

Influence of Dietary Habits on Blood Pressure in Preadolescent Boys of Coastal Karnataka

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ABSTRACT

Background: The relationship between dysregulation of cardiovascular autonomic functions and development of the hypertension has been well established in adults. Apart from the genes and environmental factors, obesity, sedentary lifestyle and dietary habits are the important contributors of increasing prevalence of hypertension even in youngsters. Studies on adults revealed that the vegetarian diet appears to be low in factors positively related to blood pressure when compared with non vegetarian diet.

Aims & Objective: This study was designed to find the impact of vegetarian and non - vegetarian diet on blood pressure regulation in early part of the life, like preadolescent boys.

Materials and Methods: The study was conducted on 100 vegetarian and 87 Non-vegetarian pre-adolescent boys from Mangalore aged between 9-13 years. The parameters studied were BMI and Blood Pressure (Basal Supine, and hand dynamometer stress test). Values obtained were analyzed by paired and unpaired 't' test and P value <0.05 was considered as significant.

Results: The results showed that basal systolic blood pressure (SBP) and diastolic blood pressure (DBP) were increased in non-vegetarians. Both SBP and DBP increased significantly in both the groups during handgrip dynamometer test. But on analysis of these changes in SBP and DBP, only change in DBP was significantly more in vegetarians.

Conclusion: Diet regulates blood pressure by influencing the autonomic activity as early as pre adolescent age group. Increased sympathetic tone at rest and a borderline response to handgrip dynamometer stress test in non vegetarians may act as a predisposing factor for the future development of cardiovascular disorders.

KEY WORDS: Hypertension; Vegetarian; Non Vegetarian; Preadolescent; Handgrip Dynamometer

INTRODUCTION

Hypertension is reported to be the fourth contributor to premature death in developed countries and the seventh in developing countries.^[1] Prevalence of hypertension is rapidly increasing in developing countries and is one of the leading causes of death and disability in developing countries including India.^[1,2] Essential hypertension (hypertension of unknown etiology) has been observed among children. This elevated blood pressure can later manifest as adult hypertension.^[3-6] The Muscatine study has shown the load of hypertension were in the range of 5.4 to 19.4%.^[7-10] Guidelines were hence formulated to include the measurement of BP in pediatric examination.^[3,11]

In adults, the interactions between genes and environmental factors could explain the pathogenesis of essential hypertension in different population.^[12] Age, gender, race, smoking, serum cholesterol, glucose intolerance, sedentary life style, dietary habits and obesity will contribute to the prognosis of the disease.^[13-15] In children blood pressure is affected by age, sex, body size, obesity and socioeconomic status.^[3,7,10]

Prevalence of high blood pressure and obesity is less seen in vegetarians and vegans as compared to non vegetarians in western affluent families. Vegetarian diet is sufficient for infancy, childhood and adolescence as recommended by American Dietetic Association and Dieticians of Canada.^[16] Comparison of vegetarian and non-vegetarian diet shows that vegetarian diets has relatively large amounts of cereals, pulses, nuts, fruits and vegetables. Vegetarian diets are usually rich in carbohydrates, n-6 fatty acids, dietary fibre, carotenoids, folic acid, vitamin C, vitamin E and magnesium and relatively low in protein, saturated fat, long-chain n-3 fatty acids, retinol, vitamin B12 and Zinc; vegans can have particularly low intakes of vitamin B12 and low intakes of Calcium.^[17]

The vegetarian diet when compared with non vegetarian diet appears to be low in factors positively related to blood pressure, and high in protective factors^[18], this is supported by previous studies showing a high prevalence rate for hypertension in adult non vegetarians in different part of the world.^[19-21] Thus identifying a relation between dietary habits and risk for future development of hypertension in children and adolescents will help in prevention of adult hypertension.

Objective: This study was designed to find the impact of vegetarian and non – vegetarian diet on blood pressure in early part of the life, like preadolescent boys.

MATERIALS AND METHODS

The pre adolescent boys with an age group of 9-13 years were recruited from the schools around Mangalore. The study was approved by the Institutional Ethics committee. The study subjects were briefed about the procedure and informed assent was obtained from each participant and consent from their parents prior to the commencement of the study. A detailed history regarding their dietary habits and history suggestive of any cardio respiratory or any other systemic illness was elicited. Based on the dietary history, participants were divided into two groups as vegetarians and non vegetarians. Those who consumed food from only plant source and milk were classified under the category of vegetarians. Those consuming food from animal source such as meat (both red and white) at least for three days in a week were considered as non vegetarians. Those who ate non vegetarian food occasionally and with cardiovascular disorders were excluded from the study. Based on these criteria a total of 187 preadolescent boys were recruited in this study, out which 100 were vegetarians 87 were non vegetarians.

Subjects were weighed in clothing using a digital load cell balance (Soehnle, West Germany) which had a precision of 0.1 kg. The heights of the subjects were recorded without footwear, using a vertically mobile scale (Holtain, Crymych, United

Kingdom) and expressed to the nearest 0.1 cm. BMI was calculated from the height and weight as follows; BMI= weight (kg)/height² (meters). After allowing the participants to take rest at the same position for a minimum period of ten minutes, the BP was recorded in supine position (JNC 7 Criteria) in the right arm to the nearest 2mm Hg using the mercury sphygmomanometer (Diamond Deluxe; Industrial Electronic and Products, Electronic Co-op Estate, Pune, India). Two readings were taken 5 minutes apart and the mean of two was taken as the BP. Following this participants were asked to change their position to standing and again immediately blood pressure was recorded.

Handgrip strength (HGS) and handgrip endurance (HGE): HGS was determined using a handgrip dynamometer (HDM) (INCO, Ambala, India) by asking the subject to maintain a maximal voluntary contraction for at least 3 seconds with the dominant arm outstretched in front and parallel to the ground. HGE was determined by noting the maximum time (seconds) for which the subject could maintain 1/3 of MVC. The subject was asked to press a handgrip dynamometer at 30% of maximum voluntary contraction and the systolic and diastolic blood pressure was recorded.

Statistical Analysis

Data are expressed as mean ± SD. The data was analyzed statistically by using the statistical software SPSS ver 17 & MS Excel. Intergroup comparisons were done using Student’s unpaired *t*-test and paired *t*-test was used to compare the values obtained within the same group. Differences in means were considered statistically significant when the two-tailed P value <0.05.

RESULTS

In the present study out of the total 187 preadolescent boys recruited, a group of 100 were vegetarians and age matched group consisting of 87 boys were non vegetarians. On comparison, the anthropometric parameters like

height and weight showed no significant differences between the two groups, but there was a slight increase in BMI in the non vegetarian group when compared to the vegetarians. (Table1)

Table-1: Anthropometric Data

Parameters	Vegetarians (n=100)	Non Vegetarians (n=87)
Height in cm	136.44 ± 5.18	137.22 ± 5.80
Weight in Kg	36.95 ± 4.57	38.18 ± 4.24
BMI	19.79 ± 1.59	20.24 ± 1.46*

Values are in Mean ± SD; * Significant –unpaired t test

Mean supine systolic and diastolic blood pressure in the case of non vegetarians is more than the vegetarians. (P<0.0001) (Table 2)

Systolic and diastolic B.P in both the groups of vegetarians and non vegetarians showed a statistically very high significant increase from their resting values during HDM test. However both groups did not show any significant difference in mean values of SBP and DBP recorded during the HDM test. (Table 2)

Table-2: Systolic and Diastolic Blood Pressure Variation during HGP

Parameters		BP (mm Hg)	
		Vegetarians (n=100)	Non Vegetarians (n=87)
At rest (Supine Position)	SBP	89.52 ± 4.25	91.41 ± 5.42**
	DBP	61.76 ± 3.52	64.23 ± 4.75**
Hand Grip Test	SBP	100.38 ± 4.6*	101.86 ± 5.85*
	DBP	76.88 ± 3.54*	76.21 ± 5.02*
Delta Values	SBP	10.86 ± 2.22	10.46 ± 2.46
	DBP	15.12 ± 2.52	11.98 ± 2.16**

Values are in Mean ± SD; *Significant (p<0.0001) - Paired test; ** Significant (p<0.0001) - Unpaired t test

The difference between the values of SBP and DBP recorded at rest and during isometric exercise (HDM) were calculated (delta values). The present study did not observe any significant difference in mean values of delta SBP between both the groups, but a significant increase in mean delta value of DBP in vegetarians was observed in comparison with non vegetarians (Table 2). Moreover the change observed in the DBP of vegetarians during isometric exercise was normal.

DISCUSSION

Earlier epidemiological studies have shown that vegetarian diet leads to blood pressure reduction in both normotensive and hypertensive subjects independent of dietary sodium. Vegetarian life style is associated with less of a rise of blood pressure with age and a decreased prevalence of hypertension.^[22]

In the present study an attempt was made to find the effect of diet on blood pressure regulation in early part of life as in preadolescents. Participants of this study were age and height matched that excludes the influence of these two factors on the blood pressure as mentioned in the earlier studies^[3,7,10] however two groups differ in BMI even though the mean values were within the limits of normal weight for both the groups. BMI was significantly higher in non vegetarian group could be one of the explanation for blood pressure changes observed in this group. This increased BMI may also suggestive of higher dietary intake of saturated fat.

At resting conditions, current study noticed a significant increase in SBP and DBP in non vegetarians. 7-year blood pressure follow-up study by Miura et al.^[23], has revealed that intake of vegetables and fruits were related to less increase in SBP and DBP over time, independent of age. They also observed that those consuming higher intake of red meat had a significantly greater increase in blood pressure and men with a higher fish and white meat intake had less increase in blood pressure. A higher resting SBP was also observed by Melby et al.^[18], in adult Black Adventist non vegetarians when compared with vegetarians. Similar to the findings of present study were also observed by Varshney et al.^[24], but in an age group of young adults. These findings indicate that vegetarian diet has an impact on lowering BP and current study provides evidence that such an effect can be observed even in the early part of the life as preadolescent age group.

Evaluation of circulatory alterations during sustained isometric muscle contractions is a

useful method to assess cardiac function.^[25] So handgrip dynamometer test was performed to elicit the sympathetic cardiovascular functions during the isometric exercise. The normal response includes an elevation of arterial blood pressure which is primarily due to an increase in cardiac output, with little or no change in systemic vascular resistance. The augmented cardiac output results from an increase in heart rate, since stroke volume remains relatively unchanged. This leads to an increase in total peripheral resistance which intern increases diastolic blood pressure significantly.^[26] Ewing et al.^[27], have defined a rise of diastolic blood pressure of 15 mmHg or more as normal, 11–15 mmHg as borderline and 10 mmHg or less as abnormal, response to Handgrip dynamometer test. Present study noticed a normal rise in diastolic blood pressure in vegetarian children, however in non vegetarian children a borderline rise in DBP was observed. Similar finding were also observed by Nageswari et al.^[28], in their study on obese school children. These findings in the form of elevated baseline blood pressure in non vegetarians is suggestive of derangements in the sympathetic cardiovascular function and borderline response to handgrip dynamometer test in the non vegetarian children points towards autonomic instability with an increased risk for future development of hypertension.

CONCLUSION

Dietary factors play a critical role in the prevention and treatment of hypertension. Sympathetic over activity and enhanced basal vasoconstrictor tone depicted by increased DBP could make non vegetarian children more prone to hypertension and other cardiovascular disorders later in life. However present study does not evaluate the genetic predisposition of participants to hypertension.

Since along with dietary habits, sedentary lifestyle and genetic factors also plays a major risk factor for the development of hypertension a study evaluating all these factors may throw more light in this field.

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