Microalbuminuria in Obese Young and Middle Aged Population: A Potential Marker of Cardiovascular Risk

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Abstract Microalbuminuria is an established cardiovascular risk indicator in diabetes, hypertension and the general population. There is lack of information on MAU in healthy obese Indian adults and an ongoing debate whether obese adults deserve targeted identification and clinical intervention for MAU and prediabetes. We aimed to screen the healthy obese, young (group I) and middle aged (group II) adults for prevalence of MAU and prediabetes and study its association with Framingham risk score. The study included 50 healthy obese young (20–30 years) and middle aged adults (31–50 years), attending the outpatient clinic of Dept. of Medicine for a duration of 2 months (July–August). The patients were screened for fasting blood sugar, lipid profile and MAU. Of the total patients 28 % had MAU, 32.14 % of which had prediabetes and 33.33 % had diabetes whereas 10 % were normoglycemic. The group I patients had 50 % cases of MAU and group II had 25 % patients with MAU. Group II 63.63 % pre-diabetics. The values of MAU obtained were correlated with age, gender, body mass index, systolic and diastolic blood pressure, FBS, waist to hip ratio using Pearson's Coefficient ($p < 0.05$). The 10 year CVD risk calculated using FRS in subjects with MAU was higher as compared to those without MAU. Thus we conclude that Indian, young and middle aged obese adults to be at a risk of prediabetes, MAU and CV risk warranting their routine screening for better clinical outcomes.

Keywords Microalbuminuria · Prediabetes · Cardiovascular risk · Obesity

Introduction

India being the third most obese country in the world, overweight and obesity have emerged as a major public health issue. Overweight and obesity are frequently and independently associated with adverse health conditions, such as gallbladder disease or non alcoholic fatty liver disease (NAFLD) or cancer. However, another major concern with obesity is cardiovascular disease (CVD) risk or type 2 diabetes mellitus (T2DM) [1].

Nowadays, microalbuminuria (MAU) has been recognized as the most important risk factor for the increased morbidity and mortality in the obese population. In this context, central obesity has received more attention as a potential risk factor for renal insufficiency in non-diabetic normotensive subjects [2]. It is an established cardiovascular (CV) risk indicator in diabetes, hypertension and even in the general population. It has been shown to be associated with endothelial dysfunction and to be predictive for coronary artery disease (CAD), myocardial infarction (MI), with stroke and all-cause mortality [3].

The global prevalence of T2DM is expected to double in the period 2000–2025 and may reach a level of almost 300 million people i.e. 5–7.6 % of the total global population by the year 2025 [4]. Prediabetes raises short term absolute risk of T2DM five to six fold. The development of T2DM can be delayed or sometimes prevented in obese individuals on losing weight [5]. According to American Diabetes Association (ADA), prediabetes is defined as impaired fasting glucose (IFG) (>100 mg/dl) but <126 mg/dl and impaired glucose tolerance (IGT) (>140 mg/dl) but

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<200 mg/dl [6]. Prediabetes has significant pathophysiological effects on insulin sensitivity, secretion and CVDs.

There is an ongoing debate whether prediabetes and MAU deserves targeted identification and clinical intervention. Since MAU is a reversible condition, we hypothesize that routine screening of obese young adults for prediabetes and MAU can help in early detection of the onset of diabetes and its related microvascular complications.

Methods and Patients Recruitment

The study was conducted on 50 apparently healthy, young obese (20–30 years) [group I] and middle aged obese adults (age 31–50 years) [group II] attending the outpatient clinic of Department of Medicine to screen for MAU and to assess their CV risk using the Framingham Risk Score (FRS) [7]. Study protocol was approved by the Institutional Ethics Committee and have been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Prior written consent from all the participants or their relatives were obtained after clearly explaining the purpose of the study.

Inclusion Criteria

Young obese patients were selected on basis of waist circumference >90 cm in males and >82 cm in females. Those fulfilling at least 3 conditions of modified ATPIII criteria for metabolic syndrome were included [8].

The patient with diagnosed diabetes mellitus, hypertension, heart failure, renal failure, previous history of proteinuria, Recent urinary tract infection (UTI), multiple renal calculi, hereditary kidney disease and treatment with corticosteroids or spironolactone, angiotensin receptor blockers (ARBs), and angiotensin converting enzyme inhibitors (ACEIs) were excluded from the study. Further the subjects having habitual attributes like Smoking, Alcoholics were also not included in the study.

Anthropometric and Biochemical Parameter Assessment

The anthropometric parameters like weight (kg), height (cm), waist circumference (cm), hip circumference (cm) further, waist/hip ratio (W/H) was calculated and blood pressure was taken in normal sitting posture three times and mean was used. Biochemical parameters like fasting blood sugar (FBS) and lipid profile were performed in all subjects as per standard guidelines. Patients were categorized as normoglycemic (FBS < 100 mg/dl) and Pre-diabetic (FBS-

100–126 mg/dl) and diabetic (FBS > 126 mg/dl) who were previously undiagnosed. Ten years cardiovascular risk shall be estimated using the FRS sheet [7].

Microalbumin estimation was performed in 1st morning urine samples of the study participants by MAU (Immuno-turbidimetric method, normal range up to 30 µg of urine albumin/mg of urine creatinine in healthy adults) on two time points at 1 month interval. Moreover, MAU was considered when levels were >30 µg/mg on both time points. As there was no case in which first sample was positive but second sample was negative or vice versa so there was no need of third sample, so average value was calculated.

Results

The study was conducted on 50 obese adults (21–50) out of which 31 were males and 19 were females. We observed 56 % patients from study population were prediabetes, 24 % were newly diagnosed diabetics and 20 % were normoglycemics. There was a 28 % frequency of MAU in the study population, with 32.14 % of being in prediabetes category, 33.33 % in diabetics and 10 % in normoglycemic subjects showing MAU. The age wise distribution of MAU showed that almost 50 % of the group I patients presented with MAU and 25 % of the group II adults showed MAU.

The baseline statistics of anthropometric and biochemical analysis showed significantly raised BMI in the females as compared to male subjects and a non-significant but raised SBP, DBP, FBS and MAU in female subjects than in males. The male subjects showed hypercholesterolemia and hypertriglyceridemia as compared to the female subjects (Table 1). Frequency of 10 year cardiovascular risk as assessed by FRS in subjects with MAU was found out to be 6 while in subjects without MAU was lower (5.83). According to this, the association of MAU with BMI, SBP, DBP and FBS was considered significant (p value <0.05) while with age and waist to hip ratio although positive was not significant (p value >0.05) in our study (Table 2).

Discussion

There is lack of data regarding the frequency of MAU in healthy, obese young and middle aged adults of India. Nowadays, MAU has been recognized as the most important risk factor for the increased morbidity and mortality in the obese population [2]. Present study screened 50 healthy obese adults with an aim to assess their frequency of MAU. There was prevalence of prediabetes and MAU in study group, with the frequency of prediabetes being 56 % ($n = 28$) and the frequency of MAU was 28 % ($n = 14$). Further the role of FBS in MAU was evident by the results

Table 1 Baseline statistics of study participants

	Males (n = 31)		Females (n = 19)	
	Mean	SD	Mean	SD
Age (years)	39.64	7.44	42.26	6.41
BMI (kg/m ²)	30.12	3.36	34.63	7.49
W/H ratio	0.985	0.043	0.878	0.051
Systolic blood pressure (mm of Hg)	128.77	14.13	132.1	12.53
Diastolic blood pressure (mm of Hg)	85.94	11.82	88.00	9.66
Fasting blood sugar (mg/dl)	115.90	29.02	117.47	14.19
Fasting blood cholesterol (mg/dl)	208.22	37.47	194.32	31.12
Fasting blood triglyceride (mg/dl)	210.13	93.89	170.47	57.95
Fasting blood HDL (mg/dl)	36.6	8.48	35.74	4.62
Fasting blood LDL (mg/dl)	147.42	30.85	140.47	24.67
Urine MAU (μg/mg)	23.64	25.29	24.46	25.90

Table 2 Correlation analysis of MAU with anthropometric and clinical parameters

Independent variables	Dependent variable (MAU)	
	r value	p value
Age	0.1162	0.41
BMI	0.3228	0.02
W/H ratio	0.0856	0.55
SBP	0.292	0.037
DBP	0.373	0.007
FBS	0.280	0.046

showing frequency of MAU in prediabetics to be 32 % while in diabetics it was 33 % and in normoglycemics it was 10 %. The study suggests FBS to have direct impact on MAU [9]. A significant positive correlation of BMI, SBP, DBP, FBS with MAU was observed, while non-significant correlation of Age, W/H with MAU were seen in current population (Table 2). The significant association of MAU with SBP and DBP emphasizes the fact that MAU is indeed an early marker of endothelial dysfunction [10]. Further, the high normal DBP associated with metabolic disorders could initiate glomerular damage, leading to future MAU [11]. A positive association of MAU and BMI suggests an aggravation of MAU with increase in BMI [12].

FRS has been reported to underestimate CV risk in Indians, however the data of MAU rather complements the CV risk assessment [13]. MAU can play pivotal role in early detection of endothelial changes and CV risk, considering the positive association with FBS, BMI and BP. Precipitating factors of MAU should be managed via lifestyle modifications and medications as it is a reversible condition [14, 15]. Thus obese young and middle aged adults should be screened regularly. To reduce the burden of cardiovascular disease

(CVD), management strategies are increasingly focusing on preventive measures following early detection of markers of atherosclerosis. Prospective and epidemiologic studies have found that MAU is predictive, independently of traditional risk factors, of all-cause and cardiovascular mortality and CVD events within groups of patients with diabetes or hypertension, and in the general population [16]. Further, larger prospective studies can help assess the CV risk of this vulnerable group of people.

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Compliance with Ethical Standards

Conflict of interest Purvi Purohit, Kunal Garg, Vikram Singh, Shailendra Dwivedi and Praveen Sharma declare that they have no conflict of interest.

Ethical Standard All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Human and Animal Rights This article does not contain any studies with animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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