

Original Article***Correlation of Vitamin B12 with Atherogenic Index of Plasma (AIP) in Lactovegetarians, Vegans and Omnivores : A Cross-sectional Study.***

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Abstract

Background: People adopt vegetarians for various reasons including physical health concern, religious convictions, compassion for animals, food preferences, or economic. But the alarming matter is that omitting of some valuable nutrients from the regular diet chart which are exclusively derived from animal origin, can cause some serious health problems. Foreexample, vitamin B₁₂, is primarily found only in foods of animal origin. That's why vegetarians, particularly vegans might have low level of vitamin B₁₂ which increases the homocysteinelevel. Hyperhomocysteinemia has been recognized as an important independent cardiovascular risk factor and that can be assayed by calculating atherogenic index. So the aim of this study is to promote the awareness of lactovegetarians and vegans about the consequence of vitamin B₁₂ deficiency that might facilitate their options for vitamin B₁₂ supplementation in diet to avoid possible cardiovascular and other atherogenic complications.

Materials and Methods: This cross-sectional, analytical study was conducted in the Department of Biochemistry, Bangabandhu Sheikh Mujib Medical University (BSMMU), during the period from July 2011 to June 2013. A total of 86 subjects were included in the study. Among them 35 subjects were lactovegetarians, 14 subjects were vegans and 37 subjects were omnivores. The variables were compared among these three groups.

Results: The median vitamins B₁₂ were in omnivores 290 pg/ml, in lactovegetarians 88 pg/ml and in vegans 82 pg/ml. The median homocysteine was higher in vegans (55.0 μmol/L) than lactovegetarians (26.6 μmol/L) and omnivores (13.6 μmol/L).

Conclusion: In this study, the median vitamin B₁₂ status was lower and plasma homocysteine was significantly higher in vegans than lactovegetarians and omnivores. the atherogenic index was elevated in all the three groups.

Key words: Lactovegetarians, Vegans, Omnivores, Vitamin B₁₂, Homocysteine, Atherogenic index

Introduction

Vegetarianism is the practice of abstaining from the consumption of meat-red meat, poultry, seafood and the flesh of any other animal; it may also include abstention from by-products of animal slaughter, such as animal-derived rennet and gelatin.¹⁻²⁻³

Consequently, the vegetarian diet adopted by a person may be influenced, to some degree, by their motives, and a range of dietary patterns of professed vegetarians coexist.⁴ Vegetarian diets can be classified as either lacto-vegetarian, ovo-vegetarian, lacto-ovo-vegetarian, or vegan if they include, respectively, dairy products, eggs, both dairy products and eggs, or no animal products at all.⁵ Nutritional status is at risk when any group of foods is regularly omitted from the diet. Whatever the motive for avoiding the food group, care must be taken to ensure that the diet remains balanced and nutritionally complete so as to avoid any deficiencies and to ensure optimal nutritional status (Phillips, 2005). Vitamin B₁₂ is an essential vitamin, required for DNA synthesis and for maintaining nerve myelin integrity. The recommended daily intake for adults is approximately 2-4 µg.⁶ It is found almost exclusively in animal-based products including red meats, poultry, seafood, milk, cheese and eggs. Vitamin B₁₂ is produced by bacteria in the large intestines of animals. Plant-based foods are generally not a source of vitamin B₁₂.⁷ Thus, the avoidance of animal products in association with a strict vegetarian diet may lead to deficiency of vitamin B₁₂.⁸⁻⁹ Vitamin B₁₂ deficiency is a serious health problem that can result in megaloblastic anemia, inhibition of cell division, and neurological disorder.

Vitamin B₁₂ deficiency can also lead to demyelination of peripheral nerves, the spinal cord, cranial nerves and the brain, resulting in nerve damage and neuropsychiatric abnormalities. Neurological symptoms of vitamin B₁₂ deficiency include numbness and tingling of the hands and feet, decreased sensation, difficulties walking, loss of bowel and bladder control, memory loss, dementia, depression, general weakness and psychosis.¹⁰ Methionine is an essential amino acid obtained from protein in the diet. Some methionine is turned into homocysteine. The body turns much of this homocysteine back into methionine with the help of vitamin B₁₂. If someone is B₁₂-deficient, homocysteine levels will increase because this reaction cannot take

place.¹¹ Hyperhomocysteinemia has been recognized as an important independent cardiovascular risk factor.¹² It is hypothesized that homocysteine alters endothelial and smooth muscle cell function by generating reactive oxygen species.¹³⁻¹⁴ The resulting increase in oxidative stress diminishes antioxidative capacity, which increases the risk for atherosclerotic vessel diseases in these subjects.¹⁵⁻¹⁶ Atherogenic index of plasma (AIP) is the new marker of atherogenicity, since the AIP is related directly to the atherosclerosis risk. AIP is the ratio calculated as $\log(\text{TG}/\text{HDL-C})$.¹⁷ Triglycerides and HDL-C in AIP reflects the balance between the atherogenic and antiatherogenic lipoproteins respectively (Dobiasova, 2004). Atherogenic lipoprotein profile of plasma is an important risk factor for CHD. It is characterized by high low density lipoprotein cholesterol to high density lipoprotein cholesterol ratio and increased level of triglyceride.¹⁸

Materials and Methods

This cross-sectional, analytical study was conducted in the department of biochemistry, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbagh, Dhaka during the period from July 2011 to June 2013. A total of 86 subjects were included in the study. Among them 35 subjects were lactovegetarians (vegetarians who include milk and milk products), 14 subjects were vegans (vegetarians who exclude milk and dairy products also) and 37 subjects were omnivores. The lactovegetarians and vegan groups were selected from ISKCON Society Shwamibagh, Dhaka, Kashipur and Pagla, Narayanganj. Omnivorous subjects were selected throughout Narayanganj.

Semi-vegetarians, obese and person with vitamin B₁₂ medication, anemic, hypertensive, diabetic and patient with renal impairment and thyroid disorder were excluded from the study.

Ethical clearance for the study was taken from the central ethical committee of BSMMU and written informed consent was obtained from all participants. Preformed questionnaire were used to collect data. With all aseptic precaution 5 ml venous blood was delivered immediately into a clean dry heparinized tube and centrifuged. Fasting blood samples were collected from them to estimate plasma vitamin B₁₂, homocysteine and lipid profile by Chemiluminescent Microparticle Immunoassay (CMIA). The data were compiled for

analysis. Atherogenic index of plasma was calculated. The relation of AIP and plasma vitamin B₁₂ and homocysteine level among the vegans, lactovegetarians and omnivorous was obtained.

Analysis of data was done with the help of software–SPSS version 20 (IBM Corp, Armonk, NY, USA). A p-value of less than 0.05 was considered indicative of statistical significance.

Results

A total of 86 subjects were included in the study. Among them 35 subjects were distributed into group I, lactovegetarians, 14 were distributed in group II, vegans and 37 were distributed in group III, omnivores. Fasting blood sample were collected from them to estimate plasma vitamin B₁₂, homocysteine and lipid profile. Atherogenic index of plasma was calculated.

Table I: Status of Vitamin B₁₂ and Homocysteine in different groups of study subjects

	Groups			P-value
	Group -I (n=35)	Group -II (n=14)	Group -III (n=37)	
	Median (Min -Max)	Median (Min-Max)	Median (Min -Max)	
B 12 (pg/mL)	86 (65 - 187)	82 (60 – 273)	290 (83 - 592)	0.001
Homocysteine (µmol/L)	26.6 (12.9 -51.0)	55.0 (10.4 -70.0)	13.6 (7.4 - 41.0)	0.001

Kruskal Wallis Test was done to measure the level of significance

Table I showing the level of plasma vitamin B₁₂ and homocysteine among lactovegetarians, vegans and omnivores. Here the median vitamin B₁₂ was higher in omnivores (290 pg/ml) than lactovegetarians (88 pg/ml) and vegans (82 pg/ml). The median homocysteine was higher in vegans (55.0 µmol/L) than lactovegetarians (26.6 µmol/L) and omnivores (13.6 µmol/L). There was statistical significant difference regarding both B₁₂ and homocysteine level.

Table II: Status of Atherogenic Index of Plasma (AIP) in different groups of study subjects

Parameter	Groups			P-value
	Group -I (n=35)	Group -II (n=14)	Group -III (n=37)	
AIP median (range)	0.25 (-0.18 - 1.07)	0.32 (-0.08 - 1.05)	0.34 (-0.40 -1.51)	0.600 #

Kruskal Wallis Test was done to measure the level of significance

Table II shows, AIP level of study subjects. Median AIP was 0.25 in lactovegetarian, 0.32 in vegans and 0.34 in omnivores which were higher in all the three groups (P = 0.600).

Table III: Correlation of Vitamin B₁₂ with Atherogenic index of plasma

Groups	r value	P - value
Lactovegetarian	-0.166	0.349
Vegan	-0.503	0.080
Omnivore	-0.117	0.496

Spearman's correlation was done to measure the level of significance

Table III shows, correlation of vitamin B₁₂ with atherogenic index of plasma. Spearman’s correlation test showed no correlation of vitamin B₁₂ with AIP in vegans (r = - 0.503 & P = 0.080), in lacto-vegetarians (r = - 0.166 & P = 0.349) and also in omnivores (r = - 0.117, P = 0.496).

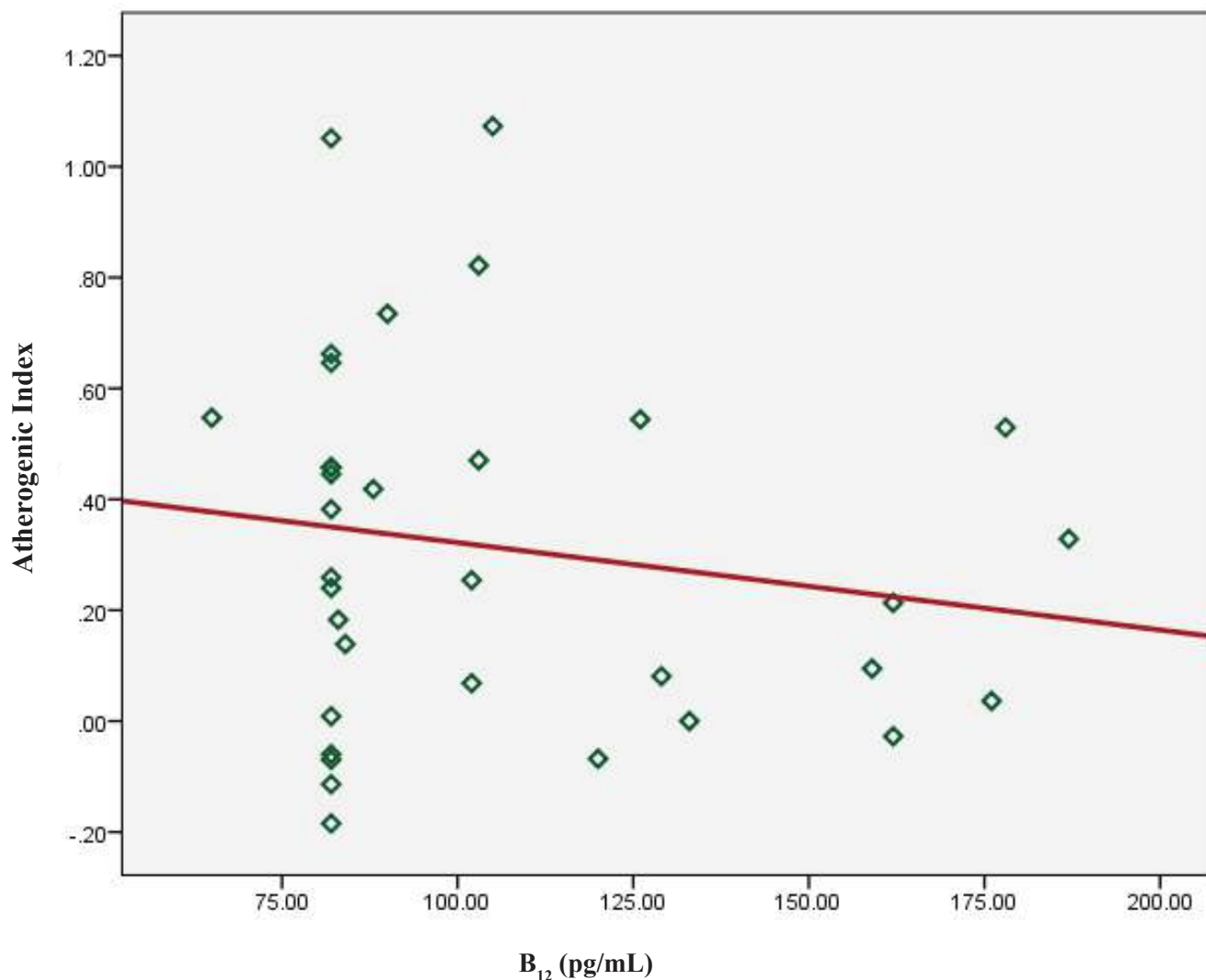


Figure 1: Correlation of Vitamin B₁₂ with Atherogenic Index in lactovegetarian group
 Spearman's correlation was done to measure the level of significance.
 (r = - 0.166; P = 0.349) (Fig.III)

Discussion

Despite existing evidence that well-planned vegetarian diets provide several health benefits and can be appropriate for all stages of the life. It is also known that animal foods provide micronutrients that are nonexistent or available only in limited amounts in plant foods.¹⁹ As a result of this insufficient intake of some valuable nutrients regularly, can cause deficiency of that nutrients and vitamins which ultimately exert different adverse health effects. So, vegetarians might have low level of vitamin B₁₂ which is derived from animal food and that's why homocysteine level may be increased in those subjects. Hyperhomocysteinemia can cause serious cardiovascular problems.

In this present study, plasma vitamin B₁₂ was significantly higher in omnivores than lacto-vegetarians and vegans. The median level of vitamin B₁₂ was 82 pg/mL in vegans, 86 pg/mL in lacto-vegetarians and 290 pg/mL in omnivores. We found significantly high vitamin B₁₂ value in non-vegetarian. A Study conducted by Farzana et al. (2013) showed that mean level of vitamin B₁₂ was significantly higher in non-vegetarian (217.56±95.64 pmol/L) than vegetarian (134±46.21 pmol/L).

Majchrzak et al., (2006) conducted the similar study.²⁰ They showed the mean level of plasma vitamin B₁₂ among vegetarians, vegans, and omnivores were 238.5±99.1 pmol/L, 203.2±101.5 pmol/L, 251.5±83.0 pmol/L respectively.

Here atherogenic index was calculated by using AIP = Log (TG/HDL-C) formula. Here atherogenic index were increased in all the three groups. Mean AIP was 0.25 in lactovegetarians, 0.32 in vegans and 0.34 in omnivores. Viswabharathi et al., (2013), showed the study about atherogenic index in between vegetarians and fish eaters.²¹ There TC/HDL-C ratio was higher in vegetarians when compared to fish eaters. The ratio of LDL-C/HDL-C was also a little higher in vegetarians in comparison to fish eaters.

The reduced risk of cardiovascular events is associated with low AIP level (< 0.11); the range extending from 0.11 to 0.21 indicates intermediate risk of cardiovascular disease and value > 0.21 indicates a high cardiovascular risk.²²

Conclusion

This study showed that plasma vitamin B₁₂ was significantly lower in and homocysteine levels significantly higher among vegans and lactovegetarians compared with omnivores. AIP levels of study subjects were higher in all the three groups. So that, in this study, besides omnivores, vegans and lactovegetarians is in risk of cardiovascular disease due to high atherogenic index.

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