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Original Article

PREVALENCE OF METABOLIC SYNDROME IN IMPAIRED FASTING GLYCEMIC SUBJECTS.

ARTHI.R*, VINODHINI.V.M, W.EBENEZER WILLIAM, S.SWAMINATHAN

SRM medical college ladies hostel (III yr MBBS), SRM university, Kattangulathur, Chennai- 603203
E-mail: arthi.2093@gmail.com

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ABSTRACT

Objectives: The objective of the study was to determine the prevalence of metabolic syndrome in subjects with impaired fasting glucose. Since IFG is an intermediate stage in the development of diabetes and cardiovascular diseases it may be associated with abdominal obesity and atherogenic dyslipidemic profile.

Methods: 50 Subjects with impaired fasting glucose (IFG) and 50 normoglycemic adults in the age group of 18-45 years were selected for the study. Fasting blood samples were collected for glucose and lipid profile. Anthropometric measurements were measured.

Results: The prevalence of metabolic syndrome in patients with IFG according to the National Cholesterol Education Program Adult Treatment Panel (ATP) III was 38% and according to the Consensus definition for adult Asian Indians was 62%. The prevalence of metabolic syndrome in the euglycemic control group according to the National Cholesterol Education Program Adult Treatment Panel (ATP) III was 24% and according to the Consensus definition for adult Asian Indians was 24%.

Conclusion: The results of this study involving patients with impaired fasting glycemia shows an increased prevalence of metabolic syndrome. Identification of individuals with impaired fasting glycemia and screening for the presence of metabolic syndrome will help to decrease the morbidity associated with this condition.

Keywords: cardiovascular disease, diabetes, impaired fasting glycemia, metabolic syndrome

INTRODUCTION

Metabolic syndrome is characterised by the presence of risk factors such as central obesity, increased blood pressure, impaired glucose tolerance, altered lipid profile mainly low high density lipoproteins (HDL) and high triglycerides. Patients with metabolic syndrome are at an increased risk for development of diabetes mellitus and cardiovascular diseases [1, 2].

Impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) represent intermediate stages of abnormal glucose regulation that exists between normal glucose homeostasis and diabetes [2]. IFG is defined as elevated fasting plasma glucose concentration ≥ 100 mg/dl and < 126 mg/dl [3].IFG has received increasing attention in recent years, because it is an intermediate stage in the development of diabetes and cardiovascular diseases (CVDs) [4, 5, and 6]. Many cardiovascular risk factors (low HDL cholesterol, hypertension and elevated triglycerides) are prevalent in IFG [7].

Hyperglycemia is seldom an isolated metabolic abnormality and is often the consequence of abdominal obesity and is therefore commonly accompanied by an atherogenic dyslipidemic profile [8]. It has been documented that the waist circumference is one of the best anthropometric markers of abdominal visceral adipose tissue accumulation, especially the amount of intra-abdominal or visceral adipose tissue [9].

Tankova et al has demonstrated a rather high prevalence of metabolic syndrome in both IFG and IGT [10]. IFG is thus considered as a potential indicator of preventive importance for diabetes and CVDs [11].

Since IFG is the early stage of diabetes and cardiovascular diseases, identifying preventable risk factors associated with IFG at this early stage is very important in prevention and control of these diseases [12].

Lifestyle modifications have resulted in an early emergence of hyperglycemia and dyslipidemia especially in the urban population. Therefore we have analyzed a group of 50 impaired fasting glycemic subjects and 50 age matched euglycemic subjects for the prevalence of metabolic syndrome.

MATERIALS & METHODS

Study setting and study subjects:

The present cross-sectional study was carried out at SRM Medical College Hospital and Research Centre, SRM Nagar, Potheri. The subjects were selected randomly from participants who attended a screening programme for diabetes. The protocol was approved by the institutional ethical committee.

Sampling method and sample size:

50 Subjects with impaired fasting glucose (IFG) in the age group of 18-45 years were selected for the study. IFG is defined as elevated fasting plasma glucose concentration ≥ 100 mg/dl and < 126 mg/dl. 50 Normoglycemic adults in the age group of 18-45 years formed the control group. The written informed consent was obtained from each participant.

Patients with history of ischemic heart disease, clinical evidence of acute infection, renal and hepatic disease, hypo and hyperthyroidism, recent surgery/major trauma and patients on lipid lowering drugs were excluded from the study.

Anthropometric measurements:

BMI was calculated as the weight in kilograms divided by the square of the height in metres (kg/m^2). The waist circumference was measured at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest in mid inspiration. Arterial blood pressure measurements were taken as per standard procedures.

Laboratory analysis:

5 ml of venous blood was collected from the subjects after an overnight 12 hour fast. The serum was separated by centrifugation

at 3000 RPM for 10 minutes. The fasting blood sugar was estimated by glucose oxidase-peroxidase (GOD/POD) method; total cholesterol was estimated by cholesterol oxidase method: high density lipoprotein cholesterol (HDL-C) and LDL cholesterol by direct antibody inhibition method; and triglycerides by glycerol oxidase-peroxidase method.

The diagnosis of metabolic syndrome in the IFG and control groups was done on the basis of the consensus definition for adult Asian Indians [13] as well as according to National Cholesterol Education Program Adult Treatment Panel (ATP) III [14, 15].

According to the National Cholesterol Education Program Adult Treatment Panel (ATP) III, the diagnosis of metabolic syndrome was made when three or more of the following risk factors were present: a waist circumference >102 cm in men and >88 cm in women, fasting glucose ≥110 mg/dl, systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥ 85 mmHg, fasting triglycerides ≥150 mg/dl, and HDL cholesterol < 40 mg/dl in men and < 50 mg/dl in women. As Indians have higher body fat content than their western counterparts for the same BMI, lower cut-offs of waist circumference were used as suggested by Asia-Pacific guidelines. Waist circumference (WC) cut-offs were taken as >90 cm for males and >80 cm for females to define overweight [14, 15].

According to the Consensus definition for adult Asian Indians, the diagnosis of metabolic syndrome was made when three or more of the following risk factors were present: a waist circumference >90 cm in men and >80 cm in women, fasting glucose ≥100 mg/dl, systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥ 85 mmHg, fasting triglycerides ≥150 mg/dl, and HDL cholesterol < 40 mg/dl in men and < 50 mg/dl in women. The current guidelines have suggested a BMI of ≥23 and ≥25 kg/m^2 for overweight and obesity respectively and a waist circumference cut off for Asian Indians as >90 cm for men and >80cm for women[13].

Statistical analysis:

The data entry and analysis was done using SPSS15 version. Chi-square test was used to test the null hypothesis. [16]

OBSERVATIONS & RESULTS

In the IFG group the number of males was 41 (82%) and number of females was 9 (18%). In the euglycemic control group the number of males was 27(54%) and number of females was 23(46%). (Table I)

Table 1: It shows the sex distribution of the study subjects

Sex	IFG group(n=50)		Euglyemic Control group (n=50)	
Males	41	82%	27	54%
Females	9	18%	23	46%

The details of clinical biochemistry, blood pressure and anthropometric measurements of all the participants of the research are in the table 2.

Table 2: It shows the clinical biochemistry, blood pressure and anthropometric parameters

S.no	Parameters	Euglycemic Control group (n=50) (mean ± S.D)	IFG group (n=50) (mean ± S.D)	P-value
1	Weight (Kg)	67.54 ± 9.22	72.46 ± 11.09	0.018*
2	Height (Meters)	1.64 ± 0.07	1.66 ± 0.05	0.036*
3	BMI (Kg/m^2)	24.86 ± 2.91	26.28 ± 4.46	0.307
4	Systole (mm of Hg)	118.08 ± 13.99	126.28 ± 13.04	0.003*
5	Diastole(mm of Hg)	78.92 ± 9.31	85.52 ± 8.49	0.000*
6	FBS (mg/dl)	91.88 ± 4.53	107.24 ± 5.85	0.000*
7	Total Cholesterol (mg/dl)	157.96 ± 35.74	169.48 ± 33.30	0.099
8	HDL (mg/dl)	43.14 ± 9.62	40.36 ± 11.09	0.184
9	LDL (mg/dl)	107.96 ± 32.70	113.76 ± 31.12	0.366
10	TGL (mg/dl)	101.04 ± 59.64	134.78 ± 90.07	0.030*
11	Waist Circumference (Cm)	86.04 ± 10.10	88.92 ± 7.92	0.116

* P value <0.05

Based on the NCEP ATP III guidelines for diagnosis of metabolic syndrome, the most commonly observed components in the impaired fasting glycemic group of this study were high blood pressure(56%), low HDL(56%) followed by increased waist circumference (54%), high fasting blood glucose (24%) and high triglycerides(26%).

Based on the NCEP ATP III guidelines for diagnosis of metabolic syndrome, the most commonly observed components in the euglycemic control group of this study were low HDL (60%) followed by increased waist circumference (54%), high blood pressure (32%) and high triglycerides (18%).

The prevalence of metabolic syndrome in patients with IFG according to the National Cholesterol Education Program Adult Treatment Panel (ATP) III was 38% and according to the Consensus definition for adult Asian Indians was 62%.

Table 3: It shows the prevalence of metabolic syndrome in the euglycemic and impaired fasting glycemic group.

Criteria	IFG group(n=50)		Euglycemic Control group (n=50)	
NCEP ATP III	19	38%	12	24%
Consensus definition	31	62%	12	24%

The prevalence of metabolic syndrome in the euglycemic control group according to the National Cholesterol Education Program Adult Treatment Panel (ATP) III was 24% and according to the Consensus definition for adult Asian Indians was 24%. (Table 3)

Table 4. It shows the proportion of adults with metabolic syndrome according to consensus definition for adult Asian Indians

IFG Group		Euglycemic control group		Chi square P value
31	62%	12	24%	x^2 =14.7 df = 1 p = <0.001

DISCUSSION

Prevalence of metabolic syndrome is high among Asians including Indians, and is rising, particularly with the adoption of modernized lifestyle [17, 18, and 19].

In the present study, the prevalence of metabolic syndrome in patients with impaired fasting glycemia was found be 62% according to the consensus definition for adult Asian Indians [13] and 38% according to the National Cholesterol Education Program Adult Treatment Panel (ATP) III criteria [14, 15].

IFG is considered to be a pre diabetic state [20]. Patients with diabetes or IFG have a substantially higher risk of cardiovascular events [21]. Lifestyle modifications have resulted in an increased prevalence of dysglycemia in young individuals [22].

In our study the increased prevalence of components of metabolic syndrome in patients with impaired fasting glycemia when compared to the euglycemic group indicates the major role of hyperglycemia in the pathogenesis of metabolic syndrome.

Table 5: It shows the proportion of adults with the components metabolic syndrome according to consensus definition for adult Asian Indians.

Parameters	IFG Group		Euglycemic control group		Total
	Male	Female	Male	Female	
Blood Pressure (systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥ 85 mmHg,)	24	4	12	4	44
Fasting glucose (≥100 mg/dl)	41	9	0	0	50
HDL cholesterol (< 40 mg/dl in men and < 50 mg/dl in women)	20	8	16	14	58
Fasting triglycerides (≥150 mg/dl)	10	3	8	1	22
Waist circumference (>90 cm for males and >80 cm)	19	8	12	15	54

Hyperglycemia due to insulin resistance is characterised by dyslipidemia and inflammation [23].Fasting blood glucose is often associated with other adverse CVD risk factors and may serve to identify patients with hypertension and dyslipidemia [24]. There is increasing evidence indicating that elevated triglyceride levels are independent risk factors for cardiovascular disease. [25]

Abdominal obesity is increasingly being recognized as an important cardiovascular risk factor [26]. In some studies, association of abdominal obesity with various metabolic risk factors appears to be stronger than generalized adiposity [27, 28]. Common surrogate measures of abdominal obesity are WC and WHR [13].

In this study we have found the prevalence of abdominal obesity in patients with impaired fasting glycemia to be 54%. Higher abdominal fat (android obesity) is known to be a risk factor for hypertension, hypertriglyceridaemia, hyperinsulinaemia and diabetes [29, 30, 31].

A recent meta-regression analysis of prospective studies of WC and WHR as predictors of cardiovascular events has shown that both the measures are associated with the risk of incident CVD [32].

Ramchandran *et al*, reported the prevalence of metabolic syndrome to be 41% in urban area of Chennai using modified ATP-3 criteria among adults aged 20 to 75 yr [33].

Mishra *et al* reported 30 per cent prevalence among the urban slum population in Delhi [34]. Individuals with this condition have an elevated risk of developing cardiovascular diseases and type 2 diabetes in different ethnic populations [35, 36].

The ICMR task force collaborative study reported the prevalence of metabolic syndrome to be 30 per cent in urban areas of Delhi and 11% in rural Haryana using ATP-3 criteria [37]. The presence of metabolic syndrome was seen in 5.0 per cent rural adults of Wardha by ATP-III criteria [38].

In a study involving 150 rural women in a primary health centre of Tamil Nadu the prevalence of metabolic syndrome was found to be 36% based on the modified NCEP ATP III criteria [39].

Studies involving a larger population will help us to understand the impact of impaired fasting glycemia in the pathogenesis of metabolic syndrome and its complications.

CONCLUSION

The result of this study involving patients with impaired fasting glycemia shows an increased prevalence of metabolic syndrome. Identification of individuals with impaired fasting glycemia and screening for the presence of metabolic syndrome will help to decrease the morbidity associated with this condition. This study highlights the importance of impaired fasting glycemia in the pathogenesis of metabolic syndrome.

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