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Obesity as an Independent Risk Factor for the Development of Microalbuminuria

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ABSTRACT

Background: Obesity is one of the important risk factors for coronary heart disease (CHD), hypertension, diabetes and dyslipidemia. This constellation of risk factors is also associated with end-stage renal disease (ESRD), the prevalence of which has increased despite the availability of interventions to control blood sugar and blood pressure and because albuminuria appears early in the natural history of kidney disease, it's a potential target of primary prevention.
Objectives: Obesity is common in adults and likely has a causal role for Kidney disease incidence and progression. The aim of this study was to evaluate the association of obesity defined as per Asia-Pacific guidelines with microalbuminuria which is an early marker of kidney disease in adults.
Patients and Methods: Observational study based on 120 obese and 120 healthy individuals between 30-70 years of age. Urine albumin-to-creatinine ratio and body mass index (kg/m^2) were measured among healthy and obese individuals at Kasturba Medical College, Mangalore, India.
Results: There was a strong association between obesity and microalbuminuria. Microalbuminuria was highly prevalent among obese subjects compared to the controls (OR = 15.33, 95% CI: 5.83 to 40.32, $P < 0.001$)
Conclusions: This study supports a significant association between obesity and the presence of microalbuminuria in adults. Given the increasing prevalence of obesity, this association is particularly alarming. A prospective study of the relationship between obesity and early markers of kidney damage in adults is warranted.

Implication for health policy/practice/research/medical education:
Studies are urgently needed to determine the safe approaches for effective and sustained weight loss in order to prevent kidney damage in obese individuals.

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1. Background

Obesity has reached epidemic proportions globally. It has been defined by the World Health Organisation (WHO) as a body mass index (BMI) of more than 30 kg/m^2 (1). According to Asia Pacific guidelines, obesity is defined as a BMI of more than 25 kg/m^2, pre-obese as BMI between 23-24.9 kg/m^2 and those with BMI of 18.5-23 kg/m^2 were considered as normal range (2). Obesity is one of the important risk factors for coronary heart disease (CHD), hypertension, diabetes and dyslipidemia (3). This constellation of risk factors is also associated with end-stage renal disease (ESRD), the prevalence of which

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Table 1. Comparision of Baseline Characteristics Between obese (cases) and Healthy Subjects (controls) (n = 120)

	Case, No. (%)	Control, No. (%)	*P* value
Sex			0.579
Male	84 (70.0)	80 (66.7)	
Female	36 (30.0)	40 (33.3)	
Age			0.547
20-40	24 (20.0)	29 (24.2)	
40-60	84 (70.0)	76 (63.3)	
> 60	12 (10.0)	15 (12.5)	
Normoalbuminuria [a] (ACR [b] < 30 mg/g)	72 (60.0)	115 (95.8)	< 0.001
Microalbuminuria [a] (ACR = 30-300 mg/g)	48 (40.0)	05 (4.2)	< 0.001

[a] Incidence of Spot urine for albumin to creatinine ratio 30-300 mg/g (microalbuminuria) is significantly more in cases (40.0% vs 4.2%) when compared to controls with $x^2 = 44.774$; $P < 0.001$ and OR of 15.33 (95% CI: 5.83- 40.32) indicating that, cases have 15 times more likely to have microalbuminuria compared to controls

[b] Abbreviation: ACR, Albumin to Creatinine Ratio

has increased despite the availability of interventions to control blood sugar and blood pressure (4). The prevalence of early chronic kidney disease (CKD) has also increased in the past two decades (5). Albuminuria is an early marker of CKD, as well as a predictor of cardiovascular disease and mortality in general population (6-8). Because albuminuria appears early in the natural history of kidney disease, it's a potential target of primary prevention (9).

2. Objectives

The purpose of present study was to determine the association of obesity with microalbuminuria, in turn leading to the development of early CKD. A better understanding of this association will improve our understanding of the cause as well as guide for better prevention and intervention.

3. Patients and Methods

The study was performed on 120 obese and 120 healthy controls at KMC hospital, Mangalore, India. The subjects were randomly selected, and they were detected to be obese on the basis of BMI. Subjects with BMI above 25 were considered obese. Subjects with BMI between 18.5 to 22 were considered as controls. Subjects whose BMI < 18.5 (underweight) and whose BMI is 23 to 25 (overweight) were excluded from the study. This was in accordance with WHO and the National Institute of Health (NIH) classification of obesity for the Asia-Pacific region. Exclusion criteria were subjects with pre-existing co-morbidities like diabetes mellitus (FBS > 126 mg/dL), hypertension (BP > 120/80 mm of Hg), hypothyroidism (TSH > 5 μIU/ml), CKD (creatinine clearance < 60ml/min) and dyslipidemia (total cholesterol > 200 mg/dL, LDL cholesterol > 100 mg/dL and triglycerides > 150 mg/dL).

3.1. Baseline Variables

Microalbuminuria was defined as a spot urine albumin-creatinine ratio of 30-300 mg/g. Body weight was measured with indoor clothing on, but without shoes, on a digital scale, to the nearest 0.1 kg. Height was measured to the nearest millimetre using measuring tape. Body mass index was calculated as weight divided by height squared.

3.2. Statistical Analyses

Descriptive statistics included frequencies and percentages or means with standard errors. Logistic regression was used to evaluate the association of BMI with microalbuminuria. Logistic regression results are expressed as odds ratios (OR) with 95% confidence intervals (CI) and P values.

4. Results

120 obese subjects were taken as cases and 120 non-obese subjects as controls. Among the cases, 70% were found to be males and 30% were found to be females, and among controls 66.7% were males and 33.4% were females *(Table 1 and Figure 1)*. Majority of cases (70%) and controls (63.3%) belonged to 40-60 years of age *(Table 1 and Figure 2)*. After matching for age and sex among cases and controls and after excluding confounding factors like diabetes mellitus, hypertension, hypothyroidism, CKD and dyslipidemia, microalbuminuria was prevalent in 40% (n = 48) of obese subjects compared to 4.2% (n = 5) of non-obese subjects. Obese subjects had 15 times more likely to have microalbuminuria compared to their control counterparts *(Table 1 and Figure 3)*.

5. Discussion

Obesity implies deposition of excess fat in adipose tissue. According to the law of conservation of energy, energy can neither be created nor destroyed. The deposition of excess of fat is in accordance with this law. When energy intake exceeds expenditure, the excess

Figure 1. Gender Variables of the Subjects Studied

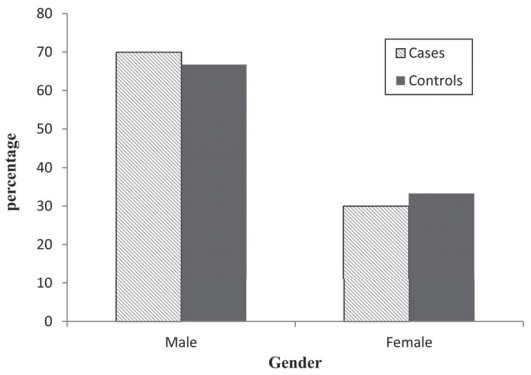


Figure 2. Demographic Variables of the Subjects Studied

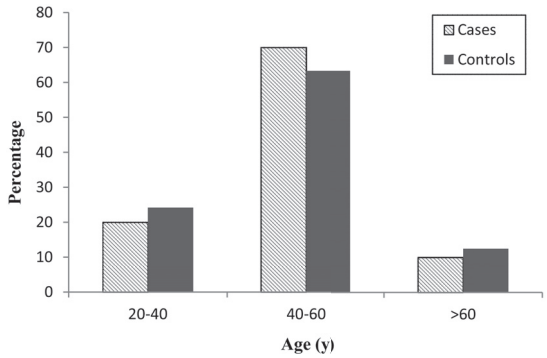
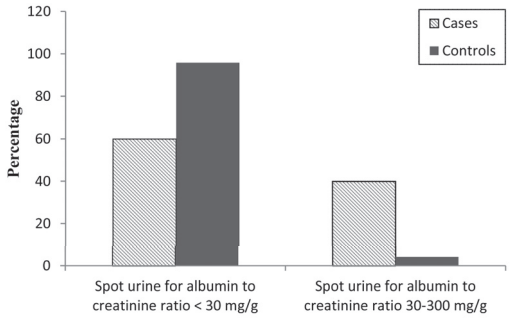


Figure 3. Microalbuminuria among Cases and Controls



calories are stored in adipose tissue and if this net positive balance is prolonged, obesity results (10). Our study suggests obesity as an independent risk factor for the development of microalbuminuria. In our study, prevalence of microalbuminuria in obese subjects was found to be 40%. Our findings are consistent with other reports that link higher BMI with albuminuria. Two US cohort studies evaluated the association of BMI and albuminuria in younger adult populations: The Coronary Artery Risk Development in Young Adults (CARDIA) study (11) and the Bogalusa Heart Study (12). In the CARDIA study, subjects aged 18 to 30 yr were enrolled; albuminuria was measured at 10 and 15 yr and found in 6.3 and 6.7% of participants, respectively. The Bogalusa study enrolled subjects aged 5 to 17 yr and found a 4.7% prevalence of albuminuria at 16 years of follow-up. The much higher prevalence of microalbuminuria in our study population may be related to the genetic, environmental and dietary habits. Moreover, these studies were performed two decades earlier; the prevalence of obesity had not reached epidemic proportions during that time.

Obesity related glomerulopathy is a well-known entity. Glomerular hyperfiltration, high protein and salt intake, hypertension, hyperinsulinemia, and increased tubuloglomerular feedback as a result of increased sodium reabsorption, dyslipidemia, inflammation, and elevated leptin levels are implicated in obesity related glomerulopathy (13-15). Secondary FSGS is a frequent complication of obesity related glomerulopathy. Obesity related glomerulopathy often manifests clinically as albuminuria and is a frequent finding in men than women. This observation is in conjunction with our finding of a high association increased BMI and microalbuminuria in men. There are several limitations to our study. Definitive kidney disease cannot be assessed using a spot urine specimen and kidney biopsy was not performed in our study population. Only 120 subjects were studied, this is a small number compared with prevalence of obesity in the society. Some studies that suggested obesity measured in terms of waist to hip ratio, provide better information as a risk factor for albuminuria. These measurements were not taken in our study. Our study suggests obesity as an independent risk factor for the development of microalbuminuria and this association is particularly alarming. Primary preventive strategies are needed to stem rising rates of CKD, and obesity is a potential target. A prospective study of the relationship between obesity and early markers of kidney damage in adults is warranted. Our study is the first of its kind to define obesity according to Asia Pacific guidelines and to find its association with microalbuminuria.

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Conflict of interest

None declared.

References

1. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organ Tech Rep Ser*. 2000;**894**:i-xii, 1-253.
2. International association for the study of obesity. Asia pacific perspective- redifining obesity and its treatment; 2000.
3. Wyatt SB, Winters KP, Dubbert PM. Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. *Am J Med Sci*. 2006;**331**(4):166-74.
4. Snyder S, Pendergraph B. Detection and evaluation of chronic kidney disease. *Am Fam Physician*. 2005;**72**(9):1723-32.
5. Hsu CY, Vittinghoff E, Lin F, Shlipak MG. The incidence of end-stage renal disease is increasing faster than the prevalence of chronic renal insufficiency. *Ann Intern Med*. 2004;**141**(2):95-101.
6. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Am J Kidney Dis*. 2002;**39**(2 Suppl 1):S1-266.
7. Sarnak MJ, Levey AS, Schoolwerth AC, Coresh J, Culleton B, Hamm LL, et al. Kidney disease as a risk factor for development of cardiovascular disease: a statement from the American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention. *Hypertension*. 2003;**42**(5):1050-65.
8. Diercks GF, van Boven AJ, Hillege JL, de Jong PE, Rouleau JL, van Gilst WH. The importance of microalbuminuria as a cardiovascular risk indicator: A review. *Can J Cardiol*. 2002;**18**(5):525-35.
9. de Jong PE, Curhan GC. Screening, monitoring, and treatment of albuminuria: Public health perspectives. *J Am Soc Nephrol*. 2006;**17**(8):2120-6.
10. Jeffrey SF, Eleftheria M. Biology of Obesity. In: Anthony SF, Braunwald E, Stephen LH, Dan LL, Jameson J, editors. *Harrison's principles of internal medicine*. 17th ed: McGraw-Hill; 2008. p. 462-68.
11. Murtaugh MA, Jacobs DR, Jr., Yu X, Gross MD, Steffes M. Correlates

of urinary albumin excretion in young adult blacks and whites: the Coronary Artery Risk Development in Young Adults Study. *Am J Epidemiol*. 2003;**158**(7):676-86.
12. Hoq S, Chen W, Srinivasan SR, Berenson GS. Childhood blood pressure predicts adult microalbuminuria in African Americans, but not in whites: the Bogalusa Heart Study. *Am J Hypertens*. 2002;**15**(12):1036-41.
13. Gelber RP, Kurth T, Kausz AT, Manson JE, Buring JE, Levey AS, et al. Association between body mass index and CKD in apparently healthy men. *Am J Kidney Dis*. 2005;**46**(5):871-80.
14. Stengel B, Tarver-Carr ME, Powe NR, Eberhardt MS, Brancati FL. Lifestyle factors, obesity and the risk of chronic kidney disease. *Epidemiology*. 2003;**14**(4):479-87.
15. Rutkowski P, Klassen A, Sebekova K, Bahner U, Heidland A. Renal disease in obesity: the need for greater attention. *J Ren Nutr*. 2006;**16**(3):216-23.