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Original Research Article

Normal Reference Value of Adult Sudanese Serum Creatinine and Urea in Khartoum State

Abdarahiem A. Abeadalla[1], Amir A. Bashir[2], Isam M. Abdalla[3], Ibrahim Abdelrhim Ali[4], Kamal M. Awad[5], Abdelrman Ahmed Mohmed[6], Omer A. Musa[4]

[1]Department of Physiology, Faculty of Medicine, Omdurman Islamic University.
[2]Department of Physiology, Faculty of Medicine, Al-Imam El-Mahadi University.
[3]Department of Physiology, Faculty of Medicine, Gezira University.
[4]Department of Physiology, Faculty of Medicine, the National Ribat University.
[5]Department of Physiology, Faculty of Medicine, Gadarif University.
[6]Supervisor of Laboratory Department and Blood Bank, police Hospital.

Corresponding Author: Abdarahiem A. Abeadalla

ABSTRACT

Background: Endogenous creatinine and urea are protein metabolites and their levels in the blood give information about renal function. Normal serum creatinine and urea levels in Sudan are not known and their references values are mainly Caucasian. Some normal Sudanese values were found different from international.
Objective: To document the normal serum creatinine and urea in Sudanese and to correlate them with; age, gender and body mass index.
Methods: The study population consisted of 444volunteer (93 males - 351females) of ages ranged between 20-60 year. Blood samples were collected from all of them after their consents and samples of serum that have been separated, used for creatinine and urea measurement by full automated *mindray B 300* device.
Results: The results showed that the (mean±SD) of serum creatinine and urea levels were (0.49-1.15mg/dl) and (11.28-36.14mg/dl) respectively for all study group. Both serum urea and creatinine levels were different for the different ages, body mass index and gender.
Conclusion: The result reached disclosed that the mean levels of both urea and creatinine were within the international ranges but the maximum level is lower than the international one.

Key words: Creatinine, Urea, Sudanese, Normal values.

INTRODUCTION

Recent years have witnessed an explosive growth in the number of patients experiencing end stage renal disease (ESRD), as well as the number of centers providing therapeutic modalities such as hemodialysis, peritoneal dialysis and renal transplantation.

In Sudan, the estimated incidence of new cases of end stage renal failure patients is 70-140 per million individual /year. [(1)] End-stage renal disease (ESRD) is usually the result of slowly progressive kidney damage, because of the asymptomatic nature of renal disease, kidney damage frequently remains undetected until late in the course. In contrast, early detection and intervention may slow or halt the decline toward ESRD. [(2)] Awareness of the causes of ESRD helps the nephrologists to

anticipate problems during renal replacement therapy (RRT) and plan preventive measures for the community. [3]

Study conducted by Elsharif M. E (2011) among patients with ESRD on regular hemodialysis (HD) at the Gezira Hospital for renal disease (Sudan). The study published that the etiologies were dominated by unknown causes (53.57 %). The leading cause of ESRD for those who were younger than 40 years was glomerular disease, hypertension for those between 40 and 60 years and obstruction for those who were older than 60 years. [4]

The kidneys are largely responsible for regulation of the volume and compositions of body fluids and excretion of many metabolic breakdown products by glomerular filtration and reabsorption which are controlled by many hormones and hemodynamic signals. Measurement of glomerular filtration rate (GFR) is the most widely accepted standard for the assessment of renal function in health and diseased cases, and estimation of GFR performed by measuring urea, creatinine or by inulin. [5]

Serum urea is a less reliable marker of glomerular filtration rate than creatinine because levels are more vulnerable to change for reasons unconnected to glomerular filtration rate. [6] A high protein diet, tissue breakdown, major gastrointestinal hemorrhages, corticosteroid and aminoglycosides antibiotics therapies can lead to an increase in plasma urea. [7] Whereas a low protein diet and liver disease can lead to a reduction. [8] Also, 40-50% of filtered urea may be reabsorbed by the tubules, although the proportion is reduced in advanced renal failure.

Creatinine is the closest to an ideal endogenous substance for measuring glomerular filtration rate. [9] Plasma creatinine is almost exclusively a product of the metabolism of creatine and phosphocreatine in skeletal muscles, although ingestion of meat may also contribute slightly. [10] In patients with stable renal function, serum creatinine levels are usually constant with reference value between 0.6-1.2mg/dL, with variability daily of about only 8%. [11] Creatinine is freely filtered at the glomeruli and is not reabsorbed, but up to 15% is actively secreted by the tubules. In advanced renal failure, excretion of creatinine through the gastrointestinal tract increases. [12] The normal creatinine clearance test value is 110-150ml/min in male and100-130ml/min in female. [13] Measuring the creatinine clearance using serum creatinine level and a timed urine collection gives an estimate of glomerular filtration rate.

The currently adopted reference values in Sudan are derived from populations outside the country and may be differ from normal values for the sudanese population. A study performed over the period 2002 - 2005 to determine normal values of respiratory function for Sudanese which was found to be different from international ones. [14] Without Sudanese based reference values, there could be considerable misclassification of normal and abnormal test results.

METHODS

A Cross sectional descriptive study was performed in Khartoum state, including 444 volunteer (93 males - 351 females) with age range of 20-60 years. A questionnaire was filled by each including; personal data (age, gender, resident, job and income), diet and dietary habits, exercise and sports activities. Blood pressure, height, weight were measured and full clinical examination was done. 5 mL of venous blood collected by vacutainer to measure serum urea and creatinine, using automated analyzer apparatus *mindray B 300*. Consents were signed by all subjects.

All results were analyzed using Statistical Package of Social Science (SPSS) to significant value of ($P \leq 0.05$) was taken as statically significant using paired t-test

RESULTS AND DISCUSSION

The reference range of serum creatinine and urea levels for the 444 subjects were 0.49-1.15mg/dL and 11.28 -

36.14mg/dL respectively. These results are quite consistent with reference values (creatinine 0.8-1.3 mg/dL, urea 22.36- 33.16 mg/dL) that were adopted internationally by Medscape. [15] But the reference range of this study group is lower than international (Table 1). Moreover Dosoo DK et al, conducted a study to establish hematological and biochemical reference values for healthy 691Ghanaianadults between 18 and 59 years. Their results showed the reference range of serum creatinine and urea levels 0.55-1.3 mg/dL, 16.2-34.2 mg/dL respectively. [15] Which also is lower than international ones (Figure 1& 2).

In our study high serum creatinine and urea level was seen more in males than females, which could be attribute to great muscle mass in males. Our obtained results agrees with the study reported by Aldler AI et al and AshavaidTF et al. [17,18]

The mean serum creatinine concentrations were not significantly different between age groups (Figure 3), in agreement with; Yoshida, [19] who assessed the effect of age on renal function and Fehrman, [20] who conduct a study on renal function in the elderly. Although our study showed the highest value in age groups (30 - 39) and (40 – 49), may be explained by the fact that, high human activity occurs at those ages.

The mean serum urea concentration showed a reduction with age (Figure 4) which agreement with Ateig [21] who study the normal value of serum urea in Sudanese children. He reported that urea values reduced with increasing age.

Our study showed a reduction of urea in the age group of 30-39 years than the age group of 50-59 years. Which in line with the results of Musch W, et al study that performed on age-related effect on plasma urea levels. His study found that fractional urea excretion (FE urea) decreases with age (P <0.001). [22]

When we study the effect of BMI on creatinine and urea values, the results revealed that there no significant effect of BMI on urea but there was clear impact effect of BMI on creatinine level (table 3) which in agreement with Fernando Gerchman et al, [23] who stated that creatinine clearance was positively correlated with BMI (P <0.001), The association between creatinine clearance and BMI remained significant after adjustments for intra-abdominal fat (IAF), subcutaneous fat (SCF), and lean thigh areas by CT scan. Even our study results showed creatinine level in obese participator less than Fernando Gerchman study. Which could be attributed to low number of obese participant.

Table 1: Comparison of the serum reference range of Creatinine & Urea between Sudanese, African (Ghanaian) and international reference values.

Reference Values	Creatinine mg/dL	Urea mg/dL
International reference value (Medscape)	0.8 – 1.3	21.6 - 54
African reference value (Ghanaian)	0.55 – 1.3	16.2 – 34.2
Sudanese reference value (Khartoum state)	0.49 – 1.15	11.56– 33.16

Table 2: Showed the relation between the gender and mean of Creatinine - Urea results among study participants (93 male – 351 female)

Creatinine – Urea (Mean)	Gender		P value
	Male	Female	
Creatinine mg/dL	1.06	0.76	< 0.001
Urea mg/dL	28.92	22.36	< 0.001

Table 3: Showed the level of urea and creatinine according to body mass index among study population

BMI	UREA Mean ± SD	CREATININE Mean ± SD
Underweight	24.01 ± 12.48	0.79 ± 0.33
Acceptable	23.73 ± 13.51	0.91 ± 0.34
Overweight	22.29 ± 9.25	0.91 ± 0.34
Obese	24.58 ± 12.11	0.80 ± 0.32

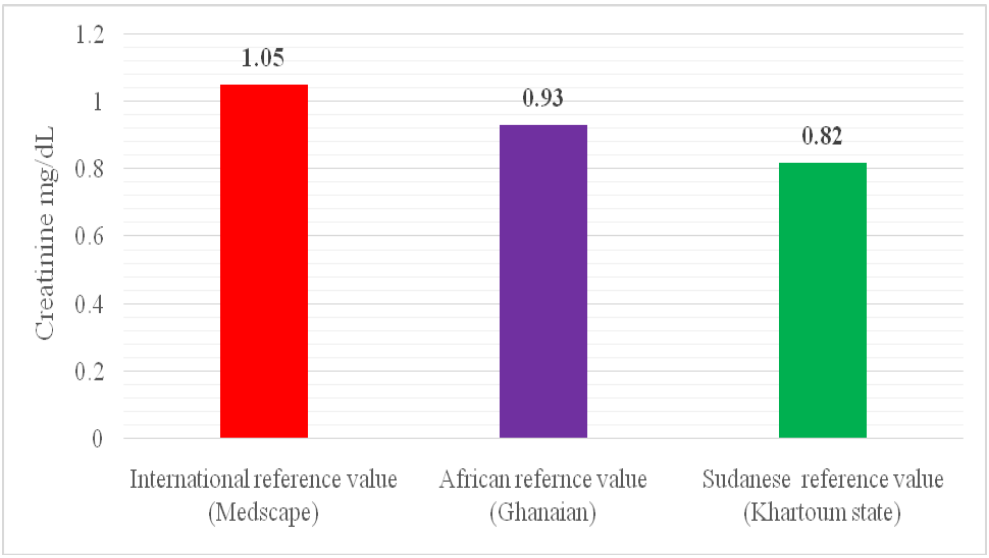

Figure 1: Comparison of serum creatinine mg/dL reference values between Sudanese, African (Ghanaian) and International references

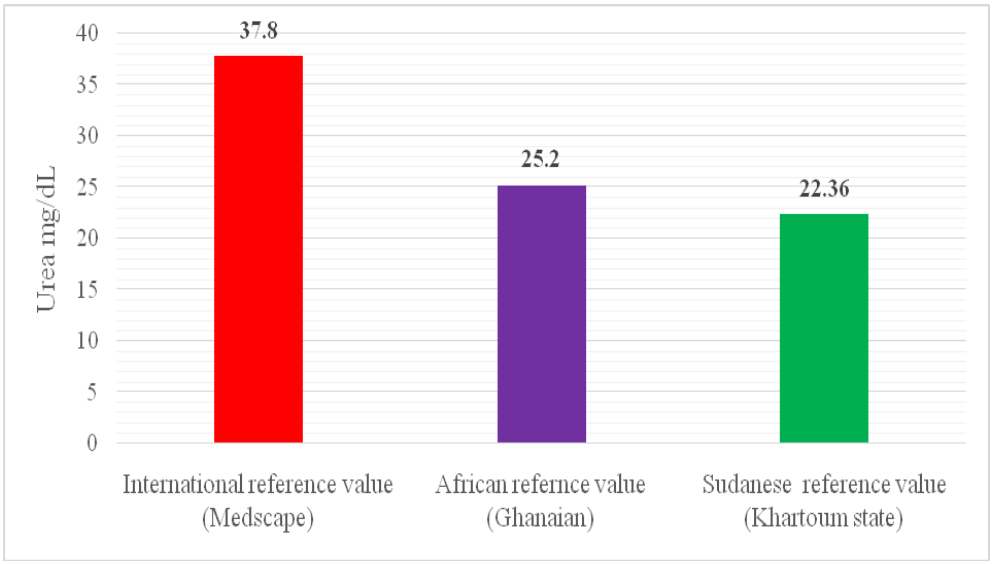

Figure 2: Comparison of serum urea mg/dL reference values between Sudanese, African (Ghanaian) and International references

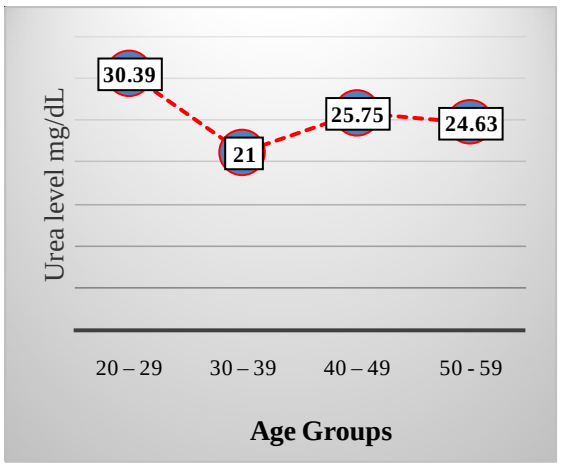

Figure 3: Show the relation between the age and the level of urea among the study population

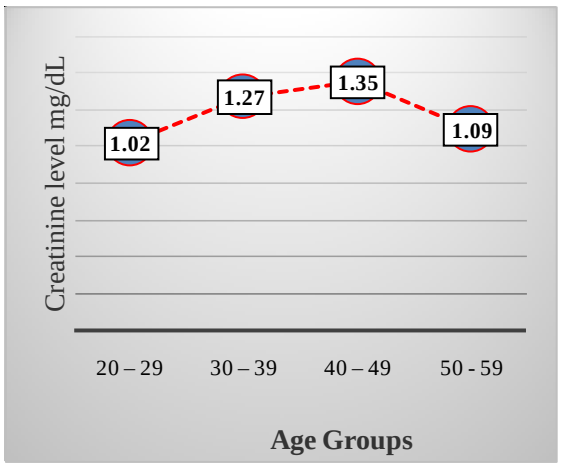

Figure 4: Show the relation between the age and the level of creatinine among the study population

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