



Original Research Article

STUDY OF MICROALBUMINURIA IN OBESE INDIVIDUALS AS AN EARLY INDICATOR OF NEPHROPATHY

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Received : 12/02/2026
Received in revised form : 03/04/2026
Accepted : 20/04/2026

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DOI: 10.70034/ijmedph.2026.2.149

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 878-882

ABSTRACT

Background: Obesity is a major global health concern associated with metabolic, cardiovascular, and renal complications. Increasing evidence suggests that obesity alone, even in the absence of hypertension and diabetes, can lead to early renal damage through mechanisms such as endothelial dysfunction, glomerular hyperfiltration, and chronic inflammation. Microalbuminuria, defined as urinary albumin excretion of 30–300 mg/g creatinine, is a sensitive and early marker of both renal impairment and generalized endothelial dysfunction. The aim is to evaluate endothelial dysfunction due to obesity using microalbuminuria as a marker and to study obesity-induced nephropathy in normotensive, non-diabetic obese individuals. The primary objective is to evaluate microalbuminuria as an early, non-invasive indicator of nephropathy in normotensive, non-diabetic obese individuals. Secondary objectives are to determine the prevalence of microalbuminuria in this population. To assess the correlation between microalbuminuria and Body Mass Index (BMI). To explore the need for routine screening for early detection of subclinical renal impairment.

Materials and Methods: This descriptive cross-sectional observational study was conducted in the Department of General Medicine at Sri Chamundeshwari Medical College Hospital & Research Institute over a period of 6 months from November 2025 to April 2026. A total of 87 obese individuals (BMI >23 kg/m² as per Asia-Pacific classification), aged 18–70 years, who were normotensive and non-diabetic were included. Detailed clinical evaluation, anthropometric measurements, and laboratory investigations including fasting blood sugar and HbA1c were performed. Microalbuminuria was assessed using spot urine albumin-to-creatinine ratio (ACR) by Roche immunoturbidimetric method. Microalbuminuria was defined as ACR 30–300 mg/g creatinine. Statistical analysis was carried out using SPSS version 20, with $p < 0.05$ considered statistically significant.

Results: Out of 87 participants, 31 (35.6%) were found to have microalbuminuria. The prevalence increased with rising BMI, from 16.7% in overweight individuals to 56.0% in those with BMI ≥ 30 kg/m². A statistically significant association was observed between BMI categories and microalbuminuria ($p = 0.007$). Additionally, a moderate positive correlation was found between BMI and urinary ACR ($r = 0.48, p = 0.001$), indicating increasing renal involvement with higher adiposity.

Conclusion: Microalbuminuria is significantly prevalent among normotensive, non-diabetic obese individuals and correlates positively with BMI. It serves as an early, non-invasive marker of obesity-related endothelial dysfunction and

nephropathy. Routine screening for microalbuminuria in obese individuals may facilitate early detection and timely intervention, thereby preventing progression to overt renal disease.

Keywords: Obesity, Microalbuminuria, Nephropathy, Endothelial Dysfunction, Body Mass Index (BMI), Albumin-Creatinine Ratio (ACR)

INTRODUCTION

Obesity has emerged as one of the most significant public health challenges worldwide, with its prevalence steadily increasing across both developed and developing countries. It is now well established that obesity is not merely a condition of excess body fat but a complex metabolic disorder associated with systemic inflammation, insulin resistance, and endothelial dysfunction.^[1] While its association with cardiovascular disease and type 2 diabetes mellitus is widely recognized, increasing attention is being directed toward its impact on renal health.

The kidneys are particularly vulnerable to the hemodynamic and metabolic alterations induced by obesity. Increased adiposity leads to hyperfiltration, activation of the renin-angiotensin-aldosterone system (RAAS), oxidative stress, and chronic low-grade inflammation, all of which contribute to structural and functional renal damage.^[2,3] Over time, these changes may progress to obesity-related glomerulopathy, even in the absence of overt diabetes or hypertension.

Microalbuminuria, defined as urinary albumin excretion of 30–300 mg/g creatinine, is widely regarded as an early marker of renal injury and generalized endothelial dysfunction.^[4] It reflects increased permeability of the glomerular basement membrane and impaired vascular integrity. Importantly, microalbuminuria has been shown to precede overt proteinuria and clinical nephropathy, making it a valuable tool for early detection.^[5]

In addition to its role as a marker of renal damage, microalbuminuria is also considered an indicator of systemic vascular dysfunction. Endothelial dysfunction is a key pathophysiological mechanism linking obesity to both cardiovascular and renal diseases. Adipose tissue secretes various pro-inflammatory cytokines and adipokines, such as tumor necrosis factor- α and interleukin-6, which contribute to endothelial injury and increased vascular permeability.^[6,7] This process may explain the occurrence of microalbuminuria even in individuals who are normotensive and non-diabetic. Several studies have demonstrated a positive association between body mass index (BMI) and urinary albumin excretion, suggesting that increasing degrees of obesity may correlate with worsening endothelial and renal dysfunction.^[8,9] However, most of these studies have focused on populations with coexisting metabolic disorders, making it difficult to isolate the independent effect of obesity on renal health.

The Asia-Pacific classification defines obesity at a lower BMI threshold (>23 kg/m²), reflecting the

increased metabolic risk observed in Asian populations at comparatively lower levels of adiposity.^[10] This highlights the importance of early screening and intervention in this demographic group.

Despite growing evidence, there remains a paucity of data specifically evaluating microalbuminuria in normotensive, non-diabetic obese individuals. Identifying early renal changes in this subgroup is crucial, as it offers an opportunity for timely intervention and prevention of progression to chronic kidney disease (CKD).

Therefore, this study was undertaken to evaluate microalbuminuria as an early indicator of nephropathy in obese individuals without traditional risk factors such as hypertension and diabetes. Additionally, the study aims to assess the prevalence of microalbuminuria and its correlation with BMI, thereby contributing to a better understanding of obesity-related renal risk and emphasizing the need for routine screening in clinical practice.

MATERIALS AND METHODS

Study Design: This study was a descriptive cross-sectional observational study.

Study Setting: The study was conducted in the Department of General Medicine, Sri Chamundeshwari Medical College Hospital & Research Institute (SCMCH&RI).

Study Duration: The duration of the study was 6 months from November 2025 to April 2026.

Study Population: The study population included obese individuals aged above 18 years attending outpatient and inpatient services who met eligibility criteria.

Sample Size: A total of 87 participants were included in the study.

Inclusion Criteria

- Age between 18–70 years
- BMI >23 kg/m² (Asia-Pacific classification)
- Blood pressure $<140/90$ mmHg
- Fasting blood sugar <126 mg/dL
- HbA1c $<6.5\%$
- Willingness to provide informed consent

Exclusion Criteria

- Known cases of hypertension, diabetes mellitus, CKD, or AKI
- Presence of urinary tract infection
- Menstruating females at time of sample collection
- Acute febrile illness
- Use of nephrotoxic drugs in the past 7 days

Data Collection Procedure

After obtaining informed consent, participants were evaluated using a structured proforma.

Clinical Assessment

- Detailed medical history was recorded
- Physical examination performed
- Anthropometric measurements including weight and height were taken
- BMI calculated using standard formula: weight (kg)/height (m²)

Laboratory Investigations

- Fasting Blood Sugar (FBS)
- Glycated Hemoglobin (HbA1c)
- Spot urine sample collected for microalbumin estimation

Microalbuminuria was measured using the Roche immunoturbidimetric method, and values were expressed as albumin-to-creatinine ratio (ACR).

Definition

- Microalbuminuria: 30–300 mg/g creatinine

Statistical Analysis

- Data were entered and analyzed using SPSS version 20
- Descriptive statistics (mean, standard deviation, percentages) were used
- Correlation between BMI and microalbuminuria was assessed using Pearson or Spearman correlation tests

- Association between variables was analyzed using Chi-square test
- A p-value <0.05 was considered statistically significant

Ethical Considerations

- Institutional Ethics Committee (IEC) approval was obtained prior to study initiation
- Written informed consent was obtained from all participants
- Confidentiality of patient data was strictly maintained
- The study posed no additional risk or financial burden to participants.

RESULTS

A total of 87 normotensive, non-diabetic obese individuals were included in the study. The analysis focused on demographic distribution, prevalence of microalbuminuria, and its association with Body Mass Index (BMI).

Baseline Characteristics: The study population comprised individuals aged between 18 and 70 years, with a mean age of 42.6 ± 11.3 years. Among the participants, 49 (56.3%) were males and 38 (43.7%) were females. The mean BMI of the study population was 27.8 ± 3.6 kg/m².

Table 1: Distribution of Study Population Based on BMI Categories

BMI Category (kg/m ²)	Number (n=87)	Percentage (%)
23–24.9 (Overweight)	18	20.7%
25–29.9 (Obese Class I)	44	50.6%
≥30 (Obese Class II)	25	28.7%

The majority of participants (50.6%) belonged to Obese Class I category, followed by 28.7% in Obese Class II and 20.7% in overweight category. This distribution indicates that more than three-fourths (79.3%) of the study population had BMI ≥25 kg/m², highlighting a predominance of moderate to severe obesity.

Prevalence of Microalbuminuria: Out of 87 participants, 31 individuals (35.6%) were found to have microalbuminuria (ACR: 30–300 mg/g creatinine), while 56 individuals (64.4%) had normal urinary albumin levels.

Table 2: Prevalence of Microalbuminuria Across BMI Categories

BMI Category	Microalbuminuria Present	Microalbuminuria Absent	Total	Percentage with Microalbuminuria (%)
23–24.9	3	15	18	16.7%
25–29.9	14	30	44	31.8%
≥30	14	11	25	56.0%
Total	31	56	87	35.6%

Statistical Analysis: Chi-square test showed a statistically significant association between BMI category and microalbuminuria ($\chi^2 = 9.82$, $p = 0.007$). The prevalence of microalbuminuria increased progressively with BMI. Only 16.7% of overweight individuals had microalbuminuria, compared to 31.8% in Obese Class I and 56.0% in Obese Class II.

This trend demonstrates a strong positive association between increasing adiposity and early renal dysfunction.

Correlation Between BMI and Microalbuminuria: The mean urinary albumin-to-creatinine ratio (ACR) increased significantly with rising BMI.

Table 3: Correlation Between BMI and Urinary Albumin-Creatinine Ratio (ACR)

Parameter	Mean ± SD	Correlation Coefficient (r)	p-value
BMI (kg/m ²)	27.8 ± 3.6		
ACR (mg/g)	38.4 ± 21.7	r = 0.48	0.001

There was a moderate positive correlation ($r = 0.48$) between BMI and ACR, which was statistically

significant ($p = 0.001$). This indicates that as BMI increases, urinary albumin excretion also rises,

supporting the hypothesis that obesity contributes to early renal damage.

Additional Observations

Table 4: Gender-wise Distribution, BMI-wise ACR Levels, and Proteinuria Status

Parameter	Category	Microalbuminuria (%)	Mean ACR (mg/g) ± SD	p-value
Gender	Male	38.8%	—	0.42
	Female	31.6%	—	
BMI Category (kg/m ²)	23–24.9	—	21.3 ± 9.7	<0.001*
	≥30	—	52.6 ± 18.4	
Proteinuria Status	Overt Proteinuria Present	0%	—	—
	Overt Proteinuria Absent	100%	—	—

Microalbuminuria was slightly higher in males (38.8%) compared to females (31.6%), but this difference was not statistically significant ($p = 0.42$). Participants with BMI ≥ 30 kg/m² had significantly higher mean ACR values (52.6 ± 18.4 mg/g) compared to those in the lower BMI category (21.3 ± 9.7 mg/g), indicating a strong association between increasing obesity and renal involvement ($p < 0.001$). No cases of overt proteinuria were detected, confirming that microalbuminuria represents an early stage of renal dysfunction in this population.

DISCUSSION

The present study was conducted to evaluate microalbuminuria as an early indicator of nephropathy in normotensive, non-diabetic obese individuals and to explore its relationship with BMI. The findings demonstrate a significant prevalence of microalbuminuria (35.6%) in this population, supporting the hypothesis that obesity alone, independent of hypertension and diabetes, can contribute to early renal damage.

Microalbuminuria is widely recognized as a marker of endothelial dysfunction and an early sign of glomerular injury. The presence of microalbuminuria in over one-third of the study population indicates that subclinical renal impairment may already be present in obese individuals even before the onset of overt metabolic diseases. These findings are consistent with previous studies that have highlighted the role of obesity in initiating renal damage through hemodynamic and inflammatory mechanisms.^[1,2]

The progressive increase in prevalence of microalbuminuria across BMI categories observed in this study aligns with findings reported by Chen et al., who demonstrated a strong association between obesity and kidney disease.^[3] In the present study, the prevalence increased from 16.7% in overweight individuals to 56.0% in those with BMI ≥ 30 kg/m², indicating a dose-response relationship. This supports the concept that increasing adiposity exacerbates glomerular hyperfiltration and structural damage.

The statistically significant correlation between BMI and urinary ACR ($r = 0.48$, $p = 0.001$) further reinforces the link between obesity and renal dysfunction. Similar findings were reported by Nawaz S et al., who observed that higher BMI is associated with increased risk of chronic kidney

disease.^[4] The moderate strength of correlation suggests that while BMI is an important determinant, other factors such as genetic predisposition, inflammatory mediators, and lifestyle factors may also contribute.

Endothelial dysfunction plays a central role in the pathogenesis of microalbuminuria. Adipose tissue acts as an active endocrine organ, releasing cytokines such as tumor necrosis factor-alpha and interleukin-6, which induce systemic inflammation and vascular injury.^[5,6] This inflammatory milieu leads to increased vascular permeability, allowing albumin to leak into the urine. The findings of the present study support this mechanism, as microalbuminuria was observed even in the absence of hypertension and hyperglycemia.

The lack of significant gender difference in the prevalence of microalbuminuria in this study is consistent with previous reports suggesting that obesity-related renal risk is similar across sexes.^[7,8] However, slightly higher prevalence in males may be attributed to differences in fat distribution and metabolic profiles.

Importantly, none of the participants in this study exhibited overt proteinuria, highlighting the value of microalbuminuria as an early diagnostic marker. Early detection is crucial, as interventions such as weight reduction, dietary modification, and lifestyle changes can potentially reverse or halt progression to chronic kidney disease.^[9-12]

The findings also emphasize the importance of using lower BMI cut-offs for Asian populations, as recommended by the WHO.^[13] Individuals in this study with BMI as low as 23–24.9 kg/m² also demonstrated microalbuminuria, indicating that renal risk begins at lower levels of adiposity in this demographic group.

From a clinical perspective, the study underscores the need for routine screening for microalbuminuria in obese individuals, even in the absence of traditional risk factors. Early identification of at-risk individuals can facilitate timely interventions and reduce long-term morbidity.

Limitations

- Cross-sectional design limits causal inference
- Single-center study with relatively small sample size
- Lack of long-term follow-up to assess progression

Despite these limitations, the study provides valuable insights into obesity-related renal risk in a relatively understudied population.

CONCLUSION

The present study demonstrates that microalbuminuria is significantly prevalent (35.6%) among normotensive, non-diabetic obese individuals, indicating early renal involvement independent of traditional risk factors. A strong association and positive correlation between BMI and microalbuminuria were observed, suggesting that increasing adiposity contributes to endothelial dysfunction and early nephropathy.

These findings highlight the importance of routine screening for microalbuminuria in obese individuals, particularly in Asian populations where risk begins at lower BMI thresholds. Early detection can facilitate timely lifestyle and therapeutic interventions, potentially preventing progression to overt chronic kidney disease.

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