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Research Article

Sociodemographics-Based Assessment on Urine Albumin-To-Creatinine Ratio And Creatinine Levels Among Kidney Disease Patients At Federal Teaching Hospital, Owerri, Nigeria

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Abstract

Urinary albumin-to-creatinine ratio (UACR) and creatinine levels are essential biomarkers for diagnosing and monitoring kidney function. Understanding sociodemographic influences on these biomarkers can guide preventive and treatment strategies for kidney disease, particularly in developing countries like Nigeria. This study investigated the impact of sociodemographic factors, specifically age and gender, on UACR and creatinine levels among patients attending Federal Teaching Hospital, Owerri. A cross-sectional study was conducted among 39 kidney disease patients (37 geriatric and 2 pediatric) at FMC Owerri. Blood and urine samples were collected and analyzed using the Jaffe method for creatinine and bromocresol green (BCG) for albumin. Statistical analyses included T-tests and ANOVA, with significance set at $p \leq 0.05$. The study found significant differences ($p < 0.05$) in UACR levels across age groups, with the highest levels in the youngest age group ($\leq$ 20 years) but there was no significant difference ($p > 0.05$) in UACR levels between genders. No significant differences ($p > 0.05$) in creatinine levels were observed across age groups or between genders. This study has shown that age but not gender impacts on UACR level in patients attending Federal Teaching Hospital, Owerri. In addition, age and gender did not have any significant impact on creatinine levels in kidney disease patients attending Federal Teaching Hospital, Owerri.

1. Introduction

Urinary Albumin-to-Creatinine Ratio (UACR) serves as a key marker for diabetic nephropathy, a major microvascular complication of diabetes mellitus [1]. It reflects the level of urinary albumin excretion, an early indicator of kidney damage. Creatinine, a waste product eliminated by the kidneys, acts as a marker of kidney function [2]. Abnormal levels of both UACR and creatinine suggest potential kidney dysfunction [3]. However, UACR and creatinine remain essential biomarkers for diagnosing and monitoring kidney function [2].

Kidney disease represents a significant global health burden, particularly in developing countries like Nigeria, where access to healthcare and socioeconomic disparities are substantial [4] . Sociodemographic factors such as age, gender, ethnicity, socioeconomic status, and lifestyle habits can influence an individual's risk of developing kidney disease [2, 5]. Understanding the social and demographic determinants that influence these biomarkers can aid in identifying vulnerable populations and guide the development of effective preventive and treatment strategies [6]. Several studies have explored the relationship between sociodemographic factors and UACR/creatinine levels. Ageing is a well-established risk factor for kidney disease, with multiple studies reporting a positive correlation between age and UACR levels

[7–9]. Similarly, a decline in kidney function, as reflected by elevated creatinine levels, is also associated with increasing age [10, 11]. Documentation exists regarding gender differences in UACR and creatinine levels. Some studies suggest higher UACR levels in men compared to women [12, 13]. For creatinine, men generally have higher levels than women due to their larger muscle mass [14]. However, after adjusting for muscle mass, some studies suggest that gender-related disparities in creatinine levels might still exist [15]. Socioeconomic factors like income, education, and occupation have also been linked to kidney disease risk [16]. Lower socioeconomic status is associated with higher UACR and creatinine levels, potentially due to limited access to healthcare, unhealthy lifestyles, and environmental factors [17, 18]. Racial and ethnic disparities exist in the prevalence of kidney disease. African Americans and Asians are known to be at higher risk compared to Caucasians [19].

This study investigated the influence of sociodemographic factors, particularly age and gender, on UACR and creatinine levels among patients attending FMC Owerri. By focusing on these key demographic factors, the study aimed to contribute to the understanding of the local disease burden and the factors contributing to its distribution.

2. Materials and Methods

Study design

This study employed a cross-sectional design, collecting data at a single point in time to compare urine albumin-to-creatinine ratio and creatinine values with gender and age sociodemographic [20].

Study population

The study was conducted among kidney disease patients attending Federal Teaching Hospital, Owerri, Nigeria. The sample comprised 39 individuals: 37 geriatric patients and 2 pediatric patients aged 7, and 12 years.

Study Area

This study was conducted within Federal Teaching Hospital Owerri, located in Owerri-Municipal LGA, Imo State.

Eligibility criteria

The patients eligibility for this study are stated as follows.

Inclusion criteria

This study included patients registered at Federal Teaching Hospital, Owerri. Also, patients determined as medically healthy by medical doctors at Federal Teaching Hospital, Owerri were also included without any gender preference.

Exclusion criteria

Patients not registered and not attending Federal Teaching Hospital, Owerri were excluded. In addition, patients with no idea of their age and as such provided incomplete questionnaire.

Sampling method

The sampling method used for this study was simple random sampling technique. In this technique, participants were given an equal opportunity of being selected by asking them to pick from a tray having equal number of “I” and “E”, such that those who picked “I” were included while those who picked “E” were excluded [21].

Sample Collection

The study required the collection of two biological fluids blood and urine samples.

Blood

Two milliliters of blood were drawn through venipuncture using a heparinized anticoagulant bottle. The procedure followed standard phlebotomy techniques, including vein selection, tourniquet application, site cleaning with alcohol, and blood collection [22, 23].

Urine

A spot or random urine sample is collected into a universal container at any time of the day to reduce the chance of contamination [24].

Laboratory methods

Jaffe method was used to test for blood creatinine and as well as urine creatinine while bromocresol green (BCG) was used to assay albumin in urine. The urine albumin-to-creatinine ratio was mathematically derived as the ratio of urine albumin to urine creatinine level.

Statistical analysis

The data from the 39 samples were entered in Microsoft Excel sheet and exported to SPSS version 25 for analyses of T-tests and ANOVA. The results generated were considered significant at a pvalue less than or equal to 0.05.

3. Results

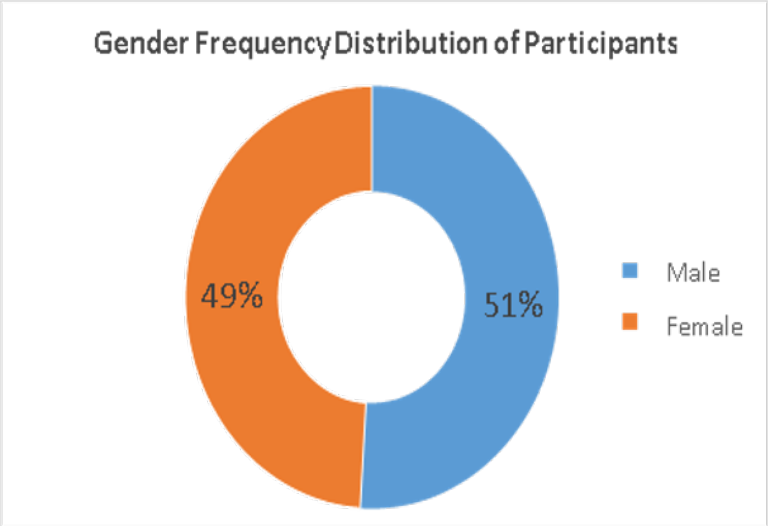

Figure 1: Gender Distribution of Participants

Figure 1 shows the gender distribution of participants in the study. There were 51% males and 49% females involved in the study.

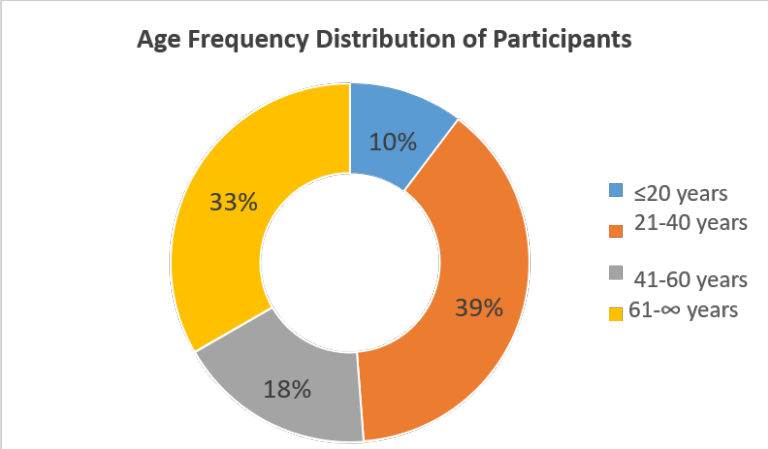

Figure 2: Age Distribution of Participants

Figure 2 shows the age distribution of participants in the study. The age distribution shows the largest group (38.5%) falling between 21 and 40 years old, followed by those 61 and above (33.3%). The youngest and middle-aged adult groups were the smallest, with 10.3% and 17.9% respectively.

Table 1 shows the comparison of UACR levels and creatinine levels across age groups (≤20, 21-40, 41-60, 61- ∞). The result shows that there was a significant difference ($p = 0.006$) in UACR levels across the age groups while there was no significant difference ($p = 0.62$) in creatinine levels across the age groups.

Table 2 compares the levels of UACR and creatinine between genders (male and female). The result showed that there is no significant difference ($p = 0.602$) in UACR level between male and female gender groups. Also, there was no significant difference ($p = 0.98$) in creatinine levels between male and female gender groups.

4. Discussion

This study analyzed UACR and CR values of patients at Federal Teaching Hospital, Owerri, focusing on comparisons across age groups and sexes. This study showed no significance difference across age groups and gender comparison in CR but revealed a significant difference in UACR level among the studied age groups. The results of this study shows that the youngest age group (≤20 years) had significantly higher UACR levels compared to the older age groups. This suggests the youngest patients may be at higher risk for kidney damage and disease.

Table 1: Comparison of UACR and Creatinine level among Age Groups

Age Group	UACR (mg/g)	CR (mmol/L)
≤ 20	12662.7 ± 3.9	517.5 ± 505.9
$21-40$	1646.9 ± 2688.2	244.3 ± 348.2
$41-60$	2137.2 ± 5441.3	293.6 ± 408.3
61-∞	916.9 ± 1216.1	399.5 ± 478.9
F-value	4.97907	0.60521
P-value	0.006	0.62
Remark	Significant	Not significant

Table 2: Comparison of UACR and Creatinine level between Genders

Gender	UACR (mg/g)	CR (mmol/L)
Male	2110.4 ± 3374.1	334.5 ± 432.9
Female	3159.4 ± 8500.5	331.32 ± 406.8
T-value	-0.502	0.02
P-value	0.602	0.98
Remark	Not Significant	Not significant

The elevated UACR in the youngest group could be due to several factors such as congenital or genetic kidney disorders, Acute kidney injury or infection, undiagnosed diabetes or hypertension, etc [25]. In relating this study findings with the reports of other authors, a study by Afkarian et al. [26] found that higher UACR was associated with younger age at diagnosis of type 2 diabetes, suggesting early kidney dysfunction in younger individuals. The report of this researcher and his colleagues align with the finding from this study which reported age-based discrimination in UACR level in children. In addition, a review by Walawender et al. [27] discussed how congenital anomalies of the kidney and urinary tract can lead to elevated UACR from birth or early childhood. To further substantiate the report of this study, another research by Coca et al. [28] demonstrated that acute kidney injury, including from infections, can transiently increase UACR levels. Recall that the population of interest in this study were patients with renal disease, however the study by Coca and his team did not consider the variability of UACR level across age groups. These studies support the key findings and implications discussed in the analysis of UACR.

In contrast, there was no significant difference in creatinine levels across the different age groups. This suggests that overall kidney function, as measured in creatinine was not altered by the age in the youngest patients. The lack of age-related differences in creatinine may be due to the fact that creatinine is a late marker, meaning it shows up late and as such may not respond to variations across age groups so quickly in acute kidney injury. UACR appears more responsive compared to creatinine alone. A longitudinal study by Garg et al. [29] showed that elevated UACR can precede declines in glomerular filtration rate, emphasizing the importance of UACR in early monitoring of kidney disease and possible reflection of variation in the distribution across possible influencing factors. This highlights the importance of using both UACR and creatinine to fully assess kidney health [17], as they provide complementary information. Elevated UACR can be an early marker of kidney damage, while creatinine levels reflect overall glomerular filtration rate [30, 31]. A study by Ford [32] demonstrated that UACR and creatinine provide distinct and complementary information about kidney health. UACR is an early marker of kidney damage, while creatinine reflects overall GFR. Using both measures allows for more comprehensive assessment of kidney function.

Also, there was no statistical significance in either UACR or creatinine levels between males and females. This may indicate that gender does not appear to be a significant sociodemographic factor influencing UACR or creatinine levels in this patient population. The lack of gender differences suggests the elevated UACR observed in the youngest age group is likely not driven by gender- specific factors.

Conclusively, the gender comparison revealed no statistically significant differences in UACR or creatinine levels between males and females. This suggests gender is not a major sociodemographic factor influencing these kidney health markers in this population, and the focus should be on the elevated UACR observed in the youngest age group, regardless of gender.

5. Conclusion

This study at FTH Owerri found that UACR levels significantly differed across age groups, with the youngest patients ($\leq$20 years) showing the highest levels, indicating a higher risk of kidney damage. Creatinine levels did not significantly vary with age or gender. Gender did not significantly influence UACR or creatinine levels in this population. These results highlight the need for further investigation and targeted interventions for the youngest age group to prevent kidney damage.

Limitations

The small sample size of 39 patients limits the generalizability of the findings, and the cross- sectional design does not allow for observing trends over time. Additionally, the study did not account for potential confounding variables such as comorbid conditions, medication use, or lifestyle factors that could influence UACR and creatinine levels.

Recommendations

To address the high UACR levels observed in the youngest age group at Federal Teaching Hospital, Owerri, it is recommended to conduct further research to identify underlying causes, implement routine screening using both UACR and creatinine, and develop targeted interventions for early detection and management of kidney damage. Studying other patients characteristics is also vital as this study only looked at age and sex.

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