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Research Article

Sex and Age-Related Difference In Renal Markers in Pediatric Patients: A Study At Federal Teaching Hospital, Owerri, Imo State, Nigeria

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Abstract

Assessing renal function in pediatric populations is essential but complex due to developmental variations influenced by age and gender. Creatinine and urea, which are primary markers for renal function, vary significantly across different sociodemographic settings, yet these variations are often under explored in clinical practice. This study investigates the impact of sociodemographic factors on renal markers, specifically serum creatinine (Cr) and blood urea nitrogen (Ur) in pediatric patients at Federal Teaching Hospital, Owerri. The crosssectional study involved 100 pediatrics who were recruited into the study by simple random sampling technique at Federal Teaching Hospital, Owerri. The 100 pediatric patients were those less than $\leq$ 6 years and comprising both males and females. Blood samples were collected for urea and creatinine investigations. Using ANOVA and t-test, the differences in this marker across age groups and between genders were analyzed respectively. The results showed that there was no significant difference in creatinine and urea levels between males and females in pediatrics. There was also no significant difference in creatinine levels across the age groups. On the other hand, there was a significant difference in urea level across the age group. This study has thus demonstrated that age and gender does not have any impact on creatinine in pediatrics neither does gender have any significant impact on urea levels except across the age groups of the pediatrics.

1. Introduction

The assessment of renal function is paramount in pediatric healthcare, yet it presents unique challenges due to the dynamic and varied nature of growing bodies [1]. Creatinine and urea levels, widely used indicators of renal health, are influenced by a range of factors, most notably age and gender [2]. Despite their routine use, the subtle nuances of how these markers fluctuate across different demographic groups remain underexplored [3]. It is conceivable that the current diagnostic thresholds we rely on are missing critical age- and gender-specific variations? Such gaps could lead to misinterpretations, impacting the accuracy of diagnoses and the efficacy of treatments [4].

In this research, we focused on the patterns of creatinine and urea levels among children, aiming to reveal any significant sociodemographic differences [5, 6]. By focusing on pediatric patients at the Federal Teaching Hospital, Owerri, we seek to bridge the knowledge gap, fill the deficit and provide a more refined understanding of renal function markers [7]. This study does not only challenge existing culture and routine in pediatric renal management but also stimulates the way. For more demographic consideration in treatment application and accurate pediatric renal management, all culminating to improving health outcomes for children [8].

Renal disease represents a significant global health challenge, particularly affecting vulnerable populations such as children [9]. The assessment of renal function through urea and creatinine values plays a vital role in early detection, management, and prognostication of renal disease [10, 11]. Pediatric populations, in particular, present unique challenges and considerations due to their dynamic growth and developmental stages [12].

In recent years, incidence and prevalence of pediatric renal disease have shown trends of great concern, influenced by various sociodemographic factors including age, gender, socioeconomic status, and geographic location [13–15]. Understanding these factors and their impact on renal markers is essential for designing effective prevention strategies and improving clinical outcomes in pediatric nephrology [16].
Federal Teaching Hospital, Owerri, serves as a pivotal institution in this study, providing a diverse patient population that reflects regional and national sociodemographic characteristics. The centre's comprehensive healthcare services and robust data infrastructure offer a unique opportunity to conduct in-depth analyses on renal markers in pediatric patients across various demographic subsets [17].
This novel research aims to address critical deficits in current literature by assessing the interplay between sociodemographic variables and renal markers (urea and creatinine) in pediatrics [18]. This work will study the effect of these age and gender on serum creatinine and blood urea levels in pediatrics. Furthermore, this research seeks to explain the roles of age and gender on renal markers, thereby contributing to individualized medicine approaches in pediatric nephrology [19]. Such insight s are expected to inform clinical decision making, health policy formulation, and targeted interventions aimed at reducing the burden of renal diseases and improving long- term renal health outcomes in pediatric population [20, 21].

2. Methodology

Study Design

This research employed a cross sectional design to investigate renal markers from a sample population divided into various age groups and genders at Federal Teaching Hospital, Owerri. There urea and creatinine levels were compared across the age groups and between the male and female gender.

3. Eligibility Criteria

Inclusion Criteria

Included in the study were children aged from birth to 6 years and registered with Federal Teaching Hospital, Owerri. Children with accessible medical records, whose legal guardians or parents provided written informed consent were selected provided they were without any known kidney disease.

Exclusion Criteria

Children with known chronic illness, particularly those affecting the kidneys, or those currently experiencing severe infections or dehydration were excluded. Participants on medications known to alter renal function or those with known congenital anomalies of the kidney and urinary tract were excluded. Children with incomplete medical records or missing key information necessary for the study were not included.

Study Setting and Population

This study was conducted at Federal Teaching Hospital, Owerri among healthy pediatrics patient registered with the health facility. A total of 100 subjects participated in the study, capturing children who were at most 6 years of age. The subjects consisted both male and female participants without gender bias or discrimination.

Ethical consideration

As part of the efforts to uphold ethical practice in research, all participating subjects provided signed written consent as documented evidence of their interest to partake in this study, notably as minors, the legal guardian or parents provided the consent on their behalf. Also, the design of this study was approved prior to commencement by the Ethics Committee, Federal Teaching Hospital, Owerri.

Sampling method

Simple random sampling method was employed in the subject recruitment process such that all consenting participates were randomly selected by allowing them choose from a numbering of "1" and "2" and all those who picked "1" were recruited while those who picked "2" were not included in the study [22].

Table 1: Demographic distribution of subjects.

Demographic Factors	No of subjects	Percentage frequency %)
Age Group		
<1 year	65	65
1-3 years	24	24
4-6 years	11	11
Gender		
Male	64	64
Female	36	36

Table 2: Gender-Based Difference in Creatinine And Urea In Pediatrics.

Gender	Urea (Ur) (mg/dL)	Urea (Ur) (mg/dL)
Male	79.78 ± 59.75	6.29 ± 3.48
Female	64.78 ± 47.57	6.04 ± 3.28
T-value	1.38	0.35
P-value	0.17	0.72
Remark	NS	NS

NS: non-significant

Sample collection and laboratory method

Blood sample was collected via venepuncture technique into heparin bottles and transported to the laboratory for urea and creatinine determination. Meanwhile, via a wellstructured questionnaire, age and sex information was obtained. Urea and creatinine estimation were performed using urease method and Jaffe method respectively [23, 24].

Statistical Analysis

Other renal markers measured included serum creatinine (Cr) and blood urea nitrogen (Ur) [23, 24]. Data were analyzed using SPSS version 25.0 for ANOVA across the age groups and T- tests were performed for gender comparisons. The level of significance was set a p-value< 0.05.

4. Results

Table 1 below shows the distribution of subjects. Based on age distribution, the most populated age group was <1year age group with 65(65%) subjects while the lowest populated age group was 4-6 years with 11(11%) subjects. Based on gender, males were the most populated gender of 64(64%).

Table 2 compares the mean creatinine and urea levels between gender (male and female). The result shows that there is no significant ($p > 0.05$) genderbased difference in creatinine and urea among the subjects.

Table 3 showed the comparison of creatinine and urea mean levels across age groups (<1 year, 1- 3 years, and 4-6 years). The result showed that there was no significant difference (p=0.06) in creatinine levels across the age group but there was a significant difference (p<0.001 in urea levels across the age groups.

5. Discussion

This study aimed to explore the differences in renal markers, specifically serum creatinine and blood urea nitrogen, across various sociodemographic factors, including age and gender in pediatrics registered at Federal Teaching Hospital, Owerri.
The analysis revealed no significant differences in serum creatinine levels across different age groups, but did reveal a significant difference in urea levels across age groups. For blood urea nitrogen, it was observed that younger children showed higher levels than older children.

Table 3: Age-Based Differences in Urea and Creatinine in Pediatrics.

Age Groups	Creatinine (Cr) (mg/dL)	Urea (Ur) (mg/dL)
<1 year	83.74 ± 59.71	7.04 ± 3.24
1-3 years	59.97 ± 51.58	4.82 ± 3.92
4-6 years	50.04 ± 17.80	4.32 ± 1.11
F-value	2.85	5.96
P-value	0.06	<0.001
Remark	NS	SS

NS: non-significant

These findings are consistent with previous studies that have reported significant age-related physiological variations in urea levels due to dehydration, increased protein catabolism from growth spurts or infections, high dietary protein intake, changes in renal perfusion due to stress or exertion, increased muscle mass, and variations in body fluid distribution
citeeiosa13. Gender differences were not evident in the renal markers. The mean blood urea nitrogen levels suggests that urea levels may be less influenced by gender at this stage of development [19].
Recent studies have shown that gender differences in creatinine are less pronounced in children due to minimal differences in muscle mass and hormonal influences compared to adults. A study by Pottel et al. [25] found no significant gender differences in serum creatinine levels in children, supporting the notion that such differences are not significant in pediatric age.
Another study by Bökenkamp et al. [26] also reported no significant gender differences in serum creatinine and urea levels in a pediatric population, emphasizing the similarity in kidney function markers between male and female children. The findings of this study have important clinical implications for the assessment of renal function in pediatric populations. Understanding the baseline variations in renal markers across different age groups and between genders can aid clinicians in interpreting test results more accurately, avoiding potential misdiagnoses. For instance, higher creatinine levels in infants should not be immediately alarming but recognized as part of normal physiological variation. Similarly, acknowledging that male children may naturally have higher creatinine levels than females can prevent unnecessary investigations.
Age-related variations in renal function markers are well-documented. In infants, higher creatinine levels can be attributed to the immaturity of renal function and maternal creatinine clearance. As children grow, their renal function matures, leading to a decline in creatinine levels. This pattern was noted in a study by Mattman et al. [27], which observed that serum creatinine levels decrease with age in children.
The significant difference in urea levels across age groups aligns with findings from studies such as that by Kandasamy et al. [28], which highlighted that urea levels tend to be higher in infants due to higher protein intake from milk and less efficient renal clearance compared to older children. The maturation of kidney function and changes in diet contribute to lower urea levels as children age.

6. Conclusion

This study focused on comparing the levels of creatinine and urea among pediatric patients <6 years to determine if there gender and age play a significant role in the distribution of urea and creatinine. The findings of this study indicated that age was the only socio-demographic factor that impacted on urea level. Gender had no effect of both urea and creatinine levels in paediatric patients attending Federal Teaching Hospital, Owerri, Imo State, Nigeria.

Recommendation

Future research should aim to consider this similar study in other settings to validate these findings. Moreover, investigating additional sociodemographic factors, such as socioeconomic status and environmental exposures, could offer a more comprehensive understanding of the determinants of renal health in children.

Limitation

This study has several limitations that should be acknowledged. The sample size, particularly in older age groups (4-6 years), was relatively small, which may limit the generalizability of the findings. Additionally, o ther factors such as nutritional status, hydration levels, and genetic predispositions were not accounted for, which could influence renal markers.

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