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Research Article

A comparative study of metabolic profile, anthropometric parameters among vegetarians and non-vegetarians- do vegetarian diet have a cardio protective role?

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ABSTRACT

Background: Various studies have evaluated the cardio protective role of vegetarian diet among diverse group of population and found that vegetarians have lower cardiovascular risk. However, studies' evaluating association between vegetarian diet and cardiovascular risk among young adults are meagre and is of special interest as they are the productive group of community.
Methods: Ninety volunteers (age 19±1 year), of which 46 non-vegetarians, and 44 vegetarians were recruited. After obtaining written informed consent and Institutional Ethical Clearance, height, weight, waist circumference, hip circumference, fasting blood sugar, serum cholesterol, triglycerides and high density lipoproteins were estimated.
Results: Significant difference was observed in weight, body mass index (BMI), waist circumference (WC), hip circumference (HC). Weight, BMI, WC, HC was lower among vegetarians compared to non-vegetarians and was statistically significant (p=0.0001, p=0.0001, p=001, p=0.0001 respectively). Serum cholesterol levels were also significantly lower among vegetarians. (p=0.01). HDL levels were 50.57±9.62 and 62.43±8.07 respectively for vegetarians and non-vegetarian group and was significantly higher among non-vegetarians (p=0.0001). Intergroup comparison among three group of vegetarians (lacto-ovo vegetarians, lacto vegetarians, total vegetarians) showed that total vegetarians have significantly lower height (p=0.001), weight (0.002), fasting blood glucose (p=0.001), total cholesterol (p=0.005) and triglycerides (p=0.0001) when compared to lacto-ovo vegetarians.
Conclusions: Vegetarians have a more favourable lipid profile and anthropometry, with lower levels of total cholesterol, lower weight, body mass index, waist and hip circumference when compared to non-vegetarians, that reduces cardiovascular risk among them. Identifying young adults with unfavourable metabolic profile and adapting suitable dietary modifications tends to reduce the burden of cardiovascular disease particularly in developing countries.

Keywords: Vegetarians, Cardiovascular disease, Metabolic profile

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death not only in developed countries but also developing countries.[1,2] According to Global Burden of disease, 2004 WHO update, out of 10 deaths, 6 deaths are due to non-communicable diseases and amongst them CVD is the leading cause for death in the world. Also, a projected trend in global mortality due to CVD is estimated to escalate to 23.4 million in 2030 (from 17.3 million in 2004).[3]

In India, non-communicable diseases account for the majority of deaths (59.1%) and half of disability-adjusted

life-years (49.7% DALYs), predominantly affecting the productive years of life mainly young adults.[4]

There has been a rapid increase in coronary artery disease (CAD) in most Asian countries; however, there is no consensus of opinion on diet and lifestyle guidelines and desirable levels of risk factors for prevention of CAD in these countries.[5] The proportion of deaths due to CVDs in Asians may be about 15% and in India CVD accounts for 53.5% of mortality.[1,4] A constellation of modifiable (smoking, hypertension, diabetes mellitus, anthropometric parameters, metabolic parameters like lipid profile) and non-modifiable factors (age, gender) interact together to substantially increase the risk of CVD.

Diet plays a major role in pathogenesis of CVD.[1,6] Various studies show that there is association between high serum cholesterol levels, triglyceride levels and the prevalence of myocardial infarction and cerebral vascular accidents.[7]

Also, evidence is present to show that vegetarian diet plays significant role in vascular protection and consumption of vegetarian diet reduces the risk of CVD.[4,8] Vegetarian diet is known to lower serum cholesterol and low density lipoprotein (LDL) levels and hence reduces risk of atherosclerosis.

Dietary fibers improve insulin sensitivity and hence reduces the risk for type II diabetes.[9,10] Vegetarians were found to have a lower incidence of gastrointestinal cancer and certain other diseases that increases the life expectancy amongst them.[10,11] Also, evidence from long term cohort studies in western countries, on the health benefits of a vegetarian diet, show positive cardiovascular, cancer, mental health and reduces overall mortality effects.[12]

Diet being a modifiable risk factor for CVD, by adapting suitable dietary pattern, we can not only reduce the cardiovascular risk but also dietary measures can also prevent progressive damage due to non-communicable diseases like hypertension or diabetes.[1] The main objective of the study is to compare the metabolic profile and anthropometric parameters among vegetarians and non-vegetarians.

METHODS

This was an cross-sectional study. Ninety healthy volunteers of either gender between the age group of 19±1 year participated in the study. Of these, 46 were non-vegetarians and 44 were vegetarians. Vegetarians included 19 lacto-ovo vegetarians, 17 lacto vegetarians, and 8 total vegetarians.

Total vegetarian diet was defined as a diet that excluded eggs, milk, meat, poultry, seafood and by-products of animals, while ovo-lacto vegetarian diet was one that excluded all meat and fish but included eggs and dairy products and lacto vegetarians were ones who consumed dairy products but excluded egg from diet.

Subject volunteers with a history of CVD, medications, bronchial asthma or any medical illness that affects lipid profile and fasting blood glucose were excluded from the study. Written informed consent was obtained from all study participants and the study was started after the approval by the Institutional Ethics Committee.

Height, weight and waist circumference (WC), hip circumference (HC) were measured thrice using standard techniques and mean was noted.[13] Height was recorded on a stadiometer to the nearest mm. Weight was measured by a digital weighing machine to the nearest 100 g and was calibrated using standard weight every day.

WC was measured with a non-stretchable tape at the midpoint between lower border of rib cage and upper border of iliac crest. BMI was calculated as weight in Kg divided by height in units of meter squared. Waist circumference and hip circumference were measured and waist-hip ratio calculated. High WC was defined based on criteria modified for Asian Indians (WC ≥90 cm in men and ≥80 cm in women. BMI ≥ 23 kg/m^2 was defined as overweight)[14].

Venous blood samples (5 ml) were collected from subjects after overnight fasting for determination of fasting blood glucose (FBG) and serum lipid profile. Estimation of FBG, total cholesterol (TC), triglycerides (TG) and high density lipoprotein cholesterol (HDL) was carried out using enzymatic method. Low density lipoprotein (LDL) cholesterol and Very low density lipoprotein (VLDL) cholesterol was calculated using Freidewald's formula. TC/ HDL and TG/ HDL ratios were subsequently calculated. Quantitative estimation was done using semiauto analyzer (Lab Life Chem. Master) Rev: 1.3 C.

Statistical analysis

Continuous data were expressed as mean and standard deviation. A comparison between 2 study groups (vegetarians and non-vegetarians) was done using independent t test. Comparisons among total vegetarians, lacto vegetarians and ovo-lacto vegetarians were made using one way ANOVA with post hoc test. A P value <0·05 was considered to be statistically significant.

RESULTS

The baseline characteristics of ninety volunteers, (46 non vegetarians, 44 vegetarians) with mean age group of 19±1 year is presented below. There was a statistically significant difference in weight and BMI (P=0.0001 for both) between the two groups with lower weight and BMI among vegetarians when compared with non-

vegetarians. WC and HC was also significantly lower among vegetarians (P=0.001) when compared with non-vegetarians. There was no difference between two groups with respect to age, height, Waist hip ratio (Table 1).

When BMI was classified under Asian Indian classification, we found that, 24 vegetarians had normal BMI, 9 were overweight, 10 obese and 1underweight. Among non-vegetarians we found none to be underweight, 14 had normal BMI, 6 overweight and another 26 to be obese (Figure 1).

Total cholesterol was found to be significantly lower in vegetarians (P=0.01) when compared with non-vegetarians. HDL levels was found to be significantly higher in non-vegetarians (p=0.0001) when compared to vegetarians. No statistically significant difference was observed for FBG, TG, LDL, LDL / HDL, and TC/ HDL between two groups (Table 2).

When compared among three groups of vegetarians (Lacto-ovo vegetarians, Ovo-vegetarians Total vegetarians), total vegetarians had a significantly lower weight when compared with lacto–ovo vegetarians (p=0.002) and ovo-vegetarians (p=0.01). However, there was no significance in BMI, WC, HC, WHR between the groups (Table 3).

Fasting blood glucose, triglycerides, total cholesterol levels were significantly lower among Total vegetarians compared to lacto-ovo vegetarians with p=0.001, p=0.005 and p=0.002 respectively. There was no statistically significant difference in HDL-C, LDL-C, VLDL and TC/HDL ratio (Table 4).

Table 1: Subject characteristics and anthropometric parameters in the two study groups.

	Vegetarians (n=44)	Non vegetarians (n=46)	P value
Age (years)	19±1	19±1	1
Weight (kg)	63±10.4	73.52±11.85	0.0001*
Height (m)	1.65±0.11	1.65±0.09	1
BMI (kg/m^2)	23.17±3.36	27.17±5.27	0.0001*
WC (cm)	73.57±6.16	80.21±11.46	0.001*
HC (cm)	90.66±6.93	97.38±8.48	0.0001*
WHR	0.81±0.07	0.83±0.1	0.29

BMI: Body mass index, WC: Waist circumference, HC: Hip circumference, WHR: Waist hip ratio, * Statistically significance at p <0.01.

Table 2: Fasting blood glucose and lipid profile parameters in the two study groups.

	Vegetarians	Non-vegetarians	P value
FBG	85.43 ±0.07	89±10.27	0.09
TC	147.30±28.30	162±25.13	0.01*
TG	90.09±37.45	84.62±29.75	0.46
HDL-C	50.57±9.62	62.43±8.07	0.0001*
LDL-C	93.38±26.95	93.95±25.75	O.92
VLDL	16.48±8.22	19.29±6	0.07
TC/HDL	3.04±0.91	3.16±0.67	0.4

FBG: Fasting blood glucose, TC: Total cholesterol, TG: Triglycerides, HDL: High density lipoprotein cholesterol, LDL: Low density lipoprotein cholesterol, VLDL: Very low density lipoprotein cholesterol, *Statistical significance at P<0.01.

Table 3: Comparison of anthropometric parameters among three groups of vegetarians.

	Lacto-ovo vegetarians	Ovo-vegetarians	Total vegetarians
Age (years)	18.6±0.2	19.27±0.40	19.25±0.65
Weight (kg)	64.63±10.71*#	62.67±9.71*	50.75±11.41
Height (m)	1.70±0.02*#	1.64±0.13	1.54±0.2
BMI (kg/m^2)	22.16±0.67	23.47±0.84	23.32±0.52
WC (cm)	75.84±1.52	72.4±1.49	70.38±1.34
HC (cm)	93.1±1.71	88.13±1.57	89.62±2.23
WHR	0.82±0.08	0.82±0.09	0.79±0.03

BMI:Body mass index, WC: Waist circumference, HC: Hip circumference, WHR: Waist hip ratio, *Statistically significant when compared to Total vegetarians, #Statistical significance at p<0.01.

Table 4: Comparison of metabolic parameters among three groups of vegetarians.

	Lacto-ovo vegetarians	Ovo-vegetarians	Total vegetarians
FBG	86.53±2.46*#	80.40±0.81	74.63±1.22
TC	158.95±5.84*#	145.4±0.6	123.25±9.22
TG	99.21±4.05*#	86.8±1.04	74.63±10.57
HDL-C	50.32±9.75	52.13±8.17	48.25±12.35
LDL-C	97.28±4.11*	93.87±2.8*	83.2±2.66
VLDL	18.93±9.6	15.67±7.18	12.18±4.19
TC/HDL	3.29±0.92	2.88±0.82	2.74±1.04

FBG: Fasting blood glucose, TC: Total cholesterol, TG: Triglycerides, HDL: High density lipoprotein cholesterol, LDL: Low density lipoprotein cholesterol, VLDL: Very low density lipoprotein cholesterol, *Statistically significant when compared with total vegetarians, #Statistical significance at P<0.01.

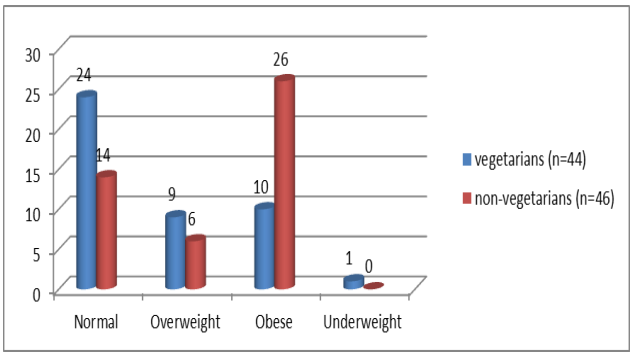

Figure 1: BMI Classification among vegetarians and non-vegetarians.

DISCUSSION

Though there are many Indian studies that have evaluated the association between diet and cardio-vascular risk factors, the role of a vegetarian diet per se, has not been well documented, especially among young adults. In a cross sectional study among urban north Indians, various cardiovascular risk factors were assessed and authors found that sedentary life style was the first most and overweight/obesity the second most prevalent cardiovascular risk factor among young adults in the age group of 20-29 years.[15]

This escalation in the prevalence of CVD has been attributed to the paradigm shift in life style including the changes in dietary pattern (more consumption of refined carbohydrates and saturated fats) and physical inactivity in association with progressive economic growth and urbanization.[16]

Overweight and obesity are well known risk factor for CVD.[15] In Indian Migration Study, a study of rural and urban adult population, mean aged 40+ years, across four regions and 18 states of India, it was found that vegetarians had lower levels of lipids and blood pressure supporting the hypothesis that a vegetarian diet has potential cardiovascular health benefits.[4] These findings are in par with our study were total cholesterol levels were lower among vegetarians.

A longitudinal follow up study among Taiwanese showed that vegetarian diet lowered the risk of obesity by 7% every year of follow up. Also each additional year of lacto-vegetarian diet lowered the risk of elevated systolic blood pressure by 8% and risk of elevated glucose by 7%. Every additional year of ova-lacto vegetarian diet increased abnormal HDL-C by 7%. In this study, better metabolic profile is partially attributable to lower BMI.[17] Similar results were obtained in our study where vegetarians had lower weight, BMI, WC, HC compared to non-vegetarians.

When BMI was classified based on Asian Indian Classification we found 26 obese among non-vegetarians, whereas among vegetarians only 10 were obese. And number of individuals with normal BMI was 24 among vegetarians when compared to 14 among non-vegetarians. Also, total vegetarians had a better metabolic profile amongst the three vegetarian categories. Henceforth, using simple anthropometric measurements, we can identify the individuals at risk for CVD.

However, in present study HDL-C was higher in individual who consume non-vegetarian diet. HDL-C has a major protective role by causing reverse transportation of cholesterol from tissue to liver. Also, it is well known, that non-vegetarians consume excess animal protein and saturated fats and hence have low HDL levels, which increases the risk of CVD among them. A meta-analysis of comparison of vegetarian diets and omnivorous diets on plasma level of HDL cholesterol provides evidence indicating that there was no significant difference in HDL levels between vegetarians and non-vegetarians.[16]

Also, meta-analysis study by Chiu et al. showed that lack of meat in vegetarian diet does not play a major protective role against CVD. Also, egg, milk and other dairy products being a staple part of vegetarian diet contains cholesterol in excess (for example in egg yolk) whereas non-vegetarians mainly consume lean meat instead of fat meat that does not increase plasma cholesterol levels.[16] This may be a probable explanation for lower HDL-C among individuals who consume vegetarian diet.

Though environmental factors such as lifestyle and nutrition, contribute variations in HDL-C level, about 70% of the variations in plasma HDL-C levels in humans are also known to be genetically determined.[18,19] It is also postulated that plasma variations in HDL-C concentration are determined by rate of production and the rate of catabolism of HDL particles.[16]

Conventionally, this anthropometric and metabolic profile among vegetarians may be attributed mainly to their diet that is lower in fat, saturated fat and protein and higher in complex carbohydrates and dietary fiber than the usual omnivorous diet and hence they exhibit lower risk factors for CVD and Type 2 diabetes compared to omnivores. However, other factors like presence of natural antioxidants that prevent oxidative modification of LDL may equally play a role in reduction of CVD.[11,16,] Henceforth, low fat diet is known to have better glycemic and lipid control.[20]

There is sufficient evidence that prevalence of almost all the studied cardiovascular risk factor progressively increased with age.[21] The prevalence of central obesity, hypertension, dysglycaemia and diabetes was maximum in the fifth decade of life.[15] In addition to CVD, its manifestations at an early age, especially among productive age groups of community, also adds to the burden of CVD.

So evaluating young adults in terms of cardiovascular risk factors and targeting preventive measures in them can reduce the burden of CVD. Also, one could speculate that timely measures in the form of dietary modification and dietary recommendation can not only be used for preventing or treating dyslipdaemias, obesity, hypertension, diabetes mellitus, coronary artery disease but also halting the progressive damage to the major organ systems due to these diseases.

CONCLUSION

Vegetarians have a more favourable lipid profile and anthropometry, with lower levels of total cholesterol, lower weight, body mass index, waist and hip circumference when compared to non-vegetarians, that reduces cardiovascular risk among them. Identifying young adults with unfavourable metabolic profile and adapting suitable dietary modifications tends to reduce the burden of cardiovascular disease particularly in developing countries.

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