

## Assessment of Selective Renal Parameters in University-Going Girls of Narowal

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### Abstract

Obesity is recognized as a root cause of various diseases and can significantly affect renal functional levels, leading to further complications in metabolic and hepatic health. Overweight and obese young women are more likely to become overweight or obese adults, putting them at higher risk for serious health conditions such as type 2 diabetes, renal diseases, and hypertension risks which are linked to alterations in serological parameters. This prospective study investigated selected serological parameters among young university-going girls aged 18–25 years in Narowal, Pakistan. A total of = 400) were included in this study, which were further divided into the Control Group and Experimental Groups (i.e., underweight, overweight, and Obese) based on BMI. Anthropometric measurements were conducted, and blood samples were collected to analyze serum creatinine and serum urea levels using an automated chemistry analyzer. The results demonstrated significant differences ( $P < 0.006$ ) in both serum creatinine and urea levels across the different weight categories. Specifically, serum creatinine and urea levels were positively correlated with participants who were underweight, overweight, or obese, while a positive correlation was observed in those with a normal weight. The findings highlighted the increasing prevalence of obesity among young adults in Pakistan, which is a growing public health concern. In conclusion, body weight is closely associated with important biochemical indicators. Changes in these parameters can lead to significant health issues, underscoring the need for effective interventions targeting young adults to prevent long-term health complications.

**Keywords:** Obesity, Renal Functions, BMI, Health

### Introduction

Obesity has become so common around the world that it's now one of the leading causes of illness, surpassing issues like undernutrition and infectious diseases in many areas (1). It's closely linked with a higher risk of several long-term health problems, such as type 2 diabetes, heart disease, certain types of cancer, and sleep-related breathing disorders (2). In simple terms, obesity means having an excessive amount of body fat that negatively affects your health (3).

The global rise in obesity isn't due to just one reason, it's the result of multiple factors, including genetic tendencies, eating too many high-calorie foods, and a sharp drop in physical activity due to our increasingly sedentary lifestyles. Because of its wide-reaching impact, obesity shouldn't just be seen as a cosmetic issue; it's a serious global public health concern that puts immense pressure on both individual well-being and healthcare systems (4).

On the other hand, when the body doesn't get enough energy, whether due to poor nutrition, intense physical activity, or stress, it can lead to chronic energy deficiency. This can interfere with the hypothalamic-pituitary-gonadal (HPG) axis, disrupting bodily functions and potentially leading to weight loss (5). Carrying excess weight, especially around the abdomen (indicated by a larger waist circumference), raises the risk of health problems. Whether someone is considered overweight or obese (as shown by a high BMI) also depends on factors like age, sex, and geographic region (6).

Body Mass Index (BMI) is a simple calculation based on a person's weight and height that helps determine whether they fall into a healthy weight range or not (7). It is commonly used around the world across different populations, races, and ethnicities—as a standard tool to define overweight and obesity (8). In everyday terms, BMI is one of the most widely recognized methods for checking if someone's weight is appropriate for their height (9).

Clinically, a BMI of 30 kg/m<sup>2</sup> or more is classified as obesity. However, this cutoff doesn't always reflect the full picture of health risks, especially when it comes to fat stored around the organs (visceral fat), which can be harmful even at lower BMI levels. An optimal BMI is considered to fall between 20 and 22, as this range is linked with the longest life expectancy and the lowest chances of developing chronic illnesses (10). A BMI between 22 and 25 is still considered healthy and is generally not associated with a high risk of heart disease or metabolic issues (11).

Once BMI crosses 25 but stays below 30, a person is considered overweight. At this stage, it's usually recommended to make some lifestyle adjustments, like eating healthier and getting more exercise, to help bring weight down and prevent future health problems (12). Interestingly, when muscle mass decreases, it can influence the metabolism of substances like urea and creatinine. Creatinine, which comes from muscle metabolism and protein intake, is produced at levels that reflect how much muscle a person has (13).

Blood urea nitrogen is a metabolic byproduct derived from the catabolism of proteins and amino acids (14). It is subsequently processed in the liver and excreted through the kidneys in the urine levels provide insight into protein metabolism, hepatic processing, and renal excretory capacity (15). Thus, BUN. Conversely, serum creatinine (Cr), a breakdown product of muscle creatine, is primarily influenced by muscle mass and metabolic activity (16). Therefore, the combined assessment of BUN and creatinine offers a broader perspective on both protein turnover and muscular metabolic status (17).

A study entitled Assessment of Selected Serological Factors in Overweight Children of Lahore, Pakistan was conducted, involving anthropometric measurements, blood sample collection, and analysis of lipid profile, serum creatinine, and serum albumin using an automated chemistry analyzer. The results showed a negative correlation between serum albumin and children's weight, while serum creatinine was positively correlated with weight. In Pakistan, pediatric obesity has reached alarming, epidemic levels. Overweight children are more likely to become overweight adults, placing them at greater risk of developing serious health conditions later in life, such as type 2 diabetes, kidney diseases, and hypertension, due to alterations in various serological parameters. In conclusion, body weight shows a clear association with biochemical parameters (19).

There is a paucity of research examining the demographic profiles and morbidity patterns of university-going female individuals classified as 'underweight, overweight, or Obese' based on body mass index (BMI), despite consistent evidence indicating elevated future risk of renal disease. None of these previous studies addressed the possible correlation of BMI and renal biochemical parameters in university-going young girls of females of Narowal. The present study aims to evaluate and compare the demographic characteristics and possible association of BMI with selective renal biochemical parameters in Narowal

## Material and Methods

### Study Design

This cross-sectional study was conducted at the Medical Laboratory Technology (MLT) Lab, Al Shifa Institute, Narowal, from April 2025 to July 2025. The objective was to assess serum creatinine and urea levels among underweight, normal weight, overweight, and obese university-going females based on Body Mass Index (BMI) classification.

### Study Population

The study population consisted of university-going female students enrolled at institutions within Narowal. A total of 400 participants were recruited using non-probability purposive sampling

### Inclusion Criteria:

- Female students aged 18 to 25 years.
- Enrolled in a university within Narowal.
- Willing to participate and provided written informed consent.
- Not suffering from any known renal, hepatic, or metabolic disorders.
- Not taking any medications affecting kidney function (e.g., diuretics, nephrotoxic drugs).

### Exclusion Criteria:

- Females below 18 or above 25 years.
- Pregnant or lactating women.
- Individuals with a history of chronic diseases such as diabetes, hypertension, or kidney disease. Those on medications that could influence serum creatinine or urea levels.

### Anthropometric Measurements and BMI Estimation:

Weight was measured using a digital weighing scale with participants wearing light clothing and no shoes. Height was measured using a measuring tape.

BMI was calculated using the formula: Based on WHO BMI classification: Underweight:  $<18.5$  kg/m<sup>2</sup> Normal weight: 18.5–24.9 kg/m<sup>2</sup> Overweight: 25–29.9 kg/m<sup>2</sup> Obese:  $\geq 30$  kg/m<sup>2</sup>

Participants were grouped accordingly in two main Groups Control and Experimental Groups (Overweight, Underweight, Obese)

### Sample Collection and Serum Analysis

5 mL of venous blood was collected from each participant under aseptic conditions. The blood was allowed to clot, and serum was separated via centrifugation at 3000 rpm for 10 minutes. Serum creatinine and urea levels were measured using automated biochemical analyzers following standard protocols. Creatinine and Urea was estimated using Commercial Kits

### Protocol for Creatinine and Urea Analysis

The experiment began by adding 8  $\mu$ L of the sample to the reaction mixture. Then, 270  $\mu$ L of sarcosine oxidase solution was added. The mixture was incubated at 37 °C for 5 minutes to allow the reaction to proceed. After incubation, the optical density (OD) was measured at 550 nm. Subsequently, 90  $\mu$ L of peroxidase solution was added to the same mixture, followed by another 5-minute incubation at 37 °C. Finally, the OD was measured again at 550 nm.

## Data Analysis

Data were recorded and analyzed using Minitab and Microsoft Excel. Mean and standard deviation were calculated for continuous variables. One-way ANOVA was used to compare mean creatinine and urea levels among the BMI groups. A p-value <0.05 was considered statistically significant.

## Results

This study was conducted on 400 subjects from university going girls in Narowal who were further divided into control and experimental groups (underweight, overweight, and obese adults) for the assessment of serum creatinine and serum urea, which was measured by a chemistry analyzer.

### Age

The mean age of the control group females was ( $20.53 \pm 1.92$ ) years. In the experimental groups, underweight females had a mean age of ( $19.83 \pm 1.40$ ) years, overweight females ( $20.66 \pm 1.95$ ) years, and obese females ( $21.31 \pm 1.22$ ) years.

### Height

Control females had a mean height of ( $1.58 \pm 0.08$ ) m. Underweight females measured ( $1.59 \pm 0.10$ ), overweight females ( $1.55 \pm 0.8$ ) meters, and obese females ( $1.83 \pm 1.95$ ) meters

### Weight

The mean weight for control females was ( $51.52 \pm 7.15$ ) kg. Underweight females weighed ( $42.62 \pm 5.06$ ) kg, overweight females  $65.05 \pm 6.95$  kg, and obese females  $69.98 \pm 19.09$  kg.

### Body Mass Index (BMI)

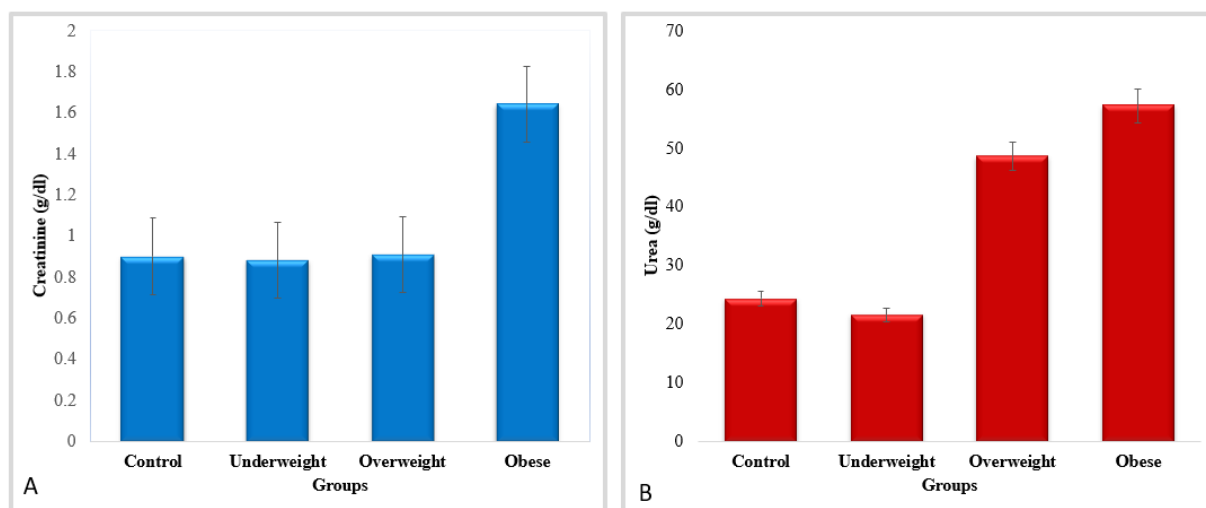
Control females had a mean BMI of ( $20.78 \pm 1.80$ ). Underweight females had a BMI of ( $16.28 \pm 1.61$ ), overweight females  $26.84 \pm 1.43$ , and obese females ( $36.59 \pm 6.77$ ).

### Serum Creatinine

The mean serum creatinine level in control females was ( $0.90 \pm 0.11$ ) mg/dL. Underweight females had ( $0.88 \pm 0.06$ ) mg/dL, overweight females ( $0.93 \pm 0.12$ ) mg/dL, and obese females ( $1.645 \pm 0.11$ ) mg/dL.

### Serum Urea

Control females showed a mean serum urea level of ( $24.3 \pm 3.90$ ) mg/dL. Underweight females had ( mg/dL, overweight females ( $48.5 \pm 2.36$ ) mg/dL, and obese females ( $57.17 \pm 2.4$ )mg/dL.



**A-Graph** Showing Creatinine Level in Control and Experimental Groups (i.e Underweight, Overweight and Obese)

**B-Graph** Showing Urea Level in Control and Experimental Groups (i.e, Underweight, Overweight, and Obese)

**Table 1:** Mean Values of Different Parameters in Control and Experimental Groups (i.e Underweight, Overweight and Obese)

Parameters	Control group	Experimental Group		
		Underweight	Overweight	Obese
Age (Years)	20.53±1.92	19.83±1.40	20.66±1.95	21.31±1.22
Height (Cm)	1.58±0.08	1.59±0.10	1.55±0.08	19.83±1.95
Weight (Kg)	51.52±7.15	42.62±5.06	65.05±6.95	69.98±19.09
BMI (Kg/m <sup>2</sup> )	20.78±1.80	16.28±1.61	26.84±1.43	36.59±6.77
Creatinine (g/dl)	0.9083±0.1167	0.88±0.06454	0.90833±0.1281	1.645±0.1148**
Urea (g/dl)	24.3333±3.9015	21.5±3.54729	48.5±2.36290	57.1667±2.4013***

\*\* sign showing a highly significant difference between

### Discussion

The present study demonstrated distinct variations in BMI among different female groups, with mean values and standard deviations of (20.78 ± 1.80) in normal weight, (16.28 ± 1.16) in underweight, (26.84 ± 1.43) in overweight, and (36.59 ± 6.77) in obese individuals. A comparable study reported mean BMI values of (21.83 ± 4.52) in normal weight, (1.19 ± 2.25) in underweight, (0.89 ± 1.80) in overweight, and (0.84 ± 0.43) in obese females (64).

A positive correlation between serum creatinine, urea, and BMI was observed in the present study, aligning with findings by S. Aktar, who also reported significantly higher serum creatinine levels in overweight and obese female adults compared to normal-weight females ( $p < 0.001$ ). Both serum creatinine and urea levels increased proportionally with BMI, reinforcing the recommendation for routine BMI screening to monitor body weight and related metabolic alterations (65).

In the current study, mean serum creatinine levels were (0.9083 ± 0.1169) mg/dl in the control group and (0.88 ± 0.06454) mg/dl in the experimental group (Underweight). Mean serum urea values were 24.33 ± 3.90 mg/dl (control) and 21.50 ± 3.54 mg/dl (experimental underweight). Ude, Ugomma A. reported comparatively higher serum creatinine values (1.25 ± 0.47) in controls, (1.39 ± 0.70) in experimental, and lower urea levels (3.03 ± 1.66 mg/dl) while maintaining a positive correlation between BMI and both creatinine and urea (66).

Similarly, the present study's correlation between serum creatinine and BMI in obese individuals is in agreement with other reports showing consistent positive associations. Divya Pandya documented serum creatinine means of (0.94 ± 0.20) mg/dl in controls and (7.19 ± 4.77) mg/dl in experimental groups, with corresponding serum urea levels of (26.74 ± 3.91) mg/dl and (112.66 ± 43.52 mg/dl,) respectively. Notably, Pandya's work also indicated that salivary urea and creatinine

levels can serve as non-invasive markers for estimating serum concentrations in renal disorders (67).

Other studies have emphasized the diagnostic value of serum urea and creatinine in assessing renal function. For example, blood urea in experimental groups has been reported as high as  $18.1 \pm 31.7$  mg/dl compared to ( $6.4 \pm 15.0$  mg/dl) in controls, and serum creatinine at  $0.8 \pm 2.2$  mg/dl versus  $0.5 \pm 1.0$  mg/dl, indicating strong correlations with renal impairment (68). Additional evidence from salivary analysis showed significantly elevated creatinine (2.60 mg/dl) and urea (92.00 mg/dl) in chronic kidney disease patients compared to controls (0.20 mg/dl) and 20.50 mg/dl, respectively) with a strong positive association to blood levels (69).

Moreover, serum urea and creatinine have been recognized as prognostic indicators for renal damage. In one study, creatinine levels were higher in males, attributed to greater muscle mass, but positive correlations between BMI and creatinine were evident in both sexes. Mean creatinine in controls was ( $0.89 \pm 0.21$ ) mg/dl compared to ( $1.13 \pm 0.77$ ) mg/dl in experimental groups, while urea levels increased from  $18.31 \pm 4.55$  mg/dl to  $29.22 \pm 20.32$  mg/dl between the two groups in previous studies (70).

Finally, another study reported mean BMI values of ( $24.30 \pm 2.12$ ) in healthy controls and ( $29.8 \pm 7.36$ ) (experimental), with serum creatinine levels of ( $64.60 \pm 7.06$ ) mg/dl and ( $84.17 \pm 54.73$ ) mg/dl, respectively. Serum urea levels showed only minor variation between groups ( $4.30 \pm 0.42$ ) mg/dl vs. ( $4.34 \pm 3.77$ ) mg/dl (71).

Collectively, these findings and prior literature suggest that elevated BMI, particularly in overweight and obese individuals, is consistently associated with higher serum creatinine and urea levels. These biochemical markers, in both blood and saliva, provide valuable insights into renal function and may serve as early indicators of renal stress in individuals with higher BMI.

## Conclusion

This study demonstrated that serum creatinine levels tend to be slightly higher among university-going females with higher BMI, while serum urea levels show minimal variation across BMI categories. Although the observed differences in creatinine were statistically significant, they remained within the normal physiological range for healthy young women, indicating no immediate evidence of renal impairment. The results suggest that BMI should be considered when interpreting renal biomarkers, even in an otherwise healthy, young population.

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#### **Competing Interests**

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#### **Availability of data and material:**

Corresponding authors will provide data on request.