Original Research Article

Screening for metabolic syndrome in children aged 10-18 years with parental history of premature coronary artery disease

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ABSTRACT

Background: The metabolic syndrome is appearing with increasing frequency in children and adolescents and is characterized by the clustering of abdominal obesity, impaired fasting blood glucose (FBS), hypertriglyceridemia, low HDL cholesterol and hypertension. Objective of this study was to screen for components of metabolic syndrome in children aged 10-18 years with parental history of premature coronary artery disease (CAD) and to compare them with children without parental history of premature coronary artery disease.

Methods: A total of 90 children each between the ages of 10-18 years were selected as the study group and comparison group. These children were screened for components of metabolic syndrome like fasting blood sugar, hypertension, obesity and dyslipidemia. Diet and hours of physical activity were assessed. Statistical analysis was carried out through SPSS for windows (version 17.0).

Results: The most common component of metabolic syndrome in the study group was abnormal FBS followed by elevated triglycerides, low HDL cholesterol, obesity and hypertension. The mean values of FBS, Systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol, triglycerides were found to be significantly higher in the study group. Children in the study group had a higher mean body mass index (BMI) and a history of excessive oily food intake with a sedentary lifestyle.

Conclusions: Children with parental history of premature coronary artery disease have higher incidence of dyslipidemia and abnormal FBS. Children in the study group had a sedentary lifestyle with unhealthy diet practices.

Keywords: Lipid profile, Metabolic syndrome, Obesity

INTRODUCTION

The incidence of coronary artery disease (CAD) in the young has been reported to be 6% in Indians.¹

CAD in Indians has been shown to be premature, occurs at an early age and is more aggressive, extensive and malignant.

Primary prevention of CAD is important as approximately 1/4 to 1/3 of first Myocardial Infarction results in death.

Metabolic syndrome in children

The metabolic syndrome which is appearing with increasing frequency in children and adolescents is characterized by the clustering of abdominal obesity, impaired fasting glucose, insulin resistance, hypertriglyceridemia, low HDL cholesterol, and hypertension.² Atherosclerotic process begins in childhood and is influenced by genetics, diet and life style. The changes in arteries that precede formation of intimal plaques are present in life as early as 3-9 years of age. The only way to significantly alter the cause of

atherosclerosis is to attack the constitutional and environmental precursors long before the overt symptoms become manifest. Hence, in the present context it is very important that we identify metabolic syndrome in these high-risk group children whose parents are already suffering from premature CAD so that, we prevent the progression of metabolic syndrome by appropriate diet and lifestyle modifications in these children who are at high risk for health complications and safeguard the health of our future citizens. Therefore, the present study was undertaken.

Objectives

Primary

To screen for components of metabolic syndrome in children aged 10-18 years with parental history of premature CAD and to compare them with children without parental history of premature CAD.

Secondary

To study diet and life style factors in study group having family history of premature CAD.

METHODS

The present study was a comparative study conducted from January 2014 to June 2015. A total of 90 children each were selected as the study group and comparison group. Children aged 10-18 years whose parents were diagnosed with premature CAD at our Department of Cardiology, Mysore were taken as the study group. The age cut off for parents with premature CAD was a <65 years for females and <55 years for males. Healthy children aged 10-18 years whose parents did not have premature CAD were selected from the outpatient department as the comparison group.

All children having cardiovascular disorder, endocrine diseases like type 1 diabetes, Cushing's syndrome or renal diseases were excluded from the study. After obtaining the written informed consent from parents of all children included in the study, each child and parent was evaluated as per predesigned proforma. Parent's CAD status was taken into account by their history, medical

case sheets, and laboratory data. For children, dietary information, intake of junk food and hours of physical activity were noted. In both the groups blood pressure was measured by auscultatory method using standard mercury sphygmomanometer. Hypertension was defined as per IDF criteria.³

All the children included were subjected to evaluation of the physical growth namely weight, height, waist circumference and body mass index as per standard norms by the same coinvestigator after verifying the equipment. Waist circumference values were interpreted according to IDF criteria.³ BMI was calculated using height (in meters), weight (in kg) using the formula kg/m^2 . CDC charts were used for interpretation.⁴ Obesity was defined according to IDF criteria.³ Blood samples for lipid profile and fasting blood glucose (FBS) were done after 12 hours of fast and sent to the central lab, Biochemistry, K R Hospital. The cut-off values for abnormal lipid levels were considered according to the National cholesterol education programme (NCEP) guidelines for children.⁵ FBS levels more than 100 mg/dl were considered abnormal according to IDF criteria.³

As a part of ethical issue, those children who were diagnosed as having metabolic syndrome in our study were further counselled regarding a healthy diet and lifestyle.

Statistical analysis

Considering the prevalence of premature CAD to be 6% in India and a 0.05 significance level, a sample size of 180 children (90 cases and 90 controls) between 10-18 years were selected for the study. All the statistical methods (descriptive statistics, chi square/contingency coefficient analysis, independent samples t-test) were carried out through the SPSS for windows (version 17). Lipid levels/BMI/Hypertension/FBS were expressed as the mean, SD.

RESULTS

A total of 90 children each were selected as the study group and comparison group. The mean age of the children in the present study group was 14.43 ± 2.6 years and 12.98 ± 2.5 years in the comparison group.

Table 1: Fasting blood sugar values (FBS) among the study group and comparison group-IDF criteria.³

			Study group	Comparison group	Total
Fasting Blood Sugar	Abnormal	Count	16	0	16
		% of total	8.9%	0%	8.9%
	Normal	Count	74	90	164
		% of total	41.1%	50.0%	91.1%
Total		Count	90	90	180

P value: 0.000

16 children were found to have abnormal FBS values in the study group according to the IDF criteria whereas in the comparison group all the 90 children had normal FBS values. There was a statistical difference between the two groups (P value: 0.000).³ Also, the mean value of FBS was found to be higher in the study group than the comparison group which was statistically significant (p value <0.001).

Comparison of blood pressure (BP)

BP values have been interpreted according to the IDF criteria.³ The IDF criteria for metabolic syndrome includes different values for SBP and DBP. In the study group only 2 children had high SBP values and 1 child was found to have high DBP values. All the children in the comparison group had normal SBP and DBP values. There was no statistically significant difference between the two groups. However, the mean SBP and DBP were found to be higher in the study group when compared to the comparison group which was statistically significant as shown in Table 2.

Table 2: Mean systolic and diastolic blood pressure values among the study group and comparison group.

	Group	No	Mean±SD	P-value
Systolic BP (in mm Hg)	Study group	90	108.62±7.959	<0.001
	Comparison group	90	99.51±6.917	
Diastolic BP (in mm Hg)	Study group	90	69.51±5.862	<0.001
	Comparison group	90	63.78±6.551	

Table 3: Mean lipid profile values among the study and the comparison groups.

	Group	No.	Mean±SD	P value
Total cholesterol (mg/dl)	Study group	90	146.13±22.351	<0.001
	Comparison group	90	113.78±21.871	
Triglycerides (mg/dl)	Study group	90	107.01±48.211	<0.001
	Comparison group	90	84.03±18.436	
HDL (mg/dl)	Study group	90	45.93±6.333	0.186
	Comparison group	90	47.09±5.289	
LDL (mg/dl)	Study group	90	85.03±22.750	0.051
	Comparison group	90	78.90±18.944	

Comparison of lipid profile values

Total cholesterol (TC)

Among the study group, 9 children had borderline high TC values and 1 child had high TC value according to

NCEP cut offs.⁵ In the comparison group only 1 child had borderline high TC values and the rest of them had normal values. There was a statistically significant difference between the two groups (p value- 0.019). The mean TC was higher among the study group with a statistical significance.

Triglycerides (TG)

Serum triglyceride values were compared according to the IDF criteria.¹² 12 children in the study group had high triglyceride values whereas in the comparison group, all the children had normal triglyceride values which was statistically significant (p value-0.000). The mean triglyceride levels were found to be higher among the study group which was statistically significant.

HDL

Serum HDL values were compared according to IDF criteria.³ According to the IDF criteria, among the study group, 10 children had low HDL levels whereas in the comparison group, 6 children had low HDL levels. There was no statistically significant difference between the two groups (p value: 0.295). There was no statistically significant difference in the mean HDL levels between the two groups

LDL

According to the NCEP cutoffs among the study group, 6 children had borderline high LDL levels, 3 children had high LDL levels and 81 children had normal LDL levels. In the comparison group, only 4 children had borderline high LDL values which was not statistically significant (P value: 0.170). There was no statistically significant difference in the mean LDL levels between the two groups.

Table 4: BMI values among the study and comparison groups.

	Group	No.	Mean±SD	P value
BMI (kg/m ²)	Study group	90	18.79±3.994	<0.001
	Comparison group	90	15.92±2.726	

Comparison of BMI and waist circumference values

Among the study group, 68 children had a normal BMI according to the CDC cut offs.⁴ Two children were obese, 1 child was overweight, and 19 children were underweight. Among the comparison group, 47 children had a normal BMI and 43 were underweight, none of the children were overweight or obese. There was a statistically significant difference between the two groups (P value: 0.001). The mean BMI was also found to be higher in the study group which was statistically

significant as shown in Table 4. Among the study group, according to the IDF criteria, 8 children had abnormal waist circumference values and in the comparison group all the children had normal waist circumference which was statistically significant (P value: 0.007).

Comparison of oily food intake and physical activity

20 children in the study group and only 5 children in the comparison group had a history of excessive oily food intake which was statistically significant (P value-0.001). Intake of oily foods more than 3 times a week was considered to be excessive.⁶ 17 children in the study group and 6 children in the comparison group had a history of decreased physical activity according to WHO criteria which was statistically significant (P value: 0.014).⁷

Table 5: Frequency of individual components of metabolic syndrome among the study and comparison groups-IDF criteria.

Components	Cases (% of study group)	Controls (% of study group)
Fasting blood sugar	16 (17)	0 (0)
Elevated triglycerides	12 (13)	0 (0)
Low HDL	10 (11)	6 (6.7)
Obesity	8 (9)	0 (0)
Hypertension	4 (4.4)	0 (0)

Comparison of metabolic syndrome

Only one child in our study had all the components of metabolic syndrome in the study group according to IDF criteria.³ There was no statistically significant difference between the two groups. However, in the present study, as shown in Table 5, the most common component of metabolic syndrome in the study group was abnormal FBS followed by elevated triglycerides, low HDL, obesity and hypertension).

DISCUSSION

Body Mass index (BMI) comparison

In the present study, the mean BMI of the study group (8.79 ± 3.9 kg/m²) was found to be significantly higher than the comparison group (15.92 ± 2.7 kg/m²). Present results were comparable with a similar study conducted by Savitha et al.⁸ The mean BMI in their study was 20.7 ± 3.36 kg/m² in the cases and 18.9 ± 2.2 kg/m² in the control group. However, in the studies conducted by Dutta et al and Rallidis et al there was no statistically significant difference in the mean BMI values between the two groups.^{9,10}

In the study conducted by Dutta et al, the children were in the age group of 5-18 years and the sample size was only 90 (45 cases and 45 controls) which was small when

compared to the present study. In the study conducted by Rallidis et al, even though the sample size was adequate (104 cases and 89 controls) the age group of the children was between 6 years to 25 years of age which was very different from our study which only included children between the age group of 10-18 years. This could have led to the difference in the mean values of BMI between the studies.

Physical activity comparison

Majority of the children in the study group had a sedentary lifestyle when compared with the comparison group which was similar to a study by Savitha et al.⁸

Comparison of FBS

In our study, the mean FBS values were found to be more in the study group (87.19 ± 12.6 mg%) when compared to the comparison group (79.32 ± 9.10 mg%). The present study was similar to that done by Khalil et al with respect to mean FBS levels.¹¹

Comparison of BP values

The mean SBP was found to be higher in the study group (108.62 ± 7.9 mm Hg) than the comparison group (99.51 ± 6.9 mm Hg) in our study which was similar to a study conducted by Khalil et al with a statistically significance.¹¹ The mean DBP was found to be higher in the study group (69.51 ± 5.8 mm Hg) than the comparison group (63.78 ± 6.5 mm Hg) in the present study which was similar to the study conducted by Khalil et al.

Metabolic syndrome in children

In the present study the most common component of metabolic syndrome in the study group was abnormal FBS followed by elevated triglycerides, low HDL, obesity and hypertension. The most common component in the comparison group was low HDL. Two components of metabolic syndrome were present in 2 children in the study group and 3 components were present in 4 children in the study group. Only one child had metabolic syndrome with all the components.

In a study conducted by Kelishadi R et al in 2007 in Iran, in children without a parental history of premature CAD, the most common components of metabolic syndrome identified were high triglycerides and low HDL.¹²

CONCLUSION

Children born to parents with premature CAD were found to have abnormal FBS, followed by elevated triglycerides, low HDL, obesity and hypertension when compared to controls. Children born to parents with premature CAD were found to have excessive oily food intake and a sedentary lifestyle.

Recommendations

Screening for components of metabolic syndrome in children with parental history of premature CAD should be initiated at an early age.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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