

## **Lipid Profile and Atherogenic Index of Plasma (AIP) in Vegetarians**

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### **Abstract**

**Background:** Diet deficient in fresh fruits and vegetables are associated with an increased risk of coronary diseases. Low levels of vitamin C, vitamin E and other antioxidants may enhance the production of oxidized LDL and are important independent risk factors for coronary disease.

**Objective:** To make a comparative evaluation of lipid profile and atherogenic index of plasma (AIP) between vegetarians and nonvegetarians. **Materials and Methods:** This case-control study was carried out in the Department of Biochemistry of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka between July 2011 to June 2012. Vegetarian and nonvegetarian subjects of male sex were the study population. Vegetarians were considered as cases while nonvegetarians as controls. After proper ethical consideration a total of 30 vegetarians and 40 nonvegetarians were consecutively included in the study based on predefined inclusion and exclusion criteria. Laboratory investigations were done in the Department of Biochemistry, BSMMU, Dhaka. **Results:** The vegetarians had significantly lower total cholesterol and LDL-cholesterol than the nonvegetarians ( $p=0.000$  and  $p=0.000$  respectively). Serum HDL cholesterol was also lower among the vegetarians ( $p=0.002$ ) and triglycerides were almost identical in both the groups ( $p=0.272$ ). **Conclusion:** The study reveals lower level of total cholesterol, LDL-cholesterol and HDL-cholesterol in vegetarians. No difference regarding triglycerides and AIP was found between the groups. So, the findings of this study do not indicate any superiority of vegetarian diet in control and prevention of cardiac diseases.

**Key words:** Vegetarian; Nonvegetarian; Lipid profile; Coronary disease; Atherogenic index of plasma (AIP)

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### **Introduction**

Cardiovascular disease is the major cause of mortality all over the world being responsible for about 50% of all adult deaths. The disease is increasing globally, particularly in developing countries.<sup>1</sup> The prevalence of coronary heart disease in Bangladesh was found 33 per 10000 in 1976, which increased to more than five-fold (172 per 10000) in 1998.<sup>2</sup>

Serum lipid profile consists of total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-cholesterol), and high-density lipoprotein cholesterol (HDL-cholesterol). The HDL-cholesterol is protective for heart, while LDL-cholesterol increases the risk of coronary heart disease.<sup>3</sup> There is also a weak correlation between plasma TG concentration and the

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evidence of coronary heart disease (CHD).<sup>4</sup>

Clinical and epidemiological studies have demonstrated a strong association between eating habits and chronic diseases, particularly cardiovascular events, although not all the mechanisms are yet understood.<sup>5</sup>

Diet deficient in fresh fruits and vegetables containing unsaturated fatty acids are associated with an increased risk of coronary diseases. Low levels of vitamin C, vitamin E and other antioxidants may enhance the production of oxidized LDL and are important independent risk factors for coronary disease.<sup>4</sup>

Vegetarian diets are generally characterized by the more frequent consumption of fruits, vegetables, whole grains, legumes and nuts, which results in higher intake of dietary fiber, antioxidants and phytochemicals compared to non-vegetarian diets.<sup>6,7</sup>

The potential of vegetarianism to be protective against coronary disease is confirmed in some studies, while other studies fail to confirm this potential.<sup>8</sup> The unfavorable effects of vegetarianism that result from inadequate consumption of some essential micronutrients have been repeatedly addressed.<sup>9</sup>

It is likely that the lower cholesterol and saturated fat characteristics of a plant-based diet, as compared to an animal-based diet, contribute to lower blood lipid concentrations in vegetarians. The low morbidity and mortality rates due to vascular disease reported in vegetarians<sup>10</sup> do not seem to be consistent with the findings of Karabudak et al<sup>11</sup> who showed a mild prevalence of hyperhomocysteinemia, a factor contributing to vascular disease.

Atherogenic index of plasma (log ratio of TG to HDL-cholesterol) is a strong predictor of myocardial infarction.<sup>12</sup> AIP has been used by some practitioners as a significant predictor of atherosclerosis.<sup>13-15</sup> Application of AIP as a predictor of cardiovascular diseases may offer new insights.<sup>16</sup>

So far we know, no study has been done in vegetarians in our population addressing lipid profile status and AIP. So, we conducted this study in male vegetarians to know their lipid profile and AIP status and to compare it with that of age-matched nonvegetarians.

## Materials and Methods

This case-control study was carried out in the Department of Biochemistry of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka between July 2011 to June 2012 to make a comparative evaluation of biochemical risk factor (lipid profile) between vegetarians and non-vegetarians. Vegetarian (live on vegetables, fruits and/or milks for >5 years) and non-vegetarian (accustomed to usual diet – mixed vegetables, fruits, meat, fish, milk and eggs) subjects were the study population. Vegetarians were considered as cases while non-vegetarians as controls. The vegetarian subjects included in the study were from ISkCON Society, Swamibagh, Dhaka and Ramakrishna Mission, Gopibagh, Dhaka while controls participated in the study from nearby community. A total of 30 male vegetarians and 40 non-vegetarians of 20–60 years age range were consecutively included in the study. Those having diabetes, hypertension, obesity, thyroid disorder, serious hepatic or renal disorder, smoking and alcohol consumption habit were excluded from the study.

Four mL of blood specimen was collected from each of the study subjects in fasting condition with all aseptic precautions for estimation of serum TC, TG and HDL-cholesterol levels. LDL-cholesterol level was calculated by applying Friedewald's formula. AIP was calculated as log of TG/HDL-C ratio.

Data were analyzed by unpaired t test. All comparison tests were done by using computer based SPSS 16.0 for windows software. p value <0.05 was accepted as significant.

## Results

The mean  $\pm$  SD of age of vegetarians was  $31.37 \pm 9.32$  years and that of nonvegetarian controls was  $33.60 \pm 10.97$  years. The mean  $\pm$  SD of BMIs of vegetarians and nonvegetarians were  $24.28 \pm 3.40$  and  $25.83 \pm 4.29$  respectively. Table I shows the comparison of serum lipid parameters between vegetarians and nonvegetarian controls. Statistically there was significant difference between the two groups in total cholesterol, HDL-cholesterol and LDL-cholesterol levels; but there was no difference in triacylglycerol. Table II shows the comparison of AIP between two groups. The mean  $\pm$  SD of AIP of vegetarians and nonvegetarians were  $0.3320 \pm 0.32$  and  $0.2565 \pm 0.25$  respectively. There was no significant difference in AIP between two groups.

Table I: Comparison of serum lipid parameters between vegetarians and nonvegetarian controls (N=70)

Lipid parameters (mg/dL)	Vegetarians (n=30)	Nonvegetarians (n=40)	t values	p values
Total cholesterol	146.97 ± 40.32	189.40 ± 33.84	- 4.782	0.000
Triacylglycerol	168.27 ± 91.37	162.68 ± 80.27	0.272	0.787
HDL-cholesterol	30.57 ± 7.25	36.45 ± 8.01	- 3.165	0.002
LDL-cholesterol	84.70 ± 40.39	122.53 ± 31.64	- 4.395	0.000

Table II: Comparison of AIP between vegetarians and nonvegetarians (n=70)

Groups	AIP (Mean ± SD)	t value	p value
Vegetarians (n=30)	0.3320 ± 0.32	1.113	0.270
Nonvegetarians (n=40)	0.2565 ± 0.25		

## Discussion

Clinical and epidemiological studies have demonstrated a strong association between eating habits and chronic disease, particularly cardiovascular events.<sup>17</sup>

In this case-control study lipid profile of vegetarians and nonvegetarians were carried out to evaluate whether vegetarians encounter lower cardiac risk than nonvegetarians.

In the present study we observe total cholesterol and LDL-cholesterol to be significantly lower among the vegetarians than those among the nonvegetarians ( $p < 0.001$ ). Serum HDL cholesterol was lower among vegetarians ( $p = 0.002$ ) and triglycerides were almost identical in both the groups ( $p = 0.787$ ). In respect of AIP, we found no difference between the groups.

A Spanish study conducted in 2007, which included 67 vegetarians, found that vegetarians had significantly lower total cholesterol than the 134 meat-eating participants (73% of the vegetarians were of the sort who ate eggs). According to the study, nearly 80% of the vegetarians had total cholesterol levels that the American Heart Association considers “desirable”. Conversely, about 71% of the omnivores had “borderline high risk” total cholesterol levels. More than 32% of the omnivores had “high-risk” cholesterol levels compared with just 3% of the vegetarians.<sup>18</sup> Our findings are in well agreement with above studies.

Well-planned vegetarian and vegan diets are nutritionally adequate and are appropriate for all stages of the life-cycle. Vegetarian diets are usually rich in carbohydrates, omega-6 fatty acids, dietary fiber, carotenoids, folic acid, vitamin C, vitamin E, potassium and magnesium. These usually contain lower level of saturated fat, cholesterol and animal protein.<sup>19</sup>

The study reveals lower level of LDL cholesterol and total cholesterol in vegetarian group. HDL was higher in nonvegetarians. Regarding AIP which is considered as a strong predictor for cardiovascular events, there was no difference between vegetarians and nonvegetarians. In this study TG also does not show any significant difference between two groups. So, from the findings of this study we can conclude that vegetarian diet is not superior to nonvegetarian diet in control and prevention of cardiac risk. However, more studies are recommended to explore the possible role of vegetarian diet.

The limitation of the study is that it was done in a small-scale urban people of Dhaka. Further study involving large sample size can be carried out to establish a definite conclusion.

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