

The National Ribat University  
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Normal Reference Values of Blood Urea and Serum Creatinine  
Among Normal Adult Sudanese

A thesis Submitted for Fulfillment of The Requirements of M.Sc in  
Physiology

By: Shaza Salah Naiem Gundoor

Supervisor: Prof. Omer Abdel Aziz Musa

Co- supervisor : Dr. Aamir Elmagzoub

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## Acknowledgment

To my honorable professors with gratitude

# **xNormal referene values of blood urea and serum creatinine among Normal Adult Sudanese**

Shaza salah .<sup>prof</sup> O.A Musa <sup>(1)</sup>. A magzoub <sup>(2)</sup>.

1 ,2 Department of Physiology, Faculty of Medicine, National Ribat University

## **Introduction:**

The blood urea and serum creatinine are the test for renal function ,they are used to diagnosis of many diseases also used as a prognostic factor for many of disease condition they are also used as screening of general health status -the reference values for blood urea &serum creatinine of Caucasian are used for Sudanese labs .many of researches were done in different countries to determine their own reference value and if the socioeconomic and nutrition and genetic factors makes their reference values differ from that of Caucasian so the aim is to review the literature discussing this aspects & to determine if national survey is needed to determine the Sudanese reference value of serum creatinine & blood urea

## **Methods:**

An intensive search has been conducted in medical science website on the reference values of blood urea and serum creatinine level and the impact of exercise and age and the differences in ethnic groups within one country on their level , also if there is research was done on the level of blood urea and serum creatinine in pregnant ladies in different countries to compare with that of Caucasian ,the search was conducted in 2016 covering the period - 1982-2014 under keywords " reference value of blood urea and serum creatinine level in different ethnic groups "" also reference value of blood urea and serum creatinine level in pregnant women in different countries "

## **Results:**

A total of ten studies has been found discussing the references value of blood urea &serum creatinine in different countries and the effect of difference in the ethnic group within one country on them. And one research discussing if there is difference in the level of urea & creatinine between African and caucasain pregnant women

<b>First author</b>	<b>Type of study</b>	<b>Subjects number</b>	<b>area</b>	<b>Date</b>	<b>Results</b>	<b>Main conclusion</b>

GHASEMI A,1	CROSS SECTION	5247 male and female	Tehran	2014	[ 47-98 u mol\l] (0.53_1.11)mg \ dl for men -Non menposal women 37_78u mol\l (0.42_0.77)mg\ dl -Menpose women 37_78umol\l (0.42_0.77)mg\ dl	Reference value of serum creatinine for Iranian Population
CA JONES ,2	3 <sup>rd</sup> national health and nutrition examination survey	(18723) subjects Aged 12 years and older	U.S	1988_1994	Mean serum creatinine for women 0.96 mg \ dl range 0.99_1.10mg\dl For men . the mean serum creatinine 1.16 mg \ dl , it is range 1_1.29 mg\dl	Mean serum cratinine highest in non Hispanic black ,lower in Hispanic white ,lowest in American Mexican ,it increase with age with both men and women
Rodriguez, Rudolph A,3	data from the Hispanic Health and Nutrition Examination Survey	9060 subjects	U.s	1982_1984	,the Cuban American have higher creatinine than Puerto Rican or mexican American	Serum creatinine level differ among lattino sub groups , the national origin should be taken into account in study of renal diseases
Nagah A. A. Mohamed,4	Cross section	49soldier 51 athletes (75 male 25 female )aged 14_44	Sudan	2013	Serum creatinine is not much different depending on gender occupation and daily working hours ,whether they are soldier or athletes but it affected by age progress	Research with large data collection is recommended for establishment of normal range of biochemical parameter for sport medicine in sudan
V.M.A. Passos,5	Cross section	818 adult Aged 18_59 Years old	Brazil	January to august 1997	- Serum creatinine 1.3 mg\ dl for men -for women 1. 1 mg \ dl -Mean 0.77mg\ dl -Range 0.23 _1.37 mg\dl	Epidemiological studies should be conducted with test of adequacy of international reference value for serum creatinine for developing countries
Farooq Ahinad Khan,6	Cross section	2115 from newborn to 80 years old	Rawalp ridi -islam abad	April 1993-september 1994	UREA for adult male 2,8-6,4 mmol\l- for adult female 2,7 --4,3 mmol\l The creatinine for adult male 65-132umol\	The biochemical reference value mild and moderate differ from Asian European and American so recommend to investigate

		1206 male 909 female			for adult female 54-119umol/l	all pakistani area
HUANG X,7	CROSS SECTION	1575 Subjects Aged 20_69 years OLD	CHINA	2014	3.3_7.5 mmol/l for urea Creatinine 64_113 umol/l	Reference value for both urea and creatinine show slight deviation from those developed in previous study Age and BMI reference value be applied in clinical lab
SHAHA M.AHMED,8	Cross section study	270 female 18_40 years old	University of al gezira	2013	Serum urea differ with age Creatinine and urea differ with ethnic group and menstrual cycle Urea 10.8_33mg/dl Creatinine 0.3_1.25mg/dl	The results indicated that the mean levels of both these protein metabolites were within the ranges of their values for the normal kidney function.
CLEMENT ZEH,9	Cross section study	298 subjects aged 13_34	western of Kenya	october 2003-may 2005	The creatinine level is 83,1 [54,3-137,8]umol/l in male -in the female is 70,7 [52,4 -96,8]umol/l The urea level is 3,0[1,8-5,3]umol/l in male - in female is 2,8[1,4-4,5] mmol/l	Hematological and biochemical reference value from African population differ from north American population
KA KORAM,10	Cross section study	3500aged 18_55 years	Akupem north district - eastern of ghana	2007	Creatinine for male 1.8 mmol/l Reference interval 81_141 mmol/l For female 93 mmol/l Reference interval 70_121 mmol/l Urea not differ significantly between male and female The mean is 4.4 mmol	Due to genetic and environment need to establish specific reference value for our population

					$\backslash$ Reference interval 1.7_702 mmol $\backslash$	
NADUKA N,11	Cross section	117 pregnant urban Africa & 109 pregnant caucasian women		1983	The creatinine levels for Caucasians rose as pregnancy is progressed, exceeding the normal adult level, while that for Africans rose only slightly in the third trimester of pregnancy.	The difference in the level of creatinine between African & Caucasian due to nutrition differences - Creatinine curve for Caucasian should be used for monitoring fetal wellbeing

**Conclusion:**

Most of researches concluded in that there is difference between value of urea & creatinine in the population were studied and that of the Caucasian ,the differences may be due to genetic or environment or life style and nutrition factors so future studies is recommended to assess the reference value of blood urea & serum creatinine in Sudanese population .

**References:**

1-Ghasemi A , Azimzadeh , Zahediasl S , Azizi F . 'Reference values for serum creatinine with Jaffe-compensated assay in adult Iranian subjects: Tehran Lipid and Glucose Study.', *Arch Iran Med*, ( 2014).

2- CA Jones, • GM McQuillan, • JW Kusek, • MS Eberhardt, • WH Herman, • J Coresh, • M Salive, • CP Jones, • LY Agodoa 'Jones CA, McQuillan GM, Kusek JW, et al. Serum creatinine levels in the US population: Third National Health and Nutrition Examination Survey. *Am J Kidney Dis* (1999),32: 992-9', . .

3- Rodriguez, Rudolph A.; Hernandez, German T.; O'Hare, Ann M.; Glidden, David V.; Pérez-Stable, Eliseo J. 'Creatinine levels among Mexican Americans, Puerto Ricans, and Cuban Americans in the Hispanic Health and Nutrition Examination Survey.', *kidney international*,(2004), 66(6 ); pp. 2368-2373.

4- Nagah A. A. Mohamed1,, Jumana M. ELhafiz , Faroug B.M.Ahmed ' Serum Creatinine in Normal Sudanese Athlets and Soldiers', *Science and Education Publishing*. ( 2013), 2(4), .

5-V.M.A. Passos1,3, S.M. Barreto2,3, M.F.F. Lima-Costa2,3 and the Bambuí Health and Ageing Study (BHAS) Group3 'Detection of renal dysfunction based on serum

creatinine levels in a Brazilian community. The Bambuí Health and Ageing Study', *Braz J Med Biol Res*, , (march 2003) , 36(3 ); pp. 393-401.

6- Farooq Ahinad Khan, Muhammad Dilawar, Dilshad Ahmad Khan ' Reference Values of Common Blood Chemistry Analytes in Healthy Population of Rawalpindi-Islamabad Area ', *journal of pakistani medical association*, (june 1997)

7 . .Huang X, Li S, Yang X, Peng Q, Wang J, Mo C, Wu J, Sui J, Liu Y, Lu Y, Deng Y, Xie L, Li T, He Y, Gao Y, Mo Z, Yang X, Qin X. (2014) 'Establishing reference values for blood urea nitrogen and serum creatinine in Chinese Han ethnic adult men.', *Clin Lab*. , 60(7 ); pp. 1123-8.

8- Shaza M. Ahamed<sup>1</sup>, Gad Allah Modawe<sup>2</sup>, BadrEldin Elsanni<sup>3</sup>, Mansaur A. Ballal<sup>4</sup> 'Assessment of creatinine and urea blood levels in healthy volunteers', *sudan medical monitor*, (2013), 8 (3 ); pp. 153-155.

9- Clement Zeh , Pauli N. Amornkul, Seth Inzaule, Pascale Ondoa, Boaz Oyaro, Dufton M. Mwaengo, Hilde Vandenhoudt, Anthony Gichangi, John Williamson, Timothy Thomas, Kevin M. DeCock, Clyde Hart, John Nkengasong, Kayla Laserson 'Population Based Biochemistry, Immunologic and Hematological Reference Values for Adolescents and Young Adults in a Rural Population in Western Kenya', *journals.plos.*, (2011)

10- KA Koram, MM Addae,<sup>2</sup> JC Ocran, S Adu-Amankwah, WO Rogers,<sup>1</sup> and FK Nkrumah 'Population Based Reference Intervals for Common Blood Haematological and Biochemical Parameters in the Akuapem North District', *GHANA medical journal*, (2007) , 41(4 ); pp. 160-166.

11- Nduka N, Ekeke GI. 'Serum creatinine and uric acid levels in pregnant urban African and Caucasian women.', *Trop Geogr Med.* , (1986) , 38(4 ); pp. 386-390.

## **Normal refrence values of blood urea and serum creatinine among Normal Adult Sudanese**

Shaza salah .<sup>prof</sup> O.A Musa<sup>(1)</sup>. A magzoub<sup>(2)</sup>.

1, 2 Department of Physiology, Faculty of Medicine, National Ribat University

## **Abstract**

The serum creatinine & blood urea are indicators of renal function – and because of their importance in clinical diagnosis there are different studies in different countries to determine their own reference values of serum creatinine & blood urea and to decide if it differs from the reference values of Caucasian . The aim from this pilot study is to assess the normal values of blood urea and creatinine in Sudanese and to help in deciding if a national survey is needed

- A cross sectional study was conducted during the period of (October - November 2015) in the Blood Bank of police Teaching Hospital, Khartoum City, capital of Sudan. The Study population was fifty normal adult Sudanese males their ages between 18 to 44 years old from different areas in Sudan attending the hospital's blood bank for donation and ten pregnant women in the third trimester attending the hospital for antenatal care with age of 20 to 40 years old. All of them were informed about the study and agreed to participate and signed a written consent.

A special questionnaire was used for data collection to assess the basic demographic data. Then 3ml of venous blood was collected in plain containers and serum urea & creatinine were measured by a single operator in a single laboratory. Automated analyzer was used to measure them . The Data was processed using SPSS version 23. The results showed that the mean serum urea for males was  $27.26 \pm 1.76$ mg\dl and for third trimester pregnant women was  $15.70 \pm 3.46$ mg\dl .the mean serum



creatinine was  $1.15 \pm 0.05 \text{mg/dl}$  for male, for third trimester pregnant women was  $0.56 \pm 0.08 \text{mg/dl}$ .

### **Introduction;**

Serum creatinine is an amino acid derived product that is synthesized in the liver from glycine and arginine and methionine. It is a primary determinant of renal function. It is also a strong predictor and marker for different diseases. Blood urea is a nitrogenous end product of protein catabolism. It is a very important indicator of renal function and it is a prognostic factor for different diseases. The international Caucasian normal value for creatinine in male is (0.6-1.4 mg/dl) and the international normal value for urea in male is (5-20mg/dl). In different countries there are researches to determine their own reference value for serum creatinine & urea but in Sudan there are no Sudanese reference values for serum creatinine and blood urea. In Gezira a study done by Shaza et al in 2013 on 270 females their ages between 18-40 years old, showed that the Blood urea level range was from 10.8-33mg/dl and The creatinine range from 0.3-1.25mg/dl [1]. In Khartoum state Najah et al (2013) conducted a study on soldiers and athletes showed that Serum creatinine was within the normal international ranges and was not much different depending on gender, occupation, or daily working hours whether they are soldiers or athletes but it was affected by age group [2]. This pilot study on normal levels of blood urea and creatinine can help in deciding if a national survey is needed.

### **Methods**

This is a cross sectional study conducted in the Blood Bank and laboratory of biochemistry of police Teaching Hospital, Khartoum City, capital of Sudan. Study population was 50 normal Sudanese adult males aged [18-44 years old] attending the hospital blood bank for

donation , and ten pregnant ladies in their third trimester aged between [20- 40years old] attending the antenatal care clinic .

A special questionnaire was used for data collection covering basic demographic data [name-gender-age- area –occupation] ,also questions about the life style [sun exposure and it is duration-diet in the last three days-daily water intake-exercise and it is type and frequency ] , Also there are questions about the medical profile [any current disease-previous hospitalization-chronic illness ( diabetes hypertension ,kidney disease ,liver disease , thyroid disease ) , also question about taking medication that affect the level of blood urea and serum creatinine as (diuretics ,beta blocker ,vasodilators, non steroid anti inflammatory drugs, ACE inhibitors ,radio contrast media, compound analgesics ,antiviral agents, lithium )

Then the body temperature and blood pressure and weight were measured .then three ml of venous blood samples was taken and stored in a plain container and centrifuged for two minutes then analyzed by an automatic analyzer in the laboratories of police teaching hospital . The collected data was analyzed using SPSS (Statistical Package for Social Sciences), version (23 )

Ethical approval obtained from ( N R U committee ethical ) and the hospital authorities and written a consent was taken from the participant before the data collection process.

## **Results :-**

The study included fifty males and ten third trimester pregnant women, all of them clinically assessed by physician . The mean serum creatinine in males was  $1.15 \pm 0.05$  mg\dl and ranged from .9mg\dl to 1.7mg\dl , the mean blood urea was  $27.26 \pm 1.76$  mg\dl and is ranged from 17mg\dl to 43mg\dl (table 1) .

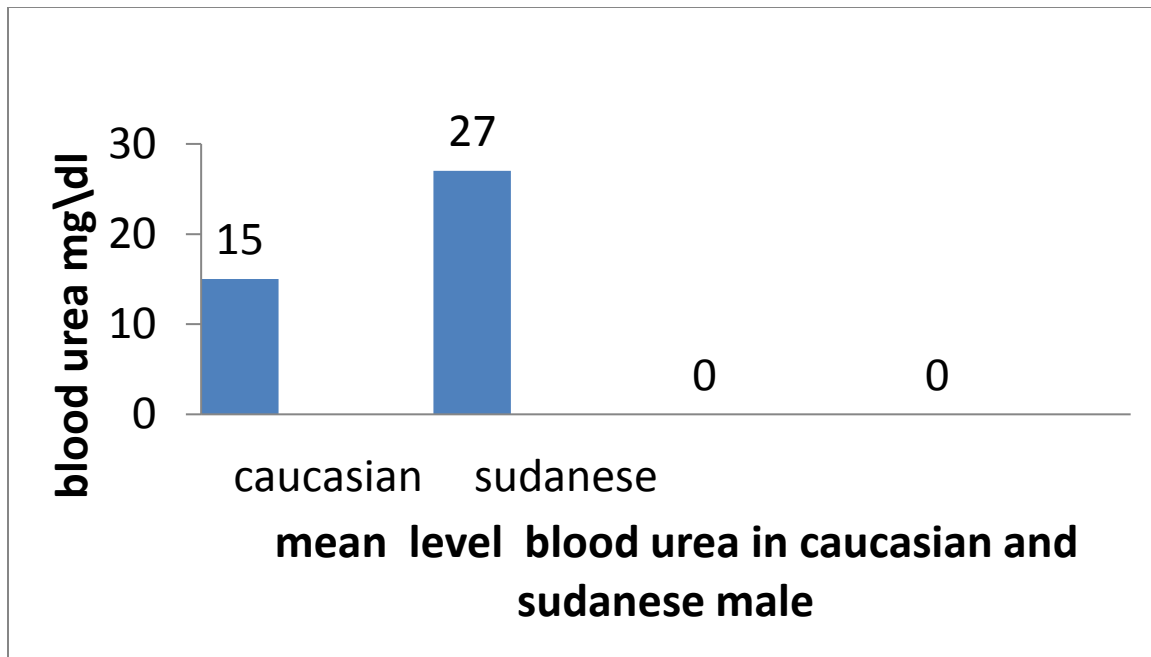
-In the third trimester pregnant women the mean serum creatinine was  $0.56 \pm 0.08$  mg \dl and ranged from 0.35mg\dl to 0.79mg\dl . The mean blood urea was  $15.70 \pm 3.46$  mg\dl and ranged from 10mg\dl to 23mg\dl ( table 2 )

**TABLE( 1 ) ;-**

**The level of blood urea and serum creatinine in Sudanese male ( n=50)**

	Minimum	Maximum	Mean	Range in Caucasian	Mean in caucasian
Blood urea level	17mg\ dl	43mg\dl	27 .26± 1.76 mg\dl	5-20 mg \dl [ 3]	15 mg\dl {5}
Serum creatinine level	0 .9mg\dl	1 .7mg\dl	1 .15± 0 .05 mg\dl	0 .6-1. 4mg\dl [ 3]	1mg\dl {5}

**FIGURE 1;-**



**FIGURE 2'-**

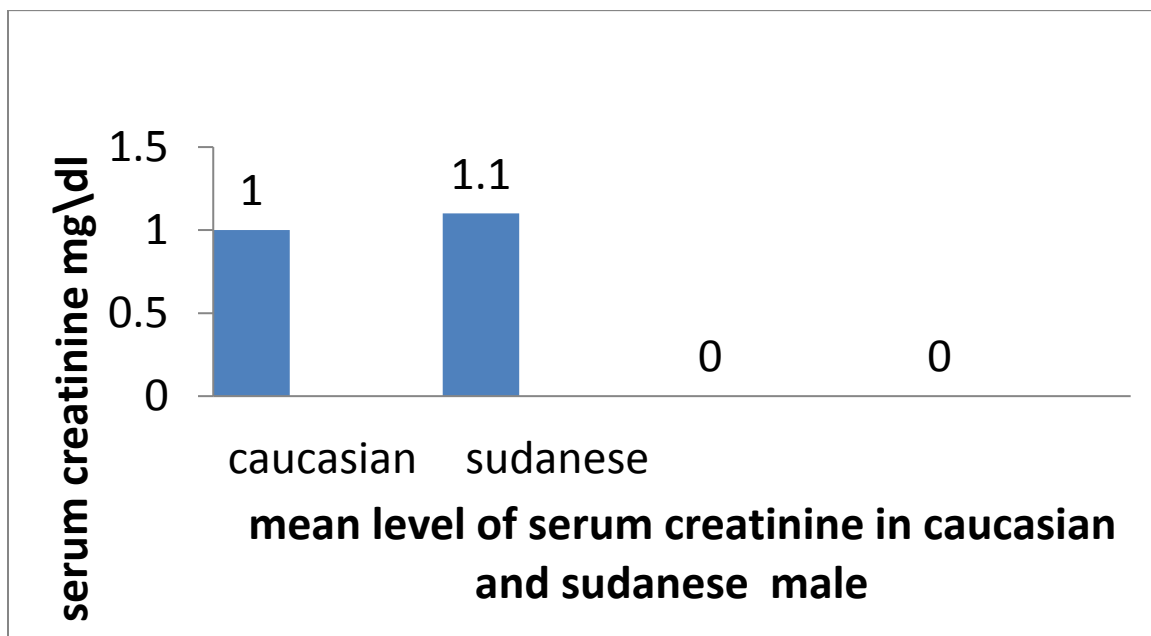


TABLE (2);-

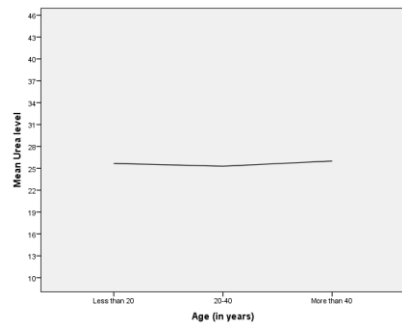
The level of serum creatinine & urea in the third trimester pregnant sudanese women ( n=10)

	Minimum	Maximum	Mean	non pregnant Sudanese women	Third trimester pregnant Caucasian
Blood urea level	10mg\dl	23mg\dl	15.70±3.46 mg\dl	10.8 - 33mg\dl [1]	3- 11mg\dl[4]
Serum creatinine level	0.35mg\dl	0.79mg\dl	0.56±0.08 mg\dl	0.3- 1.25mg\dl [ 1 ]	0.4- 0.9mg\dl [ 4 ]

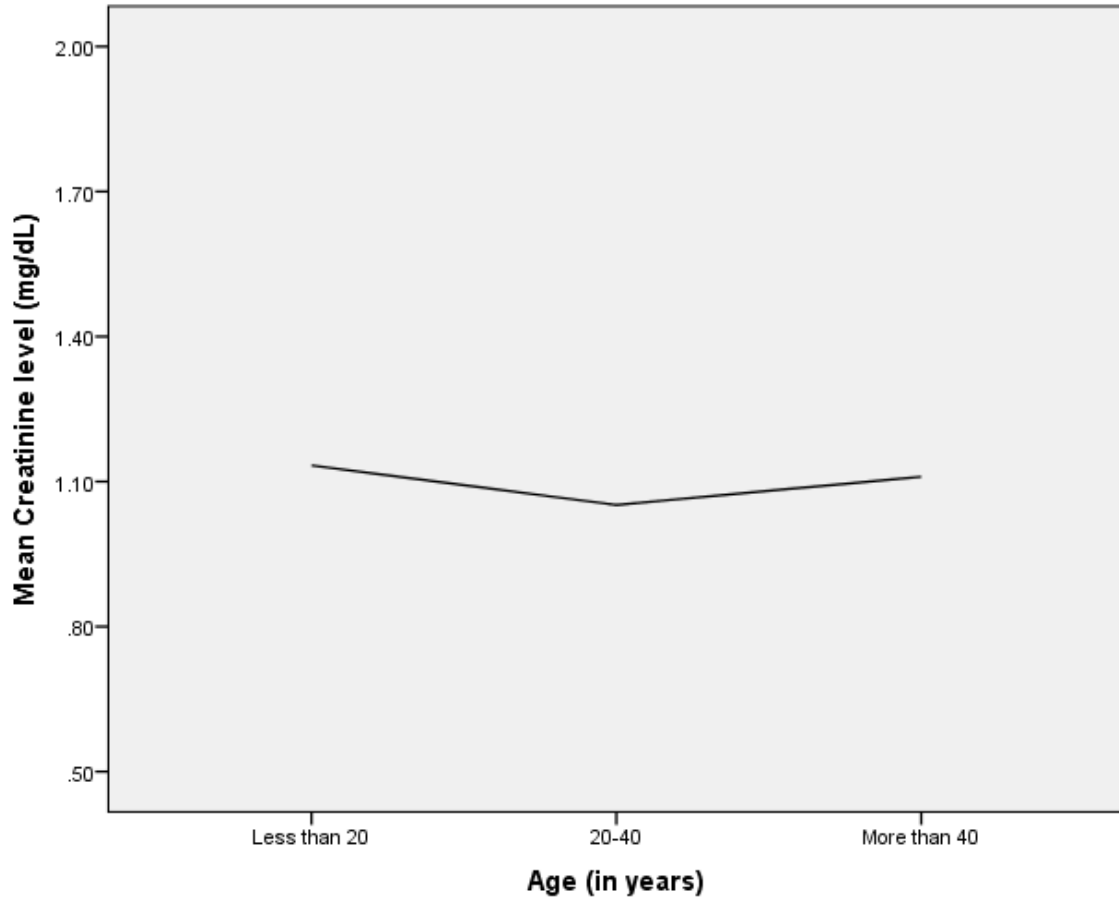
THE EFFECT OF AGE ON SERUM CREATININE & BLOOD UREA IN MALE

age has no significant effect on the mean level of blood urea( p value =,996 ) ( figure 3) and (serum creatinine (p value .885) (figure 4) in Sudanese male

**FIGURE 3 ;-**



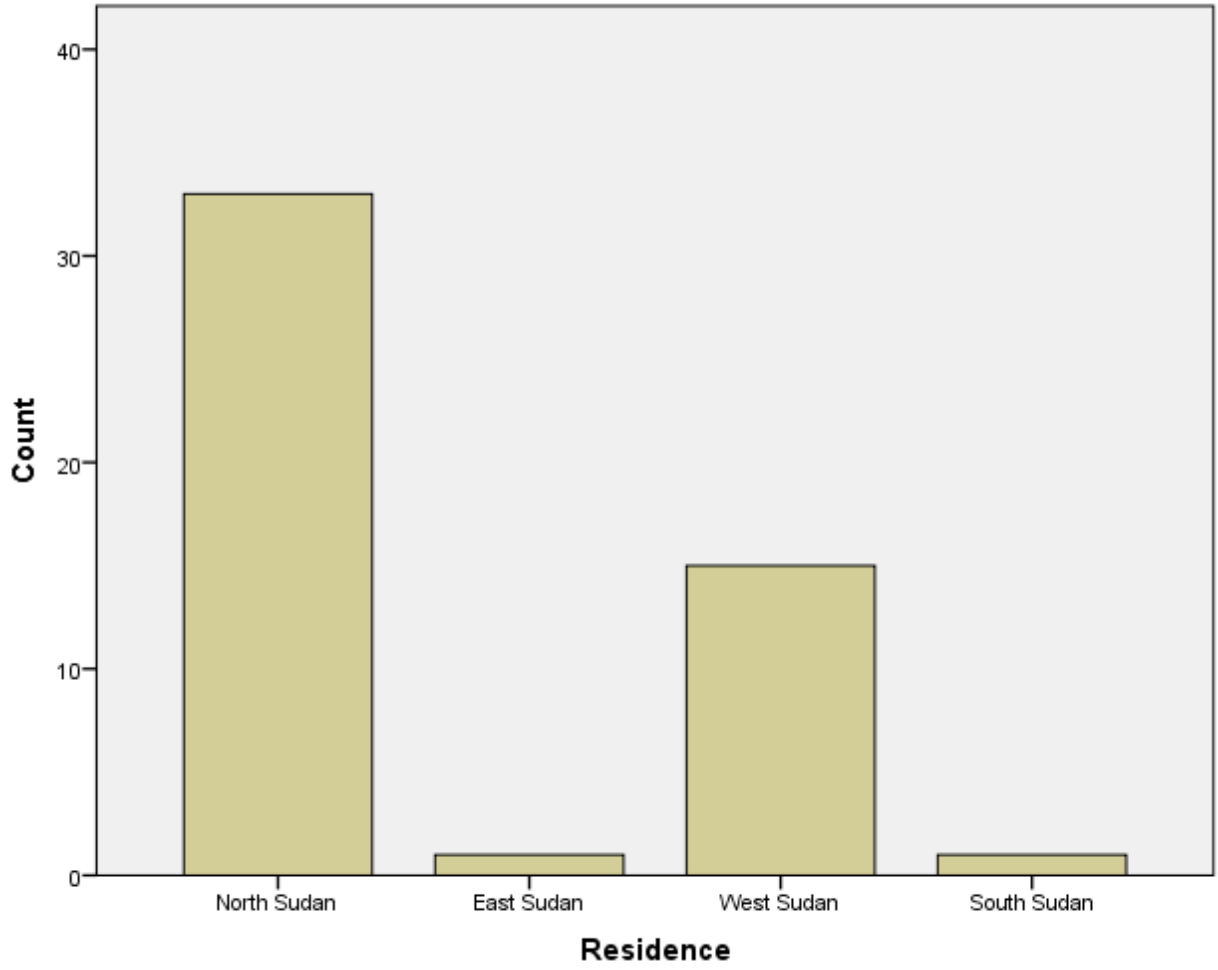
**FIGURE 4 ;-**



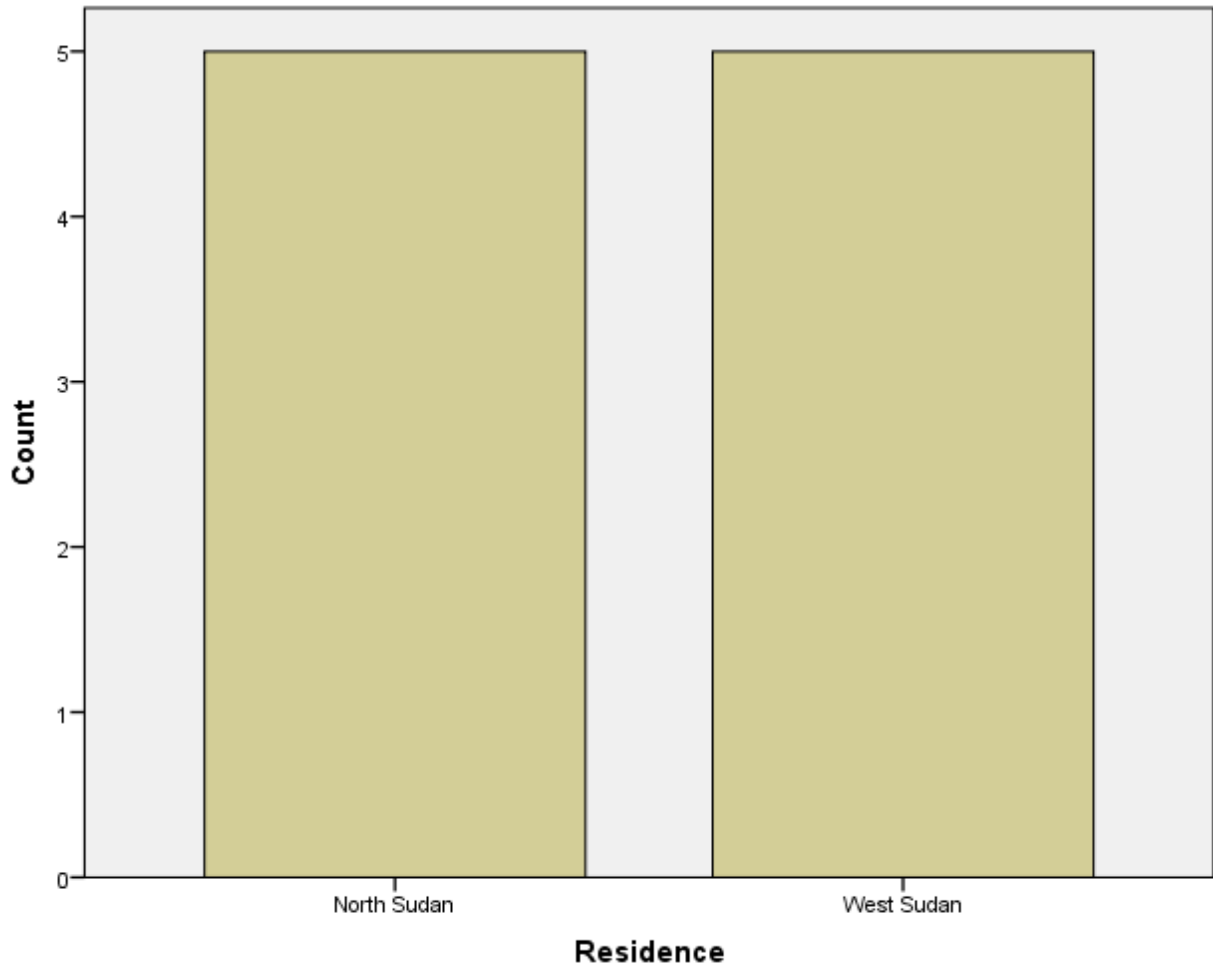
THE EFFECT OF DIFFERENCE IN ORIGIN ON THE LEVEL OF UREA AND CREATININE

NUMBER OF MALE PARTICIPATE IN IN THE STUDY ACCORDING TO DIFFERENT AREA OF ORIGIN (FIGURE5)





NUMBER OF PREGNANT FEMALE PARTICIPATE IN IN THE STUDY ACCORDING TO DIFFERENT AREA OF ORIGIN (FIGURE 6)



*THE DIFFERENCES IN ORIGIN OF VOLUNTERR [MALE OR pregnant FEMALE ]HAS VERY MINOR EFFECT ON THE LEVEL OF UREA AND CREATININE ALSO[ P VALUE] IS NOT REGISTER hence IT IS MORE THAN 0,005*

EFFECT OF DAILY SUN EXPOSURE ON THE LEVEL OF UREA AND CREATININE

*THE FREQUENCY OF DAILY SUN EXPOSURE SHOW NO SIGNIFICAT IMPACT ON LEVEL OF UREA AND CREATININE ( P VALUE MORE THAN ,005) .BUT AS GENERAL THE PERSON HAVE CONTINOUS SUN EXPOSURE show LOWER LEVEL OF UREA AND CREATININE*

THE EFFECT OF EXERCISE ON THE LEVEL OF UREA & CREATININE

MALE WHO had regular exercise CREATININE HAVE INSIGNIFICANT ( $p$  value more than 0.05 ) LOWER UREA LEVEL & HIGHER LEVEL THAN WHO DID NOT HAVE REGULAR EXCERSIZE

THE RELATION BETWEEN THE WEIGHT AND LEVEL OF UREA AND CREATININE

The level of blood urea and serum creatinine show slight increases with the increases of weight in male (figure 7) (figure 8)

( figure 7)

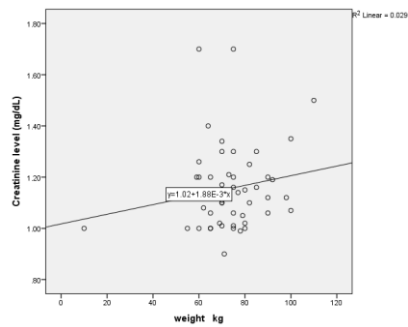
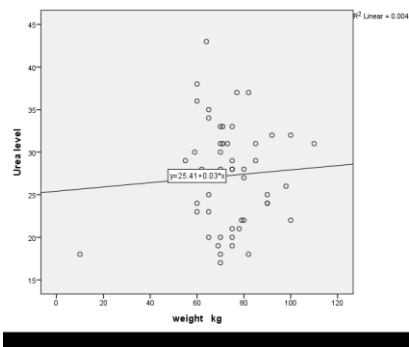


figure 8 ;=



## **Discussion**

In 50 sudanese adult male participated in this pilot study we found that they have higher serum creatinine range ( .9-1.7mg\dl) than did in the caucasian (0.6-1.4 mg\dl) [3] ,the range for serum creatinine we found in this pilot study is not similar with range of similar studies were done in tehran (0.53-1.11 mg\dl) (6) and in united state (1-1.29 mg dl) {7} also in brazil (0.23- 1.37) {8}. We found The blood urea range between (17-43mg\dl) which is higher than did in the caucasian { 5-20mg\dl } {3} .also we found in sudanese male the mean level of blood urea is  $27.26 \pm 1.76$  mg\dl which is higher than level of mean blood urea in caucasian (15mg\dl) ( figure 1 ) ,also the mean serum creatinine in sudanese male in tis study is (  $1.15 \pm .05$  mg|dl) which is slightly higher than in caucasian (1mg\dl ) ( figure 2 ) , also higher from result of similar study in brazil (0.77 mg \dl ) {8} , but it is similar to result from similar study in united state (1.16 mg\dl){7}

the result of 10 third trimester pregnant sudanese women we found higher urea range{10-23mg\dl} than did in the third trimester pregnant caucasian the range is 3-11mg\dl } (4) and lower creatinine range { 0.35 -0.79 mg \dl} than did in the third trimester pregnant caucasian { range is 0.4 -0.9 mg\dl }( 4 ) .the differences might be due to socioeconomic and nutrition and lifestyles differences .

## **CONCLUSION ;-**

This pilot study showed the levels of blood urea and serum creatinine of the sudanese volunteer participated in these study differ from that of the caucasian so there is need for national survey to establish the sudanese refrence values of blood urea and serum creatinine

## **REFERENCES :-**

- 1- Shaza M. Ahamed<sup>1</sup>, Gad Allah Modawe , BadrEldin Elsanni , Mansaur A. Ballal 'Assessment of creatinine and urea blood levels in healthy volunteers', *sudan medical monitor*, (2013 ) , 8 (3 ); pp. 153-155.
- 2- Nagah A. A. Mohamed<sup>1</sup>, Jumana M. ELhafiz , Faroug B.M.Ahmed ' Serum Creatinine in Normal Sudanese Athlets and Soldiers', *Science and Education Publishing*. , (2013 ) , 2(4), .
- 3-Adrian O. Hosten. (1990) *Clinical Methods: The History, Physical, and Laboratory Examinations*. , 3rd edn., boston: Walker HK, Hall WD, Hurst JW,
- 4 -F.GARY GUNNINGHAM .universty of texas southwestern medical center, department of obstetrics and gynecology, DALLAS TX , USA ,. Laboratory values in normal pregnancy
- 5- . . WILLIAM .F. GANONG . , Review of medical physiology, twenty second eddition USA: McGraw Hill Companies,
6. Ghasemi A , Azimzadeh , Zahediasl S , Azizi F . 'Reference values for serum creatinine with Jaffe-compensated assay in adult Iranian subjects: Tehran Lipid and Glucose Study.', *Arch Iran Med*, ( 2014).
7. CA Jones, • GM McQuillan, • JW Kusek, • MS Eberhardt, • WH Herman, • J Coresh, • M Salive, • CP Jones, • LY Agodoa 'Jones CA, McQuillan GM, Kusek JW, et al. Serum creatinine levels in the US population: Third National Health and Nutrition Examination Survey. *Am J Kidney Dis* (1999),32: 992-9', . .
8. V.M.A. Passos<sup>1,3</sup>, S.M. Barreto<sup>2,3</sup>, M.F.F. Lima-Costa<sup>2,3</sup> and the Bambuí Health and Ageing Study (BHAS) Group<sup>3</sup> ' Detection of renal dysfunction based on serum creatinine levels in a Brazilian community. The Bambuí Health and Ageing Study', *Braz J Med Biol Res*, , (march 2003) , 36(3 ); pp. 393-401.