Assessment of creatinine and urea in individuals with various ABO blood types at Madonna University

ABSTRACT

ABO blood types have historically been mainly linked to organ transplantation and blood transfusion compatibility. Beyond their traditional use in transfusion medicine, ABO blood types may also be associated with other elements of health and illness, according to new study. This study's objective is to assess the creatinine and urea concentrations in subjects at Madonna University who belong to various ABO blood groups. The study included one hundred and seventy-eight (178) Madonna University students. Urease Berthelot's method was used to measure urea, while Modified Jaffe's slot reaction method was used to determine creatinine. The ABO blood grouping system was used to determine ABO blood groups. The results were presented as mean ± SD. Data obtained from the study were analyzed using independent sample t-test and one-way analysis of variance which was used to compare mean, values and considered significant at $p<0.05$ and non-significant at $p>0.05$. The study's findings indicate that among the blood types, those with blood type AB have the highest mean levels of creatinine (1.095±0.1513 mg/dl) and urea (32.96±7.815 mg/d). In addition, the mean urea level in males is 29.07±5.506 mg/dl and in females it is 28.85±6.411 mg/dl. Males have a mean creatinine level of 0.908±0.1662 mg/dl while females have a mean level of 0.847±0.2032 mg/dl. Notably, the creatinine p-value (p=0.029*) demonstrates statistical significance and points to a variable in creatinine levels associated to gender.Notably, among the blood types, those aged 36 to 45 have the greatest mean levels of creatinine (0.902±0.0273 mg/dl) and urea (28.46±0.763 mg/dl). Notably, age did not significantly differ at any level ($p>0.05$). In conclusion, blood type AB persons consistently differ significantly from blood types A, B, and O. They also consistently show the highest levels of urea and creatinine among all blood types. Blood type ABpeople probably f have higher urea and creatinine levels, it is advised that they be constantly watched for any kidney-related problems.

Key words: urea, creatinine , subjects , different ABO blood group

INTRODUCTION

ABO blood groups are one of the most well-known and extensively studied systems of human blood types. The ABO system classifies individuals into four main blood groups: A, B, AB, and O. These blood groups are determined by the presence or absence of specific antigens (A and B) on the surface of red blood cells, along with the presence of antibodies against the missing antigen(s) in the plasma (Claudia *et al*., 2017). The frequency of the four main ABO blood groups varies in the population throughout the world.

ABO blood types have historically been mainly linked to organ transplantation and blood transfusion compatibility. Beyond their traditional use in transfusion medicine, ABO blood types may also be associated with other aspects of health and disease, according to new study (Rashaduz*et al*., 2015). There are accumulating evidences that the ABO blood antigens might play a key role in various human nephrotic diseaseand also that a particular blood group may contribute to favor life-extension via biological mechanism important for surviving or eluding serious diseases (Giancarlo and Massimo, 2018).

ABO blood types are important for organ transplants and blood transfusions, but they are also linked to a number of illnesses, such as cancer, gastrointestinal issues, and cardiovascular disease. (Claudia *et al*.,2017). Researchers have also explored potential associations between ABO blood groups and renal function, as the kidneys are responsible for filtering waste products and maintaining fluid and electrolyte balance in the body (Giancarlo and Massimo, 2018).

By filtering waste materials and extra fluid from the blood, controlling electrolyte balance, and creating hormones that regulate blood pressure, the kidneys are essential for sustaining general health. One of the most crucial tissues to be checked is the kidney. It is frequently the location of test-article-induced lesions due to its function in the filtration, metabolism, and excretion of chemicals. (Odok*et al*., 2015: Meng *et al*., 2017:).Urea and creatinine are two commonly measured markers of kidney function. Urea is formed in the liver as a result of protein breakdown and is excreted in the urine, while creatinine is a waste product of muscle metabolism and is also excreted by the kidneys (Iseki *et al*, 2019).

Elevated levels of urea and creatinine in the blood can indicate impaired kidney function, as the kidneys may have reduced filtration capabilities or other renal impairment (Petra *et al*., 2018). Monitoring and evaluating urea and creatinine levels are essential for assessing kidney health, diagnosing renal diseases, and guiding appropriate interventions (Ekrikpo*et al*., 2018).

Research investigating the association between ABO blood groups and kidney function markers, such as urea and creatinine, has garnered attention in recent years. Several studies have suggested potential links between ABO blood groups and variations in renal function (Luiz*et al*., 2014), but the findings have been inconsistent, and the underlying mechanisms remain unclear.

Madonna University recognizes the importance of exploring the potential relationship between ABO blood groups and urea and creatinine levels among its student population. By conducting this study, the university aims to contribute to the existing body of knowledge on ABO blood

groups and kidney function and shed light on any potential associations within their specific student community (Naicker *et al.*, 2016).

In this study, a representative sample of Madonna University students is enlisted, and their blood samples are used to classify them into various ABO blood groups. For every blood group, the levels of urea and creatinine will be assessed and evaluated. Furthermore, pertinent clinical and demographic information might be gathered to take any confounding factors into consideration.

The results of this investigation may offer important new understandings of the connections between ABO blood types and urea and creatinine levels. The results could advance our knowledge of personalised medicine and help design focused interventions for particular blood types. Moreover, the results may have implications beyond the Madonna University population, as they can contribute to the broader scientific community's understanding of the complex interplay between ABO blood groups and kidney function.

Kidney disease poses a significant public health burden in Rivers State, Nigeria, and across Africa (Samar *et al*., 2015).Gaining knowledge about the possible correlation between ABO blood types and urea and creatinine levels can be extremely beneficial in elucidating the mechanisms that underlie kidney function and the development of disease. This information can help develop better preventative, early detection, and management plans that are suited to the particular needs of the Rivers State population. Through examining this connection, the research hopes to improve clinical decision-making, address urgent public health issues about the burden of renal disease, and eventually improve the general health of those living with kidney illness in the area.The study will contribute to the scientific understanding of the interplay between ABO blood groups and kidney function in the context of the local population of Madonna University Rivers State. By generating data specific to this population, the study can fill existing knowledge gaps and provide valuable insights into the potential association between blood type and renal function markers.

MATERIALS AND METHOD

Study place

The research was conducted in Madonna University, Elele in Rivers State, a private institution which was founded by very Rev. Fr. E.M.P Edeh and established on the 10th of May, 1999 in Okija, Anambra State. It was then moved under the approval of the National Universities Commission (NUC) in 2004 to Elele, Rivers state. Elele is a town situated in Ikwerre local government area in Rivers State, South-south Nigeria. Elele is about 40km from Port Harcourt which is the Rivers state capital.The biochemical analyses were conducted at the facilities of Chemical Pathology Laboratory of the Madonna University teaching Hospital (MUTH), Elele, Rivers state.

Target Population

The target population were subjects with different ABO groups in Madonna University who have undergone renal function test and have ABO blood group information available.

Inclusion Criteria.

Individuals who have undergone renal function tests and have ABO blood group information available.

Subjects within the age bracket of 18-45 years of both male and female

Exclusion Criteria

Subjects less or more than the age bracket (18 - 45 years).

Subjects with known kidney diseases

Subjects on medications that can affect urea and creatinine level.

Control Subjects

Subjects were age and sex-matched. They consisted of apparently healthy individuals.

Ethical Consideration

Before the commencement of the study, ethical approval was obtained from the Madonna University Teaching Hospital Ethics Committee.

Sample Collection

Seven milliliters (7m1s) was used to collect intravenous blood sample from the subjects. 5ml in a plain tube and 2ml in an EDTA for ABO analysis. Each blood sample was dispensed into a dry specimen container (for serum) and EDTA container.The blood was allowed to clot and spun at 5000RPM for 10minutes using a centrifuge. The serum was separated, placed into plain tubes, and the labeled before storing at -20^{o}C until analyzed. Blood sample collected from these subjects were analyzed for urea and creatinine using Urease Berthelot's and Modified Jaffe's slot reaction respectively.

Biochemical Determinations

Determination of Urea Concentration was by Urease Berthelot's method while Creatinine Concentration was determined by Modified Jaffe's slot reaction method

ABO Blood Grouping; The ABO and Rh blood grouping system is based on agglutination reaction. When red blood cells carrying one or both the antigens are exposed to the corresponding antibodies, they interact with each other to form visible agglutination or clumping.

RESULTS

The studycomprised of one hundred and seventy-eight participantsin Madonna University subjected to renal function test. The urea and creatinine and blood group of the subjects was analyzed and documented. The results from the study are represented in the tables;

Table 1: - showingurea and creatinine of subjects with different ABO blood groups

ABO blood group	Urea (mg/dl)	Creatinine (mg/dl)
	Mean±SD	
A	27.78±4.502	0.818±0.1410
AB	32.96±7.815	1.095±0.1513
B	26.49±4.593	0.787±0.1395
O	28.61±4.340	0.805±0.1278
F	11.462	48.191
P	0.000*	0.000*
Post Hoc tukey test		
A VS AB	0.000*	
B VS AB	0.000*	
O VS AB	0.000*	
A VS B	0.272	
A VS O	0485	
B VS O	0.071	

The table 1 provides a comprehensive overview of the mean and standard deviation (SD) of urea and creatinine levels, measured in mg/dl, in individuals with different ABO blood groups. Notably, individuals with blood type AB exhibit the highest mean levels of both urea (32.96±7.815 mg/dl) and creatinine (1.095±0.1513 mg/dl) among the blood types. Additionally, post hoc comparisons reveal that blood type AB consistently differs significantly ($p<0.001$) from blood types A, B, and O in both urea and creatinine levels. Conversely, blood types A, B, and O do not exhibit statistically significant differences ($p>0.05$) in urea or creatinine levels when compared to each other.

Table 2: - showing urea and creatinine of subjects with different ABO blood groups based on gender.

Gender	Urea (mg/dl)	Creatinine (mg/dl)
	Mean±SD	
Female	28.85±6.411	0.847±0.2032
Male	29.07±5.506	0.908±0.1662
F	0.057	4.838
P	0.812	0.029*

Table 2 shows a comparative analysis of urea and creatinine levels, measured in mg/dl, between female and male individuals. The mean urea level in females is 28.85±6.411 mg/dl, while in males, it is 29.07±5.506 mg/dl. Similarly, the mean creatinine level in females is 0.847±0.2032 mg/dl, and in males, it is 0.908±0.1662 mg/dl. Notably, the p-value for creatinine ($p=0.029$*) indicates statistical significance, suggesting a gender-related variance in creatinine levels.

Table 3: - showing urea and creatinine of subjects with different ABO blood groups based on age.

Age (year)	Urea (mg/dl)	Creatinine (mg/dl)
	Mean±SD	
15-25	26.25±0.712	0.862±0.0217
26-35	28.99±0.865	0.872±0.0260
36-45	28.46±0.763	0.902±0.0273
F	0.251	0.778
P	0.684	0.506
Post Hoc		
15-25 vs 26-35	0.808	0.751
15-25 vs 36-45	0.481	0.250
26-35 vs 36-45	0.654	0.421

Table 3 shows a comparative analysis of urea and creatinine levels, measured in mg/dl by age. Notably, individuals between age 36-45 years exhibit the highest mean levels of both urea (28.46±0.763mg/dl) and creatinine (0.902±0.0273mg/dl) among the blood types. Notably, there was no significant level of difference ($p>0.05$) based on age.Additionally, post hoc comparisons reveal that there was no significant level of difference between the age groups ($p>0.05$).

Discussion

The study's findings indicate that among the blood types, those with blood type AB have the highest mean levels of creatinine (1.095±0.1513 mg/dl) and urea (32.96±7.815 mg/dl). Furthermore, post hoc analyses show that the levels of urea and creatinine in blood type AB are consistently considerably ($p<0.001$) different from those in blood types A, B, and O. In contrast, there are no statistically significant differences ($p>0.05$) between the urea and creatinine levels of blood types A, B, and O. This is similar to the findings in the work done by Yang *et al*. (2017), They suggested it's a reflection of specific genetic markers on the surface of red blood cells. They suggested AB blood type might possess genetic variations that influence kidney function and metabolism, leading to higher urea and creatinine (Raman *et al*., 2015).

In addition, the mean urea level in males is 29.07±5.506 mg/dl and in females it is 28.85±6.411 mg/dl. Males have a mean creatinine level of 0.908±0.1662 mg/dl while females have a mean level of 0.847±0.2032 mg/dl. Notably, the creatinine p-value ($p=0.029$*) demonstrates statistical significance and points to a variable in creatinine levels associated to gender.. This is similar to the findings in the work done by Watkings*et al*. (2018), They suggested that the higher value recorded for male is a reflection that men have a higher percentage of muscle mass compared to women.

Notably, individuals between age 36-45 years exhibit the highest mean levels of both urea (28.46±0.763mg/dl) and creatinine (0.902±0.0273mg/dl) among the blood types. Notably, there was no significant level of difference ($p>0.05$) based on age. Additionally, post hoc comparisons reveal that there was no significant level of difference between the age groups ($p>0.05$). This was in contrast with the work done by Jones*et al*. (2018), who reported higher values in age group between 25-34. They suggested it is a reflection of younger persons who engage more often physical activities including exercise which increase muscle break down and subsequently raise creatinine level.

Conclusion

Blood type AB persons consistently differ significantly from blood types A, B, and O. They also consistently show the highest levels of urea and creatinine among all blood types. In addition, there is a gender difference in creatinine levels when compared to females. Lastly, the highest mean levels of urea and creatinine are found in adults between the ages of 36 and 45.

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