Type 2 Diabetes Mellitus And Risk Factors Of Metabolic Syndrome In Rural Population Of Greater Noida U.P (INDIA)

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ABSTRACT: Type 2 diabetes mellitus (T2DM) is currently leading cause of mortality worldwide and together with risk factors of metabolic syndrome (MetS), poses a serious health threatening disease in the Asian Indian population. The present study seeks to evaluate the T2DM and risk factors of MetS in rural population. There are no reported data on T2DM and risk factors of MetS in rural population of Greater Noida, U.P India.

Aim: To find out the effect of T2DM and the risk factors of MetS in rural population of Greater Noida U.P.

Material and methods: A total of one hundred eighty four participants were recruited in the study, aged 20 to 55 years. Comprising, 149 patients (80 M, 69 F) and 35 controls (18 M, 17 F) healthy age, sex matched from the study area. Clinical and laboratory examination, data, information were obtained from participants. Blood pressure (BP), waist circumference,fasting blood glucose (FBG), triglycerides, high density lipoprotein (HDL) and glycated haemoglobin (HbA1c) were performed in rural populations. Data were analyzed by using Statistical Package for Social Survey (SPSS) for windows 16.0 software (SPSS Inc., Chicago, IL, USA) and the result were expressed as mean ± SD.

Results: Out of 22 patients with T2DM 10 were males, and 12 were females comprising of 12.5% and 17.4% respectively. As per NCEP ATP III criteria, three risk factors of MetS out of five were present in 13.8% in male and 18.8% in female in rural population.The outcome of the present study revealed that there is a strong association between T2DM and risk factors of MetS.

Conclusion: The T2DM is a precursor of MetS risk factors, hence routine screening for both T2DM and risk factors of MetS are justified. The T2DM and risk of MetS patients had elevated fasting blood glucose, hypertriglyceridemia, central obesity and reduced levels of high density lipoprotein (HDL-C) indicating that diabetes patients were more prone to have a risk of MetS.

Keywords: Body mass index, Patient, Glycated haemoglobin, Hpertriglyceridemia, Central obesity.

INTRODUCTION:

The type 2 diabetes mellitus is one of the most common endocrine disorder in all age group populations. It is a type of syndrome disturbed in intermediary metabolism, characterized by hyperglycemic disturbance of carbohydrate, fat and protein metabolism.Which is caused by decreased sensitivity of tissues to insulin or inadequate insulin secretion

or both [1,2]. India leads the world with the largest number of diabetic patients and is often referred to as the diabetes capital of the world [3] with a projected 109 million individuals with diabetes by 2035. The disease currently affects more than 62 million Indians, which is more than 7.1% of India's adult population [4, 5]. MetS is a multiplex risk factor for T2DM and atherosclerotic cardiovascular disease (ASCVD). The risk factors of MetS were defined using NCEP ATP III criteria any three of following risk factors were required to diagnose the MetS. The BP ≥130/85 mmHg, central obesity: WC >102 cm (male), >88 cm (female), hypertriglyceridemia ≥150 mg/dl, low HDL-C <50mg/dl (female), <40 mg/dl (male) and hyperglycemia ≥110 mg/dl respectively. The incidence of MetS in South Asian country was estimated 20-25 % and many more may be prone to have it [6]. The incidence of MetS is high in India and other developing countries where it is rising alarmly, particularly with increasing rapidly, unplanned urbanization, which has led to, alteration of lifestyle, characterized by lack of physical activity, unhealthy nutritional diet, and tobacco consumption [7]. The T2DM and risk of MetS are commonly associated with central obesity, hyperglycemia, hypertension, cardiovascular disease and lipid abnormalities [8,9]. The various risk factors for the development of T2DM and MetS are sedentary lifestyle, ethnicity, family history and elevation of blood pressure [10]. These risk factors may oscillate with region, ethnic population and country [11]. Most studies are conducted mainly in urban areas. Now a days rural areas population is seen to adopt an urban lifestyle pattern, which could put them to risk of developing MetS [12]. Therefore the present study was undertaken with an objective to explore the T2DM and related risk factors of MetS among apparently in rural population. This study provides a substratum to find out the awareness and intervention modalities of diabetes mellitus and associated risk factors with the entity of MetS.

METHODS: The present study was conducted at tertiary care centers (multicentric hospital based study) in Greater Noida which is located in Gautam Budha Nagar district of Uttar Pradesh India. Total 184 subjects (35 controls and 149 patients) aged 20-55 years determined for T2DM and risk factors of MetS in the year 2014-2016. Age, sex matched healthy subjects were considered as a control. Exclusion criteria of patients, pregnant female, age less than 20 years and seriously ill patients were excluded from the study. The required data information was collected from the participants and recorded in pre-tested research proforma. Fasting blood samples were collected after 10-12 hrs overnight fasting. Venous blood samples were collected aseptically to estimate FBG in a tube containing sodium fluoride, triglycerides and HDL-C in plain tubes. Plasma glucose was determined by glucose oxidase-peroxidase method. Triglycerides was measured by the GPO/PAP method and HDL-C by the precipitation / enzymatic method. HbA1c was measured using by fluorescence immunoassay based technique. All biochemical indicators were processed on semi automated analyzer. The study was approved by institutional ethical committee. Written informed consent was taken from the participant before the study.

STATISTICAL ANALYSIS: Data analysis was performed by using Statistical Package for Social Survey (SPSS) for windows 16.0 software (SPSS Inc., Chicago, IL, USA). Mean and standard deviation (SD) of the numerical parameters were calculated. P value <0.05 was considered as a significant and the results were expressed on mean ± SD.

RESULTS: The normal mean value of anthropometric measurement like BP, WC and biochemical analysis were carried in the control group as per above said established techniques [Table-1]. Rural male patients were compared

with the rural female for anthropometric and biochemical risk factors. Statistically significant p value <0.05 was noted mean ± SD. Rural female patients have significantly higher mean levels of BP diastolic, fasting blood glucose and glycated haemoglobin as compared to rural male counterparts. The mean levels of blood pressure systolic, waist circumference and triglycerides were statistically insignificant (p>0.05) [Table-1].

Table-1: Comparison anthropometric and biochemical mean value of T2DM and risk factors of MetS in rural population. Data expressed as mean ± SD. p<0.05 significant.

Variables	Rural Area controls (n=35)		Rural Area patients (n=149)		
	Male (n=18) Mean ± SD	Female (n=17) Mean ± SD	Male (n=80) Mean ± SD	Female (n=69) Mean ± SD	p value
Anthropometric measurements					
B.P (systolic) mm Hg	124.89±3.31	125.76±3.46	127.30±6.64	127.65±5.57	>0.05
B.P (Diastolic) mm Hg	82.00±1.81	80.47±1.50	81.56±4.45	84.54±4.16	<0.05
Waist circumference cms	84.39±4.55	83.12±4.06	88.65±9.33	86.96±5.26	>0.05
Biochemical Analysis					
Blood glucose fasting mg/dl	96.83±7.43	93.38±8.01	101.62±19.14	102.79±21.43	<0.05
Triglycerides mg/dl	135.53±10.20	132.87±12.39	151.09±54.18	154.95±57.81	>0.05
HDL –C mg/dl	47.58±5.54	53.16±2.08	45.50±7.03	49.28±7.40	<0.05
HbA1c %	5.07±0.60	4.69±0.38	5.56±1.10	5.60±1.42	<0.05

The incidence rate of hypertension was higher, i.e., 20.3%, central obesity (17.4%), hyperglycemia (18.8%), serum hypertriglyceridemia (27.5%), and low levels of HDL-C (24.6%), higher in rural females than male counterpart. The rates of risk factors of MetS were lower in the rural males in all the individual MetS criteria, with the highest abnormalities noted in high levels of triglycerides (23.7%), hyperglycemia (17.5%) and central obesity (13.8%) respectively. These results highlighted the incidence of the risk factors of MetS reported significantly higher among rural female than male [Table-2].

Table-2: Gender difference in incidence of MetS risk factors.

Characteristic of MetS	Male, % (n)	Female, % (n)	Total, % (n)
Hypertension	12.5(10)	20.3(14)	16.1(24)
Central Obesity	13.8(11)	21.7(15)	17.4(26)
Hyperglycemia	17.5(14)	18.8(13)	18.1(27)
Hypertriglyceridemia	23.7(19)	27.5(19)	25.5(38)
Low HDL-C	12.5(10)	24.6(17)	18.1(27)

The impact of the T2DM was 12.5% and 17.4% among the male and female patients respectively. Using the NCEP,ATP III definition, the MetS was 13.8% and 18.8% among the rural male and female patients respectively. The prevalence of the T2DM and MetS was significantly higher in female than male counterparts [Table-3].

Table-3: Incidence of T2DM and MetS in rural study population

Disease Characteristics	Male, % (n)	Female, % (n)	Total, % (n)
T2DM	12.5 (10)	17.4 (12)	14.8 (22)
MetS	13.8 (11)	18.8 (13)	16.1 (24)

Female at the age of >50 years were higher risk for MetS than male [Table-3].

Table-4: Incidence of MetS by age and sex.

Age Group in Years	20-30 Years	31-40 Years	41-50 Years	>50 Years
Male, % (n)	-	2.5(2)	3.7(3)	7.5(6)
Female, % (n)	1.4(1)	1.4(1)	4.3(3)	11.6(8)
Total, % (n)	0.7(1)	2.0 (3)	4.0(6)	9.4(14)

Table-4 shows the risk of MetS found increased with the increasing age in both male and female in the rural study area. Older age like >50 years, both male and female have a higher risk of MetS.

DISCUSSION:

The MetS increase the 2 fold risk for development of ASCVD and 3fold risk for T2DM [13]. The current study using NCEP ATP III criteria which is specific for Asian Indian populations. Dyslipidemia was elaborated by the presence of one or more than one abnormal circulatory lipid levels [14]. HbA1c is the gold standard test around the world for insulin intensification, initiation and diagnosis of T2DM. It is not easily available at a large scale for rural Indian population [15]. Lipids play a major role in the pathogenesis of T2DM and risk of MetS. Dyslipidemia as a metabolic disorder is frequently associated with T2DM. In the present study, significantly higher mean levels of fasting blood glucose, low level of HDL cholesterol and systolic blood pressure were noted in patients with T2DM, which are well known risk factors for MetS among patients, as compared to the normal control value. T2DM patients have many complications which include elevated levels of FBG and triglycerides, low levels of HDL-C and a preponderance of abnormalities in the composition of the smaller, dense particles [16]. In 2007, Idogun, et al., reported similar findings in their study [17]. The total incidence rates of hypertension and hypertriglyceridemia in this study were 16.1% and 25.5% respectively. The total incidence rates for high FBG, central obesity and low level of HDL-C in the patients were 18.1%, 17.4% and 18.1%, respectively, which is at par with Albrki, et al., [18]. T2DM and risk factors of MetS reported among rural population is numerous in different places in the world, indicating that causative factors can be influenced by the interaction of genetic and environmental factors. The prevalence of the lipid abnormalities reported by a Mexican nationwide survey reported by Carlos, et al., [19]. A total 14.1% (male-11.2%, female-17.4%) were at high risk for MetS. Various studies, like Peixoto et al., (male-33.6%, female-39.8%) [20], Pathania, D et al., (male-8.2%, female-10.7%) [21], Zafar, KS et al., (male-9.6%, female-13.8%) [22], Singh, PS et al., (male-4.9%, female-11.5%) [23] also reported high risk of MetS in female as compared to male counterparts.The risk factors of MetS are increased with the advancement of age. A significant difference was noted in male and female in the age group of >50 years that is increased incidence reported in both male and female patients. Studies have shown that the rural

population is at increased risk of T2DM and MetS, due to progressive changes of lifestyle and intake of high nutritional diet happening followed by urbanization in several countries [24]. Further, a study on Indian rural population have reported that the conservative community are not deprived of the risk for MetS with the percolation of elements of urbanization in to the rural societies and rural population can also be at risk for MetS. Such deficiency of contributing to an infrastructure that may result in poor diabetes screening, long distance travel to avail health, non-adherence to diabetes management guidelines, preventive services, and lack of available counseling services. Aged care facilities in rural areas report disparity in the diabetes management compared with their urban counterparts [25] with these populations more likely to suffer from T2DM and risk of MetS complications in rural population. It appears that there is need to address the rural inequality in diabetes intervention and prevention, which is need of the hour.

CONCLUSION:

Worryingly, T2DM is now being shown to be associated with a various complications and to be occurring at any age within the country. In India, the steady lack of awareness, physical activity, diet pattern, the economic boom, and corresponding change in lifestyle are all affecting the level of T2DM and risk of MetS in rural areas. Risk factors of MetS are high in population. Female are at high risk due to the high incidence, lack of physical activity and central obesity further more postmenopausal group is at higher risk than male, which may attribute to hormonal changes at advance age. This planned scenario would improve awareness and develop a healthy lifestyle to reduce the risk of T2DM and the risk factors of MetS in rural study population.There is now the demand for urgent intervention and modalities at regional, national, state and district levels to attempt for lower T2DM/incidence and risk factors of MetS.

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