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Original Article

Urine Microalbuminuria in Obese Comparing with Healthy Children

Manijeh Khalili[1], Simin Sadeghi[1], Alireza Teimouri[1*], Mohaddeseh Shahraki[2]

[1] *Children & Adolescent Health Research Center, Drug-Resistant Tuberculosis Institute, School of Medicine, Zahedan University of Medical Sciences, Zahedan, Iran*
[2] *School of Medicine, Zahedan University of Medical Sciences, Zahedan, Iran*

[*] *Corresponding author: Alireza Teimouri*
Email: alirezateimouri260@gmail.com

ABSTRACT

Background: Obesity is a global problem and is associated with pathophysiological mechanisms related to kidneys which may result in microalbuminuria. The aim of this study was to compare the microalbuminuria in obese and normal-weight children.
Methods: In this descriptive analytical study, 200 children in two groups of obese and normal-weight investigated. Children who met the study criteria were enrolled and their age, gender and BMI were recorded. Then levels of urinary albumin and creatinine were measured and albumin-to-creatinine ratio were calculated. The two groups were compared using chi-square and t-test.
Results: In this study, 45% of obese children and 52% of normal children were boys. In terms of gender and age group, there was no significant difference between the two groups (P-value = 0.396 for gender and P-value = 0.502 for age-group). The overall prevalence of microalbuminuria in the study population was 8.5%. The prevalence in obese children (13%) was more than normal-weight children (4%) (P-value = 0.040). Further analysis stratified by sex and age-group showed a higher significant mean value of urine microalbuminuria in obese compared to normal-weight children among girls (P-value = 0.004) and among children in 12-19 years of age (P-value = 0.033).
Conclusion: The results of this study showed that the obesity in children is associated with higher prevalence of microalbuminuria.
Keywords: Microalbuminuria, Children, Obesity
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Introduction

Obesity is increasing at an alarming rate throughout the world. Today it is estimated that there are more than 300 million obese people world-wide (1). A few epidemiologic investigations have shown that obesity expands the danger of kidney diseases (2, 3) and is firmly connected with end-stage renal disease and hypertension. In addition to the metabolic disorder, obesity, also seems to be an independent risk factor for both chronic kidney disease and end stage renal disease (4). Microalbuminuria is a term to describe a moderate increase in the level of urine albumin and is currently considered as an early marker of renal damage in nondiabetic patients (5). It occurs when the kidney leaks small amounts of albumin into the urine. It refers to the presence of a relatively small quantity of protein in the urine. The term was first used nearly 30 years ago when referring to urinary protein excretion of 30-300 mg per day, which was below the detection threshold of a standard urine dipstick test (6). Microalbuminuria has now defined as a urine albumin excretion between 20 and 200 or 30 to 300 µg/mg in the overnight or 24-h collection (7). Microalbuminuria faced with the realization of increasing prevalence of obesity and other

specific diseases such as type 2 diabetes (8), and metabolic syndrome (9) in children. Obesity is a risk factor for microalbuminuria (1) and increased urinary albumin secretion (10). In obese children increasing the secretion of urine proteins, especially albumin indicating an increase in filtration and primary kidney damage (11).

Regarding the pathologic mechanisms of microalbuminuria, it seems that the burden of blood pressure and increased systemic vascular permeability relative to albumin, which is probably due to initial damage in the endothelium, play an important role (12). But, despite of above-mentioned literature, the actual prevalence of microalbuminuria and proteinuria in obese patients is not known in the literature (13). However, several findings suggest that other factors such as lipid disorders, prothrombotic factors, increased activity of renin-angiotensin system and systemic inflammation are involved. Also, abnormalities in hemodynamic function with or without structural changes in the kidney can also be due to microalbuminuria (14). The mechanisms of this association are now unclear and might be mediated by adipogenic inflammation as well as endothelial dysfunction giving microalbuminuria. Besides, obesity is associated with subtle effects in the decline of kidney function and low-grade albuminuria, and this event potentially results in appearance and progression of cardiovascular diseases in obese patients (13). Obesity is accompanied by an increase in adipose tissue mass, which, through physiological settings, leads to an increase in cardiac output to supply the blood flow to the adipose tissue as well as other tissues in the body (15). Therefore, regarding the problems in obese children due to microalbuminuria, the present study aimed to assess the relationship between obesity and microalbuminuria among obese and normal-weight children.

Methods

Study design and study population

This case-control study was performed on 100 obese children aged from 1 to 19 years and matched with 100 controls in the pediatric ward of Ali Ebne Abi Talib hospital and pediatric clinic of Ali Asghar affiliated to Zahedan University of Medical Sciences, Zahedan (ZaUMS), Iran from January 2016 to March 2018. The patients were selected from those attending the pediatric wards and pediatric clinic as inpatients or outpatient that had been referred for the regular medical examinations or complaints of obesity without endocrine disorder. Sex-matched children consider for controls among those referred to the clinics for routine check-up. Children with congenital heart disease, active infection, malignancy, other systemic inflammatory diseases, diabetes mellitus, renal insufficiency, chronic obstructive pulmonary disease and hypertension were excluded from the case and control group. A written informed consent was taken from the parents or guardians of the children included in the study. After a pilot study on 20 obese and 30 healthy children, the mean value of microalbuminuria was 17.61 ± 13.01 and 12.95 ± 10.1, respectively. Considering a power of 80% to detect a significant difference and type I error as 0.05, a total of 98 children for each group calculated.

Study variables

Anthropometric measures were determined in all subjects. Body weight was measured with a digital scale to the nearest 0.1 kg, and height was measured in triplicate to the nearest 0.1 cm. The BMI was expressed in kilograms per square meter (kg/m2). In the present study a child or teen who was in the 95th percentile or above was considered obese and a child with BMI between the 5th percentile to 85th percentile was defined as normal-weight.

Random urine samples were used for urinalysis and the concentration of urine microalbumin was measured by immunofluorescence of the solid phase using Nephelometry method by binding kit. The urinary creatinine level was read by autoanalyzer. The ratio of microalbumin to creatinine is expressed in μg of microalbumin per mg of creatinine. The normal rate of urinary albumin excretion is defined as the ratio of microalbumin/creatinine less than 30 μg/mg. Microalbuminuria is also defined as the ratio of microalbumin / creatinine greater than 30 μg/mg and less than 30 μg/mg.

Statistical Analysis

Data was entered into 18.0 (SPSS Inc, Chicago, IL, USA). Normal distribution evaluated using visual check and Kolmogorov Simonov test. The two groups were compared using chi-square or student t-test. In the case of violating the normality assumption, a nonparametric equivalent statistical test was used.

Results

This cross-sectional study was performed on 100 obese and 100 normal children. the mean age of obese children was 10.46 ± 1.89 that was appropriately matched with the mean age of control group 9.50 ± 2.16, P-value = 0.455). Table 1 showed the distribution of obese and normal children by gender, age groups. and microalbuminuria status. The prevalence of microalbuminuria in obese children was 13% that was significantly higher than control group 4% (P-value = 0.04).

Table 1. Distribution of Study Variables in Case and Control Groups

Variables	Obese	Normal-Weight	P-value
	Number (%)	Number (%)	
Microalbuminuria			
Positive	13 (13)	4 (4)	0.04
Negative	87 (87)	96 (96)	
Sex			
Boys	45 (45)	52 (52)	0.396
Girls	55 (55)	48 (48)	
Age group			
1-12 years	49 (49)	41 (41)	0.502
12-19 years	51 (51)	59 (59)	

Table 2. Distribution of Albumin to Creatinine Ratio by Age Groups and Genders of Participants

Variables	Microalbumin / creatinine (µg/mg)		P-value
	Obese	Normal	
Participants	17.57 (16.04)	12.84 (9.58)	0.012
Age groups(years)			
1-12	22.92 (18.11)	18.99 (9.99)	0.219
12-19	12.43 (11.82)	8.57 (6.53)	0.033
Gender			
Boys	14.46 (13.01)	13.6 (11.05)	0.725
Girls	20.11 (17.86)	12.02 (7.72)	0.004

In obese children, 49% were aged 1-12 years and 51% were aged 12-19 years. This trend was 41% and 59% for healthy children respectively (P-value 0.502). Table 2 showed the mean levels of microalbuminuria according to age-groups and gender of participants. The mean value of microalbuminuria in obese children (17.57 ± 16.04) was significantly higher than normal-weight children. (12.84 ± 9.58, P-value = 0.012). Further analysis stratified by sex and age-group showed a higher significant mean value of urine microalbuminuria in obese compared to normal-weight children among girls (P-value = 0.004) and among children in 12-19 years of age (P-value = 0.033).

Discussion

The present study aimed to determine the status of the ratio of microalbumin to creatinine (µg/mg) in obese compared to healthy children. In our study, the prevalence of microalbuminuria was found (8.5%) that was higher than previous studies by Radhakishunna Holanda et al., (16) found 2.7%, and Lurbe et al., (17) that found 2.4% in Spain. The prevalence and was lower than Burgert et al., (18) in the USA that found 10.1%, Sanad et al., (19) that found 14.7% in Egypt and Okpere et al., (20) in Nigeria that found 35.4%. This study also found that obese children had higher prevalence of microalbuminuria compared to those who were normal-weight.

The prevalence of obesity among societies shows growing trends. Most adulthood obesity is rooted in childhood obesity, and it has become one of the concerns of children that need more attention and intervention during this period (21). Obesity in children and adults is associated with important complications which occur in the short or long term (22). Meanwhile, microalbuminuria, as a pathological process that is likely to be associated with obesity, has been presented in several studies (21-24).

Regarding the relationship between proteinuria and obesity in the Srivastava et al., (23) review , it was observed that the prevalence of microalbuminuria in men and women increased with increasing BMI, and as a result, BMI can independently contribute to microalbuminuria. Sanad and Gharib (19) in Egypt showed that 14.7% of obese children had microalbuminuria, and the authors identified microalbuminuria as a risk factor. This finding is consistent with the mean and frequency of microalbuminuria in the obese group in the present study. They found that BMI and abdominal obesity significantly increased the odds of microalbuminuria in obese compare to non-obese children. Moreover, they found that high triglyceride; high LDL and low HDL were significantly associated with microalbuminuria.

In another study by Chagnac et al., (24), increasing BMI was associated with functional and structural renal changes, such as increased glomerular filtration rate (GFR), renal plasma flow (RPF), and urinary albumin excretion. Rademacher et al., (25) showed that in healthy children, albuminuria was related to fasting insulin, but was not related with blood pressure, BMI, lipid levels, fasting glucose, or insulin resistance. But in obese children, albuminuria was related to multiple measures of insulin resistance. They concluded that HbA1c seems to be the most consistent clinical predictor of microalbuminuria in children with type 1 diabetes. Singh et al., (7), shown that the obese children with diabetes had higher levels of microalbuminuria than those obese children without diabetes. In compare with the present study, the interaction effect of diabetes and obesity could not be detected because we excluded diabetic patients.

Rademacher et al., (25) reported that the prevalence of albuminuria ranges from 0.3% to 23.9% in children and is influenced by gender, ethnicity and age. Concerning the relationship between gender and microalbuminuria levels, this study showed a significant difference among obese and normal–weight girls but not among boys. In contrast, Hemayati et al (26) found that the prevalence of microalbuminuria was 11% and was significantly higher in men than women. Rutkowski et al., (27) also found that microalbuminuria was higher in men than women. Obesity-related glomerulopathy presented clinically by microalbuminuria and may increase tenfold over 15 years (26).

The development of increased albumin excretion rates is associated not only with hyperglycemia but also with blood pressure elevations (28). These observations, together with our findings indicate that obesity or its severity is a determinant factor of increased microalbuminuria in children without considering marginal items.

This study suffered from some limitation including the cross-sectional design that prevent finding any temporal association, lack of measuring sufficient number of confounding variables, and lack of family satisfaction with testing their children that may result in some selection bias.

Conclusion

From this investigation concluded that, microalbuminuria was significantly higher in obese than normal-weight children. Obese girls were significantly more likely to have microalbuminuria than boys. More studies are needed to detect the temporal association of obesity and kidney disorder and interaction effect of sex and obesity status on microalbuminuria.

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Ethical consideration
The study has been approved by ethical committee of Zahedan University of Medical Sciences, Zahedan, Iran.

Conflicts of interests
Authors declared no conflict of interest.

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References

1. Strauss RS, Pollack HA. Epidemic increase in childhood overweight, 1986-1998. JAMA. 2001;286(22):2845-2848. doi: 10.1001/jama.286.22.2845.
2. Wang Y, Chen X, Klag MJ, Caballero B. Epidemic of childhood obesity: implications for kidney disease. Adv Chronic Kidney Dis. 2006;13(4):336-351. doi: 10.1053/j.ackd.2006.07.016.
3. Wang Y, Chen X, Song Y, Caballero B, Cheskin LJ. Association between obesity and kidney disease: a systematic review and meta-analysis. Kidney Int. 2008;73(1):19-33. doi: 10.1038/sj.ki.5002586.
4. Wahba IM, Mak RH. Obesity and obesity-initiated metabolic syndrome: mechanistic links to chronic kidney disease. Clin J Am Soc Nephrol. 2007;2(3):550-562. doi: 10.2215/CJN.04071206.
5. Verhave JC, Gansevoort RT, Hillege HL, Bakker SJL, de Zeeuw D, de Jong PE. An elevated urinary albumin excretion predicts de novo development of renal function impairment in the general population. Kidney Int Suppl. 2004;92:S18–S21. doi: 10.1111/j.1523-1755.2004.09205.x.
6. Lin J, Hu FB, Curhan GC. Associations of diet with albuminuria and kidney function decline. Clin J Am Soc Nephrol. 2010;5(5):836-843. doi: 10.2215/CJN.08001109.
7. Singh A, Satchell SC. Microalbuminuria: causes and implications. Pediatr Nephrol. 2011;26(11):1957-1965. doi: 10.1007/s00467-011-1777-1.
8. Rosenbloom AL, Joe JR, Young RS, Winter WE. Emerging epidemic of type 2 diabetes in youth. Diab Care. 1999;22(2):345-354. doi: 10.2337/diacare.22.2.345.
9. Weiss R, Dziura J, Burgert TS, Tamborlane WV, Taksali SE, Yeckel CW, et al. Obesity and the metabolic syndrome in children and adolescents. N Engl J Med. 2004;350(23):2362-2374. doi: 10.1056/NEJMoa031049.
10. Jense JS, Borch-Johnsen K, Jensen G, Feldt-Rasmussen B. Microalbuminuria reflects a generalized transvascular albumin leakiness in clinically healthy subjects. Clin Sci (Lond). 1995;88(6):629-633. doi: 10.1042/cs0880629.
11. Liese AD, Hense HW, Doring A, Stieber J, Keil U. Microalbuminuria, central adiposity and hypertension in the non-diabetic urban population of the MONICA Augsburg survey. J Hum Hypertens. 2006;15(11):799-804. doi: 10.1038/sj.jhh.1001266.
12. Pontremoli R, Leoncini G, Ravera M, Viazzi F, Vettoretti S, Ratto E, et al. Microalbuminuria, cardiovascular, and renal risk in primary hypertension. J Am Soc Nephrol. 2002;13(Suppl 3):S169-S172. doi: 10.1097/01.asn.0000032601.86590.f7.
13. Rosenstock JL, Pommier M, Stoffels G, Patel S, Michelis MF. Prevalence of proteinuria and albuminuria in an obese population and associated risk factors. Front Med (Lausanne). 2018;5:122. doi: 10.3389/fmed.2018.00122.
14. Jensen JS, Feldt-Rasmussen B, Strandgaard S, Schroll M, Borch-Johnsen K. Arterial hypertension, microalbuminuria, and risk of ischemic heart disease. Hypertension. 2000;35(4):898-903. doi: 10.1161/01.hyp.35.4.898.
15. Hall JE, Crook ED, Jones DW, Wofford MR, Dubbert PM. Mechanisms of obesity-associated cardiovascular and renal disease. Am J Med Sci. 2002;324(3):127-137. doi: 10.1097/00000441-200209000-00003.
16. Radhakishun NNE, van Vliet M, von Rosenstiel IA, Beijnen JH, Diamant M. Limited value of routine microalbuminuria assessment in multi-ethnic obese children. Pediatr Nephrol 2013;28(7):1145-1149. doi: 10.1007/s00467-013-2451-6.
17. Lurbe E, Torro MI, Alvarez J, Aguilar F, Fernandez-Formoso JA, Redon J. Prevalence and factors related to urinary albumin excretion in obese youths. J Hypertens 2013;31(11):2230-2236. doi: 10.1097/HJH.0b013e328364bcbf.
18. Burgert TS, Dziura J, Yeckel C, Taksali SE, Weiss R, Tamborlane W, et al. Microalbuminuria in pediatric obesity: prevalence and relation to other cardiovascular risk factors. Int J Obes (Lond) 2006;30(2):273-280. doi: 10.1038/sj.ijo.0803136.
19. Sanad M, Gharib A. Evaluation of microalbuminuria in obese children and its relation to metabolic syndrome. Pediatr Nephrol 2011;26(12):2193-2199. doi: 10.1007/s00467-011-1931-9.
20. Okpere AN, Anochie IC, Eke FU. Prevalence of microalbuminuria among secondary school children. Afr Health Sci 2012;12(2):140-147. doi: 10.4314/ahs.v12i2.10.
21. Lifshitz F. Obesity in Children. J Clin Res Pediatr Endocrinol. 2008;1(2):53-60 doi: 10.4008/jcrpe.v1i2.35.
22. Daniels SR. Complications of obesity in children and adolescents. Int J Obes. 2009;33(Suppl 1):S60-65. doi: 10.1038/ijo.2009.20.
23. Srivastava T. Nondiabetic consequences of obesity on kidney. Pediatr Nephrol. 2006 ;21(4):463-470. doi: 10.1007/s00467-006-0027-4.
24. Chagnac A, Weinstein T, Korzets A, Ramadan E, Hirsch J, Gafter U. Glomerular hemodynamics in severe obesity. Am J Renal Physiol. 2000;278(5):F817-22. doi: \10.1152/ajprenal.2000.278.5.F817.
25. Rademacher ER, Sinaiko AR. Albuminuria in children. Curr Opin in Nephrol hypertens. 2009;18(3):246-251. doi: 10.1097/MNH.0b013e3283294b98.
26. Hemayati R, Kaseb F, Ghadiri-anari A, Yosefi F. The relationship between microalbuminuria, overweight and obesity. J Nephropathol. 2020;9(4):e41. doi: 10.34172/jnp.2020.41.
27. 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):216-223. doi: 10.1053/j.jrn.2006.04.017.
28. Diabetes Prevention Program Research Group. Changes in albumin excretion in the diabetes prevention program. Diabetes Care. 2009;32(4):720-725. doi: 10.2337/dc08-1400.