Original Research Article

DOI: http://dx.doi.org/10.18203/2349-3933.ijam20192057

Microalbuminuria among obese and non-obese individuals: a case control study

G. Karthikeyan, M. Nataraj*

Department of Medicine, Government Thiruvarur Medical College, Thiruvarur, Tamil Nadu, India

Received: 09 April 2019 Accepted: 26 April 2019

*Correspondence: Dr. M. Nataraj,

E-mail: manithaila@rediffmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Microalbuminuria among obesity cases reflects specific glomerular damage or is the marker of generalized endothelial cell dysfunction is still debatable. Thus, this study aimed to assess the presence of microalbuminuria among obese persons and non-obese individuals, who were euglycemic and normotensive.

Methods: A case control study was conducted among patients attending outpatient department of general medicine in Govt Thiruvarur Medical College, Thiruvarur, for their illnesses from June 2017 to December 2017. A total of hundred participants with fifty obese cases and fifty non obese controls were included in this study. Detailed history and examination were done by the principal investigator and the same was documented in a proforma. Data entry was done using Microsoft excel and the statistical analysis includes odds ratio were calculated using Statistical Package for Social Sciences (SPSS) software version 17.

Results: Among the study participants, 32% and 4% had microalbuminuria in obese and non-obese group, respectively. Also, obese participants were 11.29 times at higher chances of having microalbuminuria when compared to the non-obese patients with significant p value (p=0.002).

Conclusions: Microalbuminuria can be used to predict the risk of complications in obese subjects in order to bring down the overall morbidity and mortality related to renal function.

Keywords: Euglycemic, Microalbuminuria, Non-obese, Normotensive, Obese

INTRODUCTION

Obesity is known to increase morbidity and mortality, mostly from cardiovascular complications and by acting as a predominant risk factor for metabolic syndrome. Last has become the sixth most important risk factor contributing to the overall burden of chronic disease worldwide. Obesity is increasingly observed in children. Obesity is closely associated with metabolic syndrome, which is defined as a cluster of risk factors that increases cardiovascular risk and often is linked to obesity.

Recently, it has been recognized that obesity is not only a cardiovascular risk factor, but also a major risk factor for kidney failure. The final common pathway involves

preglomerular vasodilation with resultant glomerular hypertrophy and hyperfiltration. This hyperfiltration ultimately results in glomerulosclerosis. This can be detected in the earliest stage itself by measuring microalbuminuria (MAU) in the urine.

Renal impairment with proteinuria has been reported by Wamke RA et al, and Weisinger JR et al, and focal glomerulosclerosis have also been reported by Kasiske BL et al.³⁻⁵ The high intake of food-including proteins-could lead to renal hyperfiltration leading to renal impairment.⁶

One of the common findings in patients with metabolic syndrome is microalbuminuria. There is ongoing

discussion about whether microalbuminuria, in metabolic syndrome, is due to obesity, or due to diabetes, or hypertension.

MAU has been defined as an abnormal urinary albumin excretion rate (UAER) of 20-200 μ g/min. Day-to-day variations in UAER can be as high as 25-40%, irrespective of the sampling method used.⁷

Whether microalbuminuria in visceral obesity reflects specific glomerular damage or is the marker of generalized endothelial cell dysfunction is still debatable. In view of the known podocyte/endothelial cell interaction, presumably both explanations are true.⁸

Weisinger JR et al, provided the first description of focal segmental glomerulosclerosis as a specific renal complication of morbid obesity.⁴ This observation has now been confirmed in many studies. It has been shown that after weight loss, induced by bariatric surgery, markers of kidney function have improved in multiple case reports.⁹

It is therefore important to look at the very earliest changes, like measuring microalbuminuria in urine to devise targeted interventions like strategies for weight reduction, drug therapy and surgical methods to reduce weight. With this background, this case control study was planned to assess the proportion of individuals having microalbuminuria among obese and non-obese individuals.

The objectives of this study were to assess the presence of microalbuminuria among obese persons and non-obese individuals, who were euglycaemic and normotensive.^{2,3}

METHODS

A case control study was conducted among patients attending outpatient department of general medicine in Government Thiruvarur Medical College, Thiruvarur, Tamil Nadu, India for their illnesses.

The study was conducted from June 2017 to December 2017. The study population includes all patients attending the outpatient department of general medicine without any chronic illnesses like diabetes, hypertension, dyslipidemia and cardiac illnesses but presented for some of their acute illnesses between the age group of 20-60 years, during the study period. All participants were assessed for blood pressure, height, weight, waist and hip circumference. Also, BMI and waist hip ratio were calculated. All the patients had undergone laboratory investigations like Random blood sugar, serum urea, creatinine, total cholesterol and urine routine. A 12-lead electrocardiogram was also taken to rule out cardiac illnesses. Individuals with hypertension, hyperglycemia, macroalbuminuria, dyslipidemia and cardiac illnesses were excluded from the study. After assessing the inclusion and exclusion criteria, the individuals were

grouped as obese and non-obese based on their BMI status and obese individuals (BMI >25) were considered as cases and non-obese individuals (\leq 25) were considered as controls. A total of hundred participants with fifty obese cases and fifty non obese controls were included in this study.

Detailed history and examination were done by the principal investigator and the same was documented in a proforma. Early morning first voided urine samples were collected from all the obese and nonobese persons who were included in the study, for assessing the presence of microalbuminuria. Using fully automated photometric calibrated system, Urine albumin to creatinine ratio in the given samples was calculated.

Data entry was done using Microsoft excel and the statistical analysis includes odds ratio were calculated using statistical package for social sciences (SPSS) software version 17.

Operational definitions

For urine albumin, the reference range of $<20~\mu g/ml$ was considered as normal and for urine creatinine reference range in males was 39-259 mg/dl and for females it was 28-217 mg/dl. Reference ranges for waist hip ratio and waist circumference for male and females were given in (Table 1).

Table 1: Reference ranges for waist hip ratio and waist circumference.

Gender	Acceptable	Unacceptable			
Waist Hip ratio (WHR) ¹⁰					
Male	≤0.90	>0.90			
Female	≤0.80	>0.80			
Waist circumference (WC) ¹⁰					
Male	≤ 102 cms	>102 cms			
Female	≤ 88 cms	>88 cms			

RESULTS

The mean age of the participants in this study was 52.96 ± 8.978 . The mean and SD of waist circumference and Hip circumference was found to 95.52 ± 7.579 and 97.38 ± 4.911 respectively.

In this study among obese participants a greater number of cases were found to be higher (N=21) in the age group of 51-60 years, followed by 41-50 years (N=19). Two patients were recorded below 40 years to have obesity in present study (Table 2).

MAU among all participants

Among obese participants, 16 of them had Microalbuminuria (MAU) and 2 patients were found to have MAU in non-obese participants with chi square

value of 13.279 and the association was statistically significant.

Table 2: Characteristics of participants.

Variables	Obese patients (N=50)	Non-obese patients (N=50)
Age group		
≤40 years	2	2
41-50 years	19	19
51-60 years	21	21
>60 years	8	8
Sex		
Male	26	26
Female	24	24

On assessing the strength of association with odds ratio for the same, it was found that obese participants were 11.29 times at higher chances of having microalbuminuria when compared to the non-obese patients and it was found to be statistically significant, but the 95% confidence interval (CI) was found to be wide (2.4-52.4) (Table 3).

BMI among obesity cases

Microalbuminuria was observed in 3 cases among overweight patients, 10 grade I obesity cases and 3 grade -II obesity cases had microalbuminuria, with chi square value 17.215. The p value was found to be highly statistically significant (p value <0.000) (Table 4).

Table 3: Strength of association between MAU and two groups.

Group	Microalbumi	Microalbuminuria		95% CI	Danahaa
	Present	Absent	Odds ratio	95% CI	P value
Obesity (Cases)	16	34	11.20	2.4-52.4	0.002*
Non obese (Control)	2	48	11.29	2.4-32.4	

^{*}Significant

Table 4: Association between BMI and MAU among obese participants.

BMI	Microalbuminur	Microalbuminuria		Danalara
	Present	Absent	Chi square value	P value
Overweight	3	26		
Obesity-Grade I	10	8	17.215	0.000*
Obesity-Grade II	3	0		

^{*}Significant

Table 5: Association between WHR, WC and MAU among male obese participants.

Variables	Microalbuminuria		Chi Canana Valua	P value
	Present	Absent	Chi Square Value	r value
WHR among males				
Acceptable	0	2	0.798	0.372
Unacceptable	7	17	0.798	
WC among males				
Acceptable	2	18	. 10.616	0.000*
Unacceptable	5	1	12.616	

^{*}Significant

Table 6: Association between WHR, WC and MAU among female obese participants.

Variables	Microalbuminuria		Chi ganara valua	P value
	Present	Absent	Chi square value	1 value
WHR among females				
Acceptable	0	3	2.057	0.151
Unacceptable	9	12	2.037	
WC among females				
Acceptable	2	5	0.226	0.532
Unacceptable	7	10	0.336	

WHR and WC among obese male cases

Among males with unacceptable waist hip ratio, 7 had microalbuminuria compared to no MAU among normal waist hip ratio males, the difference was found to be not statistically significant. Likewise, males with unacceptable waist circumference 5 of them had microalbuminuria with statistical significance (Table 5).

WHR and WC among obese female cases

Microalbuminuria was seen in 9 female cases with unacceptable waist hip ratio whereas there was no case of microalbuminuria among females who had acceptable waist hip ratio. But the difference was not statistically significant. Among females with unacceptable waist circumference 10 were normal and 7 had MAU, with no statistical significance (Table 6).

DISCUSSION

In this study, obese participants were 11.29 times at higher chances of having microalbuminuria when compared to the non-obese patients and it was found to be statistically significant. Similar results were reported by Rosenbaum P et al, Bosma RJ et al, De Jong PE et al, and Martinez MA et al, that obesity is associated with MAU. 11-14 Also, studies conducted by Jensen JS et al, Cirillo M et al, and Valensi P et al, reported significant correlation between BMI and MAU. 15-17

However, in present study, WC among obese males had a significant association with MAU whereas WHR had not. Similarly, several studies have suggested significant association with WHR also. 18,19

Collins VR et al, reported that prevalence of albuminuria increased with increasing body mass index and another study conducted by Damsgaard EM et al, found slightly higher body mass indices in subjects with slight albuminuria than in those with normal albuminuria. 20,21 A significant correlation between body mass index and urinary albumin excretion rate has also been reported previously in men with non-insulin-dependent diabetes by Mottock MB et al. The mechanism of this association remains unclear.²² Weisenger JR et al, reported nephrotic syndrome in four patients with massive obesity, but this decreased during dietary weight loss.4 They also reported that minimal morphological changes on renal biopsy, as well as normal renal blood flow and normal glomerular filtration rate. Also, Collins VR et al, reported that that the association between albuininuria and obesity was lost when fasting serum insulin was included in the regression model.²⁰

Romundstad S et al, reported that blood pressure, plasma cholesterol, smoking and BMI were significantly related to urinary albumin excretion and prevalence of microalbuminuria.²³

Løkkegaard N et al, conducted a study among obese and non-obese individuals and reported that BMI was significantly correlated with the albumin excretion rate and with volume of kidney. ²⁴

The correlation between the albumin excretion rate and the severity of obesity suggests that an increased urine albumin excretion rate could be an early risk factor predicting complications in obese subjects. Among the complications of obesity, glomerulosclerosis has been suggested by Wamke RA et al.³

In another study conducted by Prebble WE et al, it was reported that of 1000 obese subjects, 40% had evidence of excretion of albumin in the urine.²⁵ The degree of albumin excretion was not mentioned, and the observation has not been confirmed. Goldszer R et al, found proteinuria by dipstick method (>2+) in only four of 257 obese patients, in a population with 85% nondiabetic and 77% normotensive patients.²⁶ Others have found increased urinary protein excretion rates in a few obese patients.^{3,4}

The inconsistency in the findings of proteinuria in obesity is probably partly a result of the different sensitivities in the methods used. In addition, some authors found that proteinuria disappeared as weight was lost. This complicates the interpretation of the results in studies where changes in weight during the data collection period are not being accounted for.^{3,4}

CONCLUSION

This study found a strong association between the microalbuminuria and obesity. Increased excretion of albumin in urine might therefore be merely a marker for obesity. If the microalbuminuria can predict the risk of complications in obese subjects, then estimation of it could be used to point out those obese subjects at high risk. This would permit the strongest efforts to be put into treatment of these patients to bring down the overall morbidity and mortality related to renal function, most efficiently.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- 1. Berctold P, Sims EAH. Horton ES, Berger M. Obesity and hypertension: epidemiology. mechanisms, treatment. Biomed Pharmacother 1983:37:251-8.
- 2. Drenick EJ, Bale GS, Seltzer F, Johnson DG. Excessive mortality and causes of death in morbidly obese men. JAMA. 1980;243:443-5.

- 3. Warnke RA, Kempson RL. The nephrotic syndrome in massive obesity. Arch Pathol Lab Med. 1978;102:431-38.
- 4. Weisinger JR, Kempson RL, Eldridge FL. The nephrotic syndrome: A complication of massive obesity. Ann Intern Med. 1974;81:440-7.
- 5. Kasiske BL, Napier J. Glomerular sclerosis in patients with massive obesity. Am J Nephrol. 1985;5:45-0
- Brenner BM. Hemodynamically mediated glomerular injury and the progressive nature of kidney disease. Kidney Int. 1983;23:647-55.
- Eshoj O, Feldt-Rasmussen B, Larsen ML, Mogensen EF. Comparison of overnight, morning and 24-hour urine collections in the assessment of diabetic microalbuminuria. Diab Med. 1987;4:531-3.
- 8. Sharma K. The link between obesity and albuminuria: adiponectin and podocyte dysfunction. Kid Int. 2009;76(2):145-8.
- 9. Morales E, Valero M, León M, Hernández E, Praga M. Beneficial effects of weight loss in overweight patients with chronic proteinuric nephropathies. Am J Kidney Dis. 2003;41(2):319-27.
- De Boer IH, Sibley SD, Kestenbaum B, Sampson JN, Young B, Cleary PA, et al. Central obesity, incident microalbuminuria, and change in creatinine clearance in the epidemiology of diabetes interventions and complications study. J Am Society Nephrol. 2007;18(1):235-43.
- Rosenbaum P, Gimeno SG, Sanudo A, Franco LJ, Ferreira SR, Japanese-Brazilian Diabetes Study Group. Independent impact of glycemia and blood pressure in albuminuria on high-risk subjects for metabolic syndrome. Clin Nephrol. 2004;61:369-76.
- 12. Bosma RJ, van der Heide JJ, Oosterop EJ, de Jong PE, Navis G. Body mass index is associated with altered renal hemodynamics in non-obese healthy subjects. Kidney Int. 2004;65:259-65.
- 13. De Jong PE, Verhave JC, Pinto-Sietsma SJ, Hillege HL. Obesity and target organ damage: the kidney. Int J Obesity Relat Metab Disord. 2002;26:S21-4.
- 14. Martinez MA, Moreno A, Aguirre de Carcer A, Cabrera R, Rocha R, Torre A, et al., MAPA- Madrid Working Group. Frequency and determinants of microalbuminuria in mild hypertension: a primarycare-based study. J Hypertens. 2001;19:319-26.
- 15. Jensen JS, Borch-Johnsen K, Jensen G, Feldt-Rasmussen B. Atherosclerotic risk factors are increased in clinically healthy subjects with microalbuminuria. Atheroscl. 1995;112(2):245-52.
- Cirillo M, Senigalliesi L, Laurenzi M, Alfieri R, Stamler J, Stamler R, et al. Microalbuminuria in

- nondiabetic adults: relation of blood pressure, body mass index, plasma cholesterol levels, and smoking: The Gubbio Population Study. Arch Int Med. 1998;158(17):1933-9.
- 17. Valensi P, Assayag M, Busby M, Parie`s J, Lormeau B, Attali J-R. Microalbuminuria in obese patients with or without hypertension. Int J Obes. 1996;20:574-9.
- Central Bureau of Statistics. Statistical yearbook of Norway. Oslo: Kongsvinger. 1997;03:97-142.
 Accessed at: https://www.ssb.no/a/en/histstat/aarbok/1997_en.pdf
 Accessed 11 March 2019.
- 19. Midthjell K, Krüger O, Holmen J, Tverdal A, Claudi T, Bjørndal A, Magnus P. Rapid changes in the prevalence of obesity and known diabetes in an adult Norwegian population. Diab Care. 1999;22:1813-20.
- Collins VR, Dowse GK, Finch CF. Zixnmet PZ, Linnane AW. Prevalence and risk factors for microand inacroalbuminuria in diabetic subjects and entire population of Nauru. Diab. 1989;38:1602-10.
- Damsgaard EM, Frøland A, Jørgensen OD, Mogensen CE. Microalbuminuria as predictor of increased mortality in elderly people. BMJ. 1990;300(6720):297-300.
- 22. Mattock MB, Keen H, Viberti CG, El-Gohari MR, Murrells TJ, Scott GS, et al. Coronary heart disease and urinary albumin excretion rate in type 2 (non-insulin dependent) diabetic patients. Diab. 1988;31:82-7.
- Romundstad S, Holmen J, Hallan H, Kvenild K, Krüger, Midthjell K. Microalbuminuria, cardiovascular disease and risk factors in a nondiabetic/nonhypertensive population. The Nord-Trøndelag Health Study (HUNT, 1995–97), Norway. J Int Med. 2002;252(2):164-72.
- 24. Løkkegaard N, Haupter I, Kristensen TB. Microalbuminuria in obesity. Scandinavian J Urol Nephrol. 1992;26(3):275-8.
- 25. Prebble WE. Obesity: Observation on one thousand cases. Boston Med Surg J. 1923;188: 617-21.
- Goldszer R, Irvine J, Lazarus JM, Gottlieb M, Solomon H. Renal findings in obese humans. Kidney Int. 1984;24:165.

Cite this article as: Karthikeyan G, Nataraj M. Microalbuminuria among obese and non-obese individuals: a case control study. Int J Adv Med 2019;6:717-21.