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A study on the prevalence of metabolic syndrome in dyslipidemic subjects

URMILA VIJAYAN* AND V.B. AKHILA
Assistant Professor (On contract)
Department of Home Science, Vimala College, Thrissur (Kerala) India

ABSTRACT

Dyslipidemia or disorders of lipoprotein metabolism marked by an altered lipid profile (low HDL cholesterol, high LDL cholesterol, high total cholesterol, high triglycerides) along with the promotion of insulin resistance leads to the clinical condition known as metabolic syndrome in obese individuals. The National Cholesterol Education Program's Adult Treatment Panel III report (ATP III) identified the metabolic syndrome as a multiplex risk factor for cardiovascular disease (CVD). The present study was conducted among hundred dyslipidemic subjects from both sexes in the age group of 30-50 years from Thrissur district. Subjects with dyslipidemia were identified and selected by purposive sampling techniques by examination of their medical records. A specially designed questionnaire was formulated to elicit the demographic details, medical history, dietary pattern analysis and biochemical profile of the subject. The anthropometric data revealed that majority (93%) of the subjects belonged to the category of grade I and grade II obesity. The medical history reveals the presence of multiple medical problems such as CVD, HTN, DM and Obesity among the subjects. The mean nutrient intake of the subjects revealed that the calorie intake and fat intake of both sexes was high when compared with RDA. The food frequency data revealed a highest mean score for cereals and fats and oils; and a lowest score was obtained for green leafy vegetables, pulses and fruits. From the correlation tests a positive correlation was observed between obesity and dyslipidemia, energy consumption and BMI, fat intake and waist hip ratio. Among the selected 100 dyslipidemic subjects, 71 per cent had their waist to hip ratio above normal values. Ninety five per cent had their fasting blood sugar levels and 90 per cent had their Post prandial sugar levels above normal values. And 77 per cent had above normal Systolic blood pressure levels and 78 per cent had abnormal Diastolic blood pressure levels. The mean value of magnitude rate calculated from the above parameters is 82.2 per cent. The prevalence rate of metabolic syndrome was observed to be 71 per cent. Though the remaining subjects showed the presence of one or two components of the syndrome, they could not be included in the same as the term metabolic syndrome is a clustering of three or more components.

Key Words : Metabolic syndrome Dyslipidemic subjects, Anthropometric data, CVD, HTN, DM

INTRODUCTION

The metabolic syndrome (MetS) is a major and escalating public-health and clinical challenge worldwide in the wake of urbanization, surplus energy intake, increasing obesity, and sedentary life habits. Metabolic syndrome confers a 5-fold increase in the risk of type 2 diabetes mellitus (T2DM) and 2-fold the risk of developing cardiovascular disease (CVD) over the next 5 to 10 years (Alberti

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et al., 2009). Dyslipidemia or disorders of lipoprotein metabolism marked by an altered lipid profile (low HDL cholesterol, high LDL cholesterol, high total cholesterol, high triglycerides) along with the promotion of insulin resistance leads to the clinical condition known as metabolic syndrome in obese individuals. Individuals with metabolic syndrome are at increased risk for CHD (Lakka *et al.*, 2003). In Framingham, the metabolic syndrome alone predicted ~25% of all new-onset CVD. The prevalence of metabolic syndrome has increased significantly in recent years, and this increase has been attributed, for the most part, to rapid socio economic growth and change in life style (Chedid *et al.,* 2009). MetS is considered as a first order risk factor for atherothrombotic complications. Its presence or absence should therefore be considered an indicator of long-term risk (Grundy, 2006). High consumption of trans fats are worse than cholesterol levels because they lower good HDL. They also fire inflammation, an over activity of the immune system that has been implicated in heart disease, stroke, diabetes, and other chronic conditions. And they contribute to insulin resistance (Mozaffarian *et al.,* 2004). The objectives of the study are to assess the prevalence of metabolic syndrome in dyslipidemic subjects, to assess the risk factors and observe the life style of the subjects, to assess the biochemical and clinical status of the subjects, to assess the nutritional status of the subjects and to help implement necessary life style changes in the subjects.

Table 1 : ATP III Clinical Identification of the Metabolic Syndrome (Third report of the National Cholesterol Education Program, 2002)

Sr. No:	Risk Factor	Defining level
1.	Abdominal obesity, given as waist circumference[*†]	
	Men	>102 cm
	Women	>88 cm
2.	Triglycerides	≥1.7 mmol/L
3.	HDL cholesterol	
	Men	<1.04 mmol/L
	Women	<1.30 mmol/L
4.	Blood pressure	≥130/≥85 mm Hg
5.	Fasting glucose	≥ 6.1 mmol/L

METHODOLOGY

Hundred dyslipidemic subjects aged between 30-50 years were selected by purposive sampling method from few selected hospitals in Thrissur district and their medical records were examined. A specially designed questionnaire was formulated to elicit the demographic details, medical history, dietary pattern analysis and biochemical profile and clinical assessment of the subjects. Basic anthropometric measurements like body mass index and waist circumference were recorded. Biochemical parameters like total serum cholesterol, lipid profile, blood sugar levels (fasting and post prandial) and blood pressure of the subjects were recorded. Dietary assessment was done by food frequency score and 24 hour recall method. Food consumption pattern of the subjects were studied with respect to their food habits, frequency of use of food items and food and nutrient intake of the subjects. The results of the study were statistically analyzed applying different tests like chi-square and tests of descriptive statistics. Correlation tests were done to assess the association between selected parameters. Prevalence estimates were calculated using mean values of the corresponding medical conditions.

RESULTS AND DISCUSSION

Demographic and medical history :

Cardiometabolic abnormalities were more prevalent in urban populations (Ramachandran *et al.,* 2004). The rising prevalence of diabetes in India and other developing countries is chiefly attributed to urbanization (Verma and Madhu, 2000). Majority (86%) of the subjects belonged to the urban locality. 55 per cent of the subjects for the study was females. The results of the study showed that eighty eight per cent of the sample had no time to spare for exercise. Medical histories of the subjects revealed that majority (55 %) of the subjects were having multiple medical problems such as CVD, HTN, DM and Obesity. Twenty eight per cent of the subjects have a combination DM, Obesity and HTN. Another 10 per cent have Obesity and Cardiovascular disorders and remaining 7 per cent have both cardiovascular disorders and Diabetes mellitus. Obesity is linked to an increased production of inflammatory adipokines that may alter insulin sensitivity and muscle mass and is also linked to increased risk of CVD (Dominguez, 2007). Thirty per cent of samples have family history of diabetes mellitus, 18 per cent of obesity and remaining 13 per cent of cardiovascular disease. In the Botnia study, cardiovascular and overall mortality was higher in 35- to 70-year-old individuals with a family history of type 2 diabetes who had the metabolic syndrome as defined by the WHO (World Health Organization, 2002).

Anthropometric and clinical assessment :

The anthropometric data revealed that a maximum of 85 per cent of the samples had a BMI which was in the range 25-29.9 (grade I obese). 8 per cent had a BMI which greater than 30 (grade II obese). Remaining 7 per cent of the subjects had a BMI ranging from 20-24.9 which was considered to be normal. Of the total selected male subjects 24 per cent had a waist to hip ratio greater than 1 and 21 per cent of them had less than 1. Of the total selected female subjects 47 per cent had a waist to hip ratio greater than 0.8 and only 8 per cent of them had less than 0.8. Clinical assessment of the sample showed that majority (86 %) of the subjects have healthy nails and 45 per cent have healthy hair.

Dietary habits :

Dietary pattern of the subjects showed that about 95 per cent of the subjects were non vegetarians. Observational studies indicate that the weight and BMI of both male and female vegetarians on average is approximately 3 per cent to 20 per cent lower than that of non vegetarians (Susan *et al.,* 2006). It was found that 62 per cent of the samples consumed food from outside on a daily basis, about 18 per cent consumed it weekly and 2 per cent consumed occasionally. Food items frequently consumed from outside by the subjects fried items and chips, soft drinks and tea or coffee. Frequency of use of different food groups by the subjects was measured on a five point scale and lowest score was obtained for green leafy vegetables, pulses and fruits. The food and nutrient intakes of the subjects were determined by 24 hour recall method to assess the quantity and quality of nutrients presents their diet. The mean nutrient intake of the sedentary worker male and female subjects were calculated and compared with the RDA. The results revealed that the calorie and fat intake of both sexes was high. They met all the other nutrients except calcium, vitamin C and folic acid.

Biochemical details :

The biochemical parameters relevant in diagnosing the presence of metabolic syndrome like

lipid profile, blood sugar and blood pressure were analyzed. 49 per cent had total cholesterol between 200 to 250mg/dl (border line), 51 per cent had total cholesterol greater than 250mg/dl (at risk category) (Grundy *et al.,* 2004). 53 per cent had serum HDL cholesterol between 35-55mg/dl (borderline category); and 47 per cent had greater than 55mg/dl (at risk category). 29 per cent had normal serum LDL cholesterol value, 63 per cent had serum LDL cholesterol value between 160 to 180mg/dl (border line). Eight per cent had serum LDL cholesterol greater than 180 (at risk category). About 24 per cent had a normal serum VLDL value and 67 per cent of the sample had serum VLDL cholesterol value between 40 to 80 mg/dl (border line). Nine per cent had a serum VLDL value which was greater than 80 (at risk category). Hypertriglyceridemia is thought to increase the risk of coronary heart disease by two mechanisms. First and more important, triglyceride-rich lipoproteins such as very-low-density lipoprotein (VLDL) and intermediate-density lipoprotein (IDL) are thought to be atherogenic. Secondly, triglyceride-lipoprotein metabolism involves competition with high-density lipoprotein (HDL), leading to a decrease in HDL production and to denser LDL particles (Jacobson, 2006). 28 per cent had normal triglyceride value (less than 150 mg/dl).71 per cent had triglyceride value between 150 to 200 mg/dl (border line) and remaining 1per cent had triglycerides which were greater than 200 (at risk category). Elevated levels of LDL cholesterol and triglycerides with low levels of HDL cholesterol are powerfully associated with the development of CHD (Riccardi *et al.,* 2004). Blood sugar profile of the subjects showed that 5 per cent of the samples had normal fasting blood sugar value (70 – 110 mg/dl) and remaining 95 per cent had a fasting blood sugar value which was considered as above normal.10 per cent had normal post prandial blood sugar value and remaining 90 per cent had a value above normal. Insulin resistance is thought to be an underlying feature of the metabolic syndrome. Genetic abnormalities, fetal malnutrition, and visceral adiposity may play roles in the pathophysiology of insulin resistance and the metabolic syndrome (Lebovitz, 2001). Blood pressure profile of the subjects showed that 77 per cent had a systolic blood pressure which was considered as above normal and 74 per cent had a diastolic pressure which was considered as above normal. Studies suggest that hypertension is an important factor in the overall development of the phenotype "metabolic syndrome," with underlying "insulin resistance" as an etiology (Lithell and Landsberg, 2000).

Prevalence of metabolic syndrome :

Investigations done on the 100 dyslipidemic subjects revealed that 71 per cent had their waist to hip ratio above normal values. Ninety five per cent had their fasting blood sugar levels and 90 per cent had their post prandial sugar levels above normal values. And 77 per cent had above normal systolic blood pressure levels and 78 per cent had abnormal diastolic blood pressure levels. So it can be concluded that there is a high prevalence of metabolic syndrome in the dyslipidemic subjects. The mean value of prevalence rate calculated from the above parameters is 82.2 per cent.

Statistical analysis of the data :

The association between education and occupation of the samples with the development of diseases was analyzed statistically and showed significant association because of poor dietary habits and physical inactivity. Combination of CVD, HTN, Obesity, and DM were commonly seen in high educated and employed subjects (76.92 %). Combination of DM, HTN, and Obesity were more common in low or average educated and employed subjects (48.57%). Higher socioeconomic status, sedentary lifestyle, and high body mass index (BMI) were significantly associated with MetS. The differences in genetic background, diet, levels of physical activity, smoking, family

history of diabetes, and education all influence the prevalence of the MetS and its components (Cameron *et al.,* 2004). Obesity and hyperlipidemia was shown to be positively correlated. Obesity substantially increases the risk of type 2 diabetes, hypertension, cardiovascular disease, and all-cause mortality and the location of excess weight has been proven to be a strong determinant of cardiometabolic risk (Despres, 2006).

Table 2 : Test to analyze the association between education and occupation of the samples with the development of diseases

Disease	Low/Average		High		Df	χ^2 value	Table value
	No	%	No	%			
CVD + DM	5	14.29	2	3.08			
CVD + Obesity	8	22.86	2	3.08			
DM + HTN + Obesity	17	48.57	11	16.92	3	37.351**	11.34
CVD + HTN + DM + Obesity	5	14.29	50	76.92			
Total	35	100	65	100			

** significant at 0.01 level

Results show that fat intake and waist hip ratio, energy consumption and BMI were positively correlated. Consumption of energy-dense/high fat diets is strongly and positively associated with overweight that, in turn, deteriorates insulin sensitivity, particularly when the excess of body fat is located in abdominal region (Robinson *et al.,* 2009). A negative correlation between fat intake and hyperlipidemia was obtained.

Table 3 : Tests of descriptive statistics of different parameters

Parameters	*Normal range	Mean	Std. Deviation
BMI(kg/m^2)	20 - 24.9 Kg/m^2	26.68	1.855
Total cholesterol (mg/dl)	<200mg/dl	244.83	21.440
Triglycerides (mg/dl)	<150mg/dl	177.50	29.048
HDL (mg/dl)	>55mg/ dl	35.75	6.212
LDL (mg/dl)	<160mg/Dl	189.50	26.814
VLDL (mg/dl)	<40	52.27	15.398
FBS(mg/dl)	70 - 110 mg/dl	139.46	15.029
PBS(mg/dl)	120 - 140 mg/dl	175.74	21.211
Systolic blood pressure(mmHg)	120 mmHg	136.40	11.851
Diastolic blood pressure(mmHg)	80 mmHg	87.90	4.984

The above table (Raghuram *et al.,* 2007) reveals the descriptive statistics of anthropometric and biochemical parameters. The standard deviations from mean for the above parameters are quite high.

Diet counselling given to implement nutritional and lifestyle changes :

Counselling imparted to the subjects focused on disease management, diet management and prevention of complication. In disease management, the subjects were made to know about metabolic syndrome, its risk factors and complication and its influence on dyslipidemia. In diet management the importance of body weight maintenance, fibre rich foods, whole grain cereals, antioxidant foods, low glycaemic index foods, foods to be avoided and included were explained to the subjects. The subjects were asked to reduce/limit the intake of fat, salt, sugar, empty calorie foods and

refined cereal consumption. Preventive measures such as life style changes, exercise, and type of exercise and duration of exercise were emphasized to the subjects.

Conclusion :

According to the Third Adult Treatment Panel of the National Cholesterol Education Program (2002) the metabolic syndrome is defined as the presence of at least three of the following criteria, with or without diabetes: Central obesity, hypertriglyceridemia (≥150 mg/dl), low HDL cholesterol, elevated fasting glucose (>110 mg/dl), and hypertension (≥130/85 mmHg). The present study showed that higher educational levels and occupational categories were significantly associated with the syndrome prevalence in dyslipidemic subjects. The antropometric measurements data revealed that 85 per cent had a BMI which was in the range 25-29.9 (grade I obese). The data regarding mean nutrient intake of the subjects found that the calorie intake and fat intake of the male and female subjects was high. Based on the findings of the present study it can be concluded that metabolic syndrome components like obesity, fasting blood sugar, abnormal blood pressure, low HDL level, high LDL and triglycerides level are more prevalent in dyslipidemic subjects, showing a prevalence rate of 82.2 per cent in the hundred selected dyslipidemic subjects.

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