vegetarian diet that could possibly be responsible for vitamin B12 deficiency.

vegetarians. These results are consistent with those of Barghouti.

In present study, in vegetarian group 51% males and 50% females and in non-vegetarian group 12% males and 43% females were suffering from vitamin B12 deficiency. We observed no significant gender-wise difference in prevalence of vitamin B12 deficiency in vegetarian group. This is in contrast to a study which pointed out that females are more prone to develop B12 deficiency¹⁴ while a study conducted in Finnish elderly population where male gender had been observed to have increase probability for vitamin B12 deficiency²⁵. In another study conducted on South Asian patients the risk appeared could be similar for men and women²⁴.

Limitations:

In the present study vitamin B12 measurement was used as the first-line test and the definition of vitamin B12 deficiency was based on low level of serum vitamin B12 although measurements of methylmalonic acid (MMA) and total homocysteine (tHcy) and holotranscobalamin (Holo TC) have been shown to be more sensitive in the diagnosis of vitamin B12 deficiency.

Conclusion:

Vegetarians seem to be more prone to develop vitamin B12 deficiency so they should take vitamin B12 supplement and / or B-12 fortified products to avoid its deficiency consequences.

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