

Reference Value for Uric Acid in Sudanese Healthy Adults

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Abstract

Background: The final product of purine catabolism in human is uric acid. Serum uric acid is a balance between its production and excretion. The liver and intestine mucosa produce most of purine and also provided by diet. The kidneys eliminate two third of uric acid with the gastrointestinal tract eliminating one third. **Objectives:** The objective of this pilot study was to establish the normal values of serum uric acid in healthy adult Sudanese, males and females living in Khartoum state and compare the results with the international values. **Methods:** A cross sectional study was conducted during 2018 in Khartoum state on adult healthy males and females aged between 20 and 30 years as a pilot for the project. 40 participants, 20 males and 20 females, were assessed by a questionnaire covering age, medical history, physical activity, daily caloric intake and smoking history. Body mass index BMI was calculated by measuring weight and height by standard measuring device scales. A sample of 5ml venous blood was taken and measurement of uric acid was done. **Results:** The range of uric acid was: Males 2-5.7mg/dl and females 2- 4.5mg/dl. The international range of males is 3.4-7mg/dl and in females is 2.4-6mg/dl. **Conclusion:** The results of this study indicate that there is a difference in values of uric acid between international values and in Sudan, so the normal values for uric acid in Sudanese need to be established from a large sample.

Keywords: Uric acid, reference values, Sudanese.

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INTRODUCTION

The organic heterocyclic compound uric acid was discovered by the Swedish chemist Carl Wilhelm Scheele. Alfred Garrod was the first scientist to prove the association between gout and increased levels of uric acid. The British physician Frederic A. Mohamed investigated the link between higher levels of uric acid and hypertension [1].

Uric acid is heterocyclic organic compound with a molecular weight of 168Da: The conversion of two purine nucleic acids adenine and guanine to uric acid involve many enzymes. The final breakdown product of purine catabolism in human is uric acid. The liver and intestinal mucosa produce most of it and it is also provided by diet [1-4].

It is freely filtered by the glomeruli, reabsorbed and secreted by the proximal tubules and this mechanism regulates the amount of uric acid excretion. Approximately 90% is reabsorbed into blood at the level of proximal tubules by transporters exchange intracellular anions for uric acid [2]. Uric acid is excreted by the kidney, which eliminates two thirds

of it, with the gastrointestinal tract eliminating one third.

Humans cannot oxidize uric acid to the more soluble compound allantoin due to lack of uricase enzyme [2]. At the physiologic pH uric acid is a weak acid with a pK of 5.8. It exists mainly as urate, the salt of uric acid, which is present in synovial fluids and plasma [4]. As urate concentration increases in blood uric acid crystal formation increases.

The normal international reference values of serum uric acid is 3,4 - 7,0mg /dl in adult males and 2,4 -6,0 mg /dl in adult females.

Uric acid levels vary from day to day. The concentration can vary with height, blood pressure, body weight, renal function and alcohol intake. In early pregnancy uric acid levels fall by one third but rise to non pregnant levels by term [4].

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The normal reference values of serum uric acid :In adult males is 3,4 - 7,0 mg/ dl and 2,4 -6,0 mg /dl in adult females [4].

When the level of uric acid in circulation is above these levels it is termed hyperuricemia [3].

The serum level of uric acid is controlled by the balance between uric acid production and excretion [5, 2].

Uric acid levels vary from day to day, concentration can vary with height, blood pressure, body weight, renal function and alcohol intake [2].

In early pregnancy uric acid levels fall by one third but rise to none pregnant levels by term [2].

Uric acid concentration can be measured in serum plasma, urine and in exhaled breath condensate.

Determination of uric acid concentration includes phosphotungstic acid methods PTA, uricase methods and high-performance liquid chromatography methods.

Factors that may cause a high uric acid level in blood may be due to excess uric acid production or decreased excretion as in: kidney disease, dehydration, diet rich in purine, destruction of massive amounts of nucleoproteins. Leukemia, anemia, chemotherapy, drugs especially diuretics, alcoholism, chronic kidney disease, metabolic syndrome.

Decreased uric acid levels can be seen in drugs like uricosuric drugs. (Salicylate, probenecide, allopurinol, estrogen, phenothiazines, indomethacine, corticotrophin), syndrome of inappropriate Antidiuretic hormone secretion [3].

Uric acid is an antioxidant, it binds to reactive oxygen species to form stable nitric oxide donors [6].

Hyperuricemia itself is not a disease, as it causes no symptoms in some cases, but prolonged state can lead to development of crystals, which cause problems. The two most common conditions which can result from high uric acid levels are gout and kidney disease.

Research has shown that one in five people with gout will develop kidney stone [7]. Gout is a crystal deposition disease that result from chronic elevation of uric acid levels above the saturation point for monosodium urate crystal formation.

The global burden of gout is substantial and seems to be increasing in many parts of the world over the past 50 years.

Developed countries tend to have a higher burden of gout than developing countries and seems to have increasing prevalence and incidence of the disease [8].

Hyperuricemia may predict development of metabolic syndrome, diabetes, hypertension, kidney disease, and cardiovascular disorders [9, 10].

High uric acid levels are associated with carotid subclinical atherosclerosis and oxidative stress in a retrospective cohort of the atherosclerosis risk in communities' study. Several studies have found an independent association between uric acid and coronary heart disease event, whereas others failed to show any association [11].

As the normal value of uric acid is affected by so many factors and the diagnosis of hyperuricemia depend on this level, this pilot study is designed to see if there is any difference between Sudanese level and international level.

METHODS

This is an analytic, cross –sectional – community –based study performed in Khartoum state capital of Sudan, during 2018 in healthy Sudanese volunteer males and females aged 20 to 30 years old who have no gout or renal problems or endocrine problems or any chronic illness and females with pregnancy were excluded from the study.

40 volunteers were included after taking their informed consent. Questionnaire interviews with all participants were done covering information about age, medical history, daily caloric intake, smoking, and physical activity. Physical examination of the blood pressure, height, weight, and calculation of BMI was done.

Five milliliters of venous blood were collected by the standard procedure from each participant under complete aseptic condition. Uric acid was measured using a spectrophotometer.

All the data collected in this study were analyzed using the statistical package for social sciences SPSS computer program version 25. Descriptive data were provided as range compared with

the international Values. P value ≤ 0.05 is considered statistically significant.

Ethical Consideration

Ethical approval of this study was obtained from the National Ribat University. The objectives of the study were explained to all individuals participating in the study.

RESULTS

In this study the data was collected from 40 Sudanese healthy participants; 20 males and 20 females their age ranged between 20 to 30 years. In the males group the serum level of uric acid ranged between 2 -

5.7mg/dl, with mean value of 3.7mg/dl compared with the international reference of 3.4-7.0mg/dl (Table-1, Figure-1) and females range of 2.4 -4.5 mg/dl compared with international reference of 2.4 -6.0 mg/dl (Table-2, Figure-2).

In conclusion the upper limit of uric acid levels in Sudanese males and females are lower than the international levels.

This results indicates the need for a large scale study to confirm this pilot study results and to search for the possible causes and to decide the level of hyperuricemia in Sudanese.

Table-1: The Range of uric acid in Sudanese males compared to the international Range

Male Gender	Minimum	Maximum
This study	2	5.7
international	3.4	7

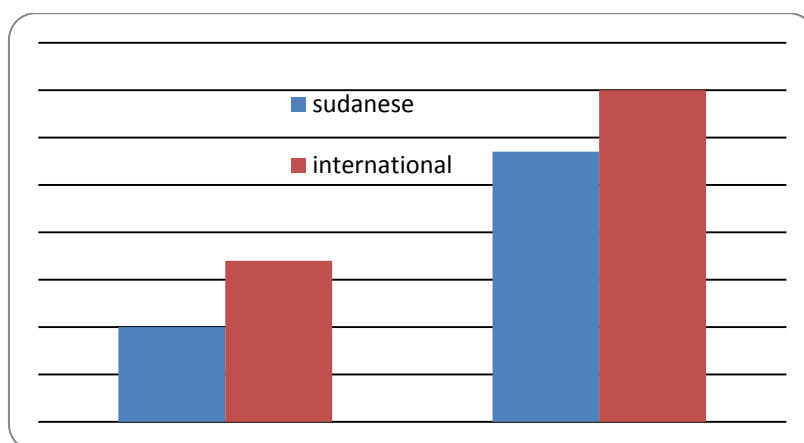


Fig-1: The Range of uric acid in males compared to the international Range

Table-2: The Range of uric acid in Sudanese females compared to the international Range

Female Gender	Minimum	Maximum
This study	2.4	4.5
international	2.4	6

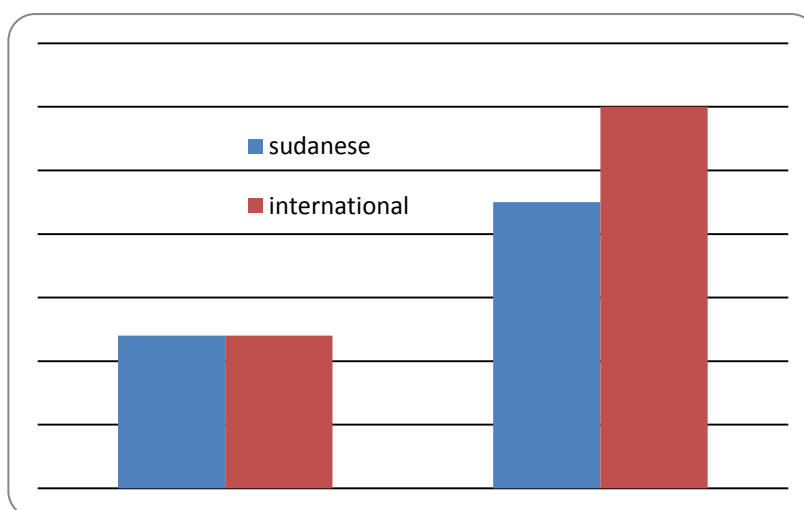


Fig-2: The Range of uric acid in females compared to the international Range

DISCUSSION

Differences in the normal values in Sudan have been documented in some hematological values [12-16], respiratory function tests parameters [17]. Renal functions test [18], serum electrolytes [19] and mean of glycated hemoglobin (Hb A_{1c}) [20-24].

In this study there were differences in the range of the normal values of serum uric acid from the international values.

We found reference range of uric acid ranging from 2_5.7mg/dl from 2.4_4.5mg/dl. Upper limits of both lower than current reference ranges used in our laboratory males range from 3_7mg/dl, females range from 2_6mg/dl.

These differences are most probably due to difference in life style, physical activity level specifically walking, type of diet.

CONCLUSION

In conclusion the upper limit of uric acid levels in Sudanese males and females are lower than the international levels. This indicates the need for a large scale study to confirm this pilot study results and to search for the possible causes and to decide the level of hyperuricemia in Sudanese

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