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Estimation of Uric Acid from Serum and Urine at the Regional Hospital in Koya-Iraq

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Abstract

Genetics, drug metabolism and diet are the main causes of high concentrations of uric acid in serum and blood which may indicate a variety of diseases. This study was performed to quantitative analysis of uric acid in both serum and blood from 42 persons (They do not have any other particular diseases) at Shahid Dr. Khalid`s hospital, Koya-Iraq. The volunteers were divided into two categories such as; half patients and half healthy (controls). The serum was separated using a centrifuge at 3000 rpm for 5 minutes. Subsequently the quantitative levels of uric acid have been determined via biolabo kit and a single-beam spectrophotometer at 520 nm. The urine samples were also centrifuged at 3000 rpm for 5 minutes and then examined under a microscope 40X for finding the urate uric acid. The results showed that the amount of uric acid in serum and urate uric acid is directly proportional and the severe cases have related disease such as kidney failure, cardiovascular diseases, diabetes

Keywords: Blood; patient; serum;uric acid

Introduction

Many Interacting metabolic pathways are a dynamic array of the human body. The response of metabolism is directly proportional to the amount of metabolomics. Metabolomics can be used to understand the process of specific metabolic pathways and for diagnosing a particular disease.

Because of ease of the collection, the rich metabolite composition repeated sampling and its relation to blood plasma make urine an interesting biological fluid[1]. Analysis of urine can be used for diagnosing many diseases for instance; renal tubular function can be measured by specific gravity (SG) of urine, renal diseases before its failure can be diagnosed by finding bacteria, WBCs, crystals, and precipitate. It can also be used for the detecting of diabetes mellitus by measuring the concentration of glucose, ketone bodies, detecting liver diseases by bilirubin and urobilinogen and indicating intravascular

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hemolysis. A complete urinalysis consists of determining SG, finding chemical properties of urines and examines the urine sediments microscopically[2].

Urine is a complex waste product of metabolism that contains organic molecules like uric acid, urea and creatinine, inorganic substances as magnesium (Mg2+), chloride (Cl1-), calcium (Ca2+), sodium (Na+), ammonia (NH4+), phosphate (PO43-), sulfate (SO42-) and other chemical compounds such as hydro-nitrogenous compounds, carbohydrates, pigments, trace amounts of enzymes, hormones, mucins, and fatty acids[3,4,5]. The concentrations of the chemical compounds mentioned are determined by many factors like physical activity, endocrine function, dietary intake, body metabolism and even body composition. The kidney is the main filter in producing urine which is stored in the urinary bladder and excreted via the urethra[5,6]. In older urine specimen bacterial metabolism can influence blood cells and plasma proteins[7].

Urine has a wide pH range from 4.6 to 8.0 with an average is 6.0. The pH of urine is influenced directly by diet, for instance, wheat and vegetables cause alkaline and protein acidic urine. Urine`s SG is between 1.001 and 1.035. The kidney can excrete 1-2 liter of urine per day. This volume is affected by the amount of water intake, disorders as diabetes, hormonal regulation and body activity around 1% is produced by filtration.

Uric Acid is a white, tasteless, and odorless nitrogenous compound, $C_3H_4N_4O_3$. "7, 9-dihydro-1H-purine-2,6,8(3H)-trione and is the end product of purine metabolism8. Purines, which occur in all cells, are built from both dietary sources and from the breakdown of body proteins. It is present in small amounts in human urine. Uric acid is only slightly soluble in water and is insoluble in alcohol and ether[8,9]. Another source of uric acid is a purine. In the small intestine purine is resorbed and excreted by urine RNA and DNA are composed of 50% and 25% of purine respectively[10]. The endogenous production account of body urate is two thirds and dietary purine is one third. The main excretion of the UA in the body is via urine a small amount of it is removed by stool13. Monosodium urate is the main ionized form of uric acid in serum and around 5% of urate is bound to proteins. A high uric acid level can cause kidney stones, kidney failure, high blood pressure and heart disease. Chronic kidney disease (CKD) is primarily caused by high amounts of uric acid. A low glomerular filtration rate (GFR) occurs when the level of serum uric acid is high (hyperuricemia). Hyperuricemia may cause cardiovascular events, hypertension, renal dysfunction, and metabolic syndrome diabetes

Materials and Methods

Sample collection

Eighty-four (42 blood samples + 42 urine samples = 84) samples are collected over a period of 5 months were included in this study. The patients' consent was obtained according to a special questionnaire form and for each patient urine and blood samples were collected.

Urine sample collection

Five mL of urine was collected from patients and healthy people in a properly labeled plain tube. Chemical analysis of the urine samples was done by using a commercial dipstick (Uripath, Plasmatic). Then, the urine samples were centrifuged at 3000 rpm for 5 minutes. The supernatant was discarded, and the precipitate examined directly under a light microscope at a 40-fold magnification.

Blood sample collection

Forty-two samples were collected in this study, half of them had a high range of uric acid and the other half were normal therefore, they were used as a control group.

Two milliliters of venous blood was collected under aseptic conditions in a plain tube. Blood was allowed to clot at room temperature. Then the samples were centrifuged at 3000 rpm for 5 minutes. The serum was transferred to an Eppendorf tube and stored at -20 0C.

Statistical analysis

Means and standard deviations are reported by using Microsoft-excel program. For comparison of groups t-tests were used.

Results

Microscopic examination: Microscope has been used in the mode of high power field (Hpf)(FIG. 1-3**)**

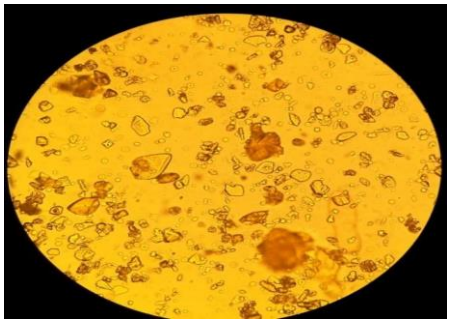

FIG 1.**Calcium oxalate, uric acid crystal and RBC under the light Microscope 40x (Hpf)**

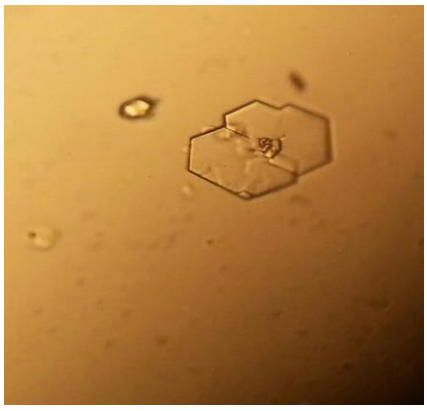

FIG 2. **Uric acid crystal under the light microscope (Hpf)**

FIG 3. **Epithelial cells, calcium phosphate, bacteria, uric acid and RBC under a light microscope (Hpf)**

Forty two samples are collected in this study, 21 from patients with elevated uric acid and 21 from a healthy control group. The means and standard deviations of the age (years) of the patients, pH and the specific gravity of urine, and serum uric acid (mg/dl) are shown in (TABLE 1-2) .

TABLE 1.**Mean and standard deviation for age, pH, specific gravity and serum uric acid of the 2 groups**

Parameter	Age		pH		Specific gravity mg/dl		Serum uric acid	
Group	mean±SD	p-value	mean±SD	p-value	mean±SD	p-value	mean±SD	p-value
Patient	19.2±29.6	0.58	0.7±6.09	0.64	1.01±1.02	0.13	1.95±5.73	0.21
Control	11.8±26.9		0.1±6.02		1.03±1.02		2.11±4.94	

TABLE 2.**Sample data satisfied by age**

Age(years)	Patient			Control		
	Patient #of the case	Urinary uric acid crystals mean±SD	Serum uric acid mean±SD	Control #of the case	Urinary uric acid crystals	Serum uric acid mean±SD
1-10	5	10.8±11.4	1.8±6.5	2	-	0.1±4.1
11-20	2	0±5	0.2±5.8	3	-	1.8±3.9

21-30	5	4±5.6	1.5±4.9	10	-	1.3±5.3
31-40	3	0±2	1.4±5.6	4	-	3.7±5.3
41-50	2	8±11.3	2.7±7.1	2	-	4.1±4.6
51-60	4	0.9±2.9	2.4±4.5	-	-	-

2- Result and statistical analysis (graph)

The mean age for the patient is (29.6), the oldest age is (60) and the youngest age is (4) years and in the control group the mean is (26.9), the oldest age is (50) and the youngest age is (5) years. The difference between both study groups is p-value (0.64) which is not significant >0.05.

As shown in (FIG. 5-8)

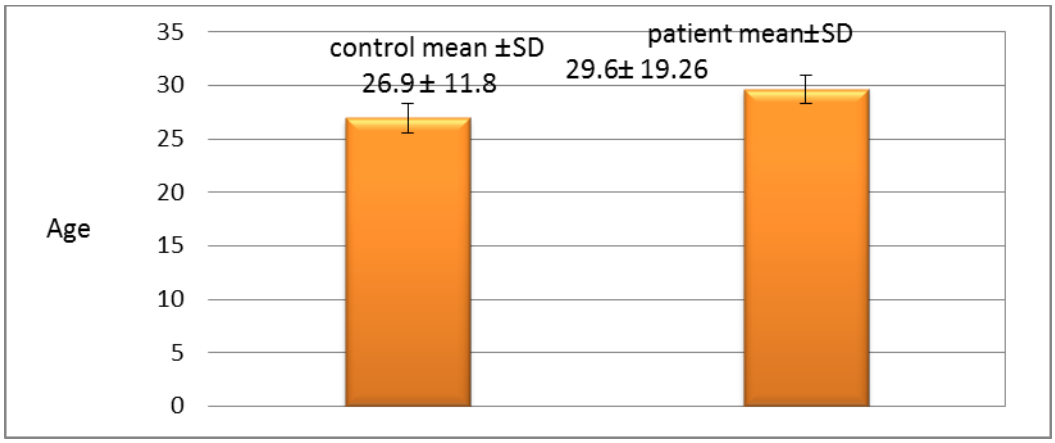

FIG 5.**Mean of the age patient and control**

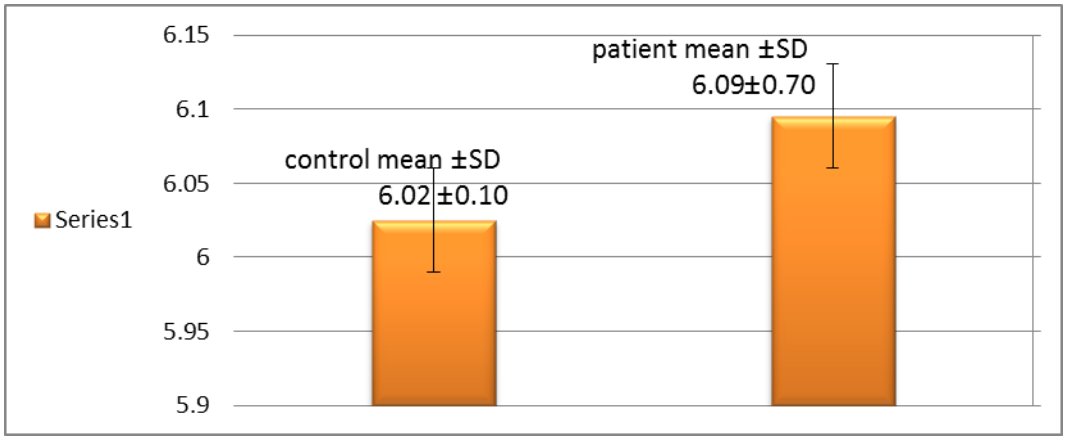

FIG 6. **Mean of PH urine for the patient and control groups**

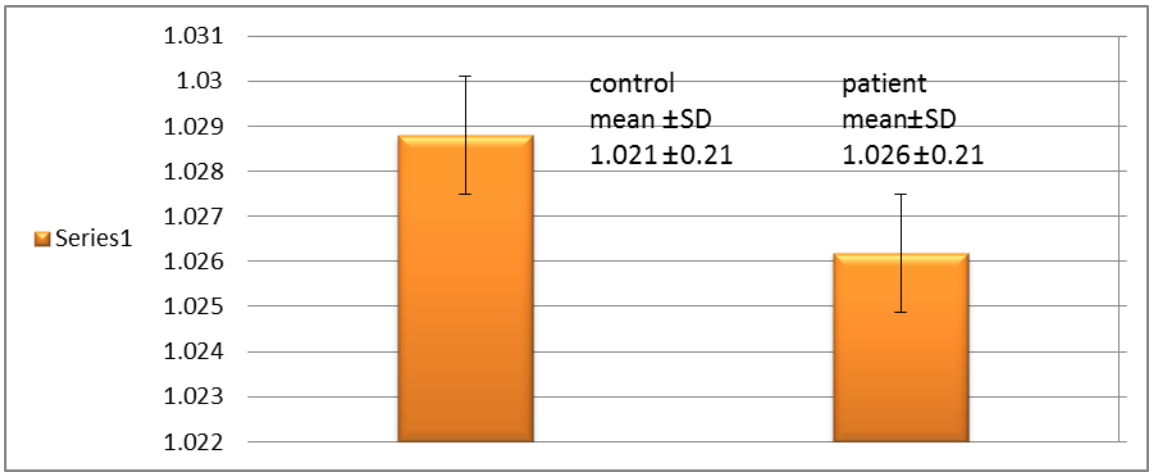

FIG 7. **Mean of the SG patient and control**

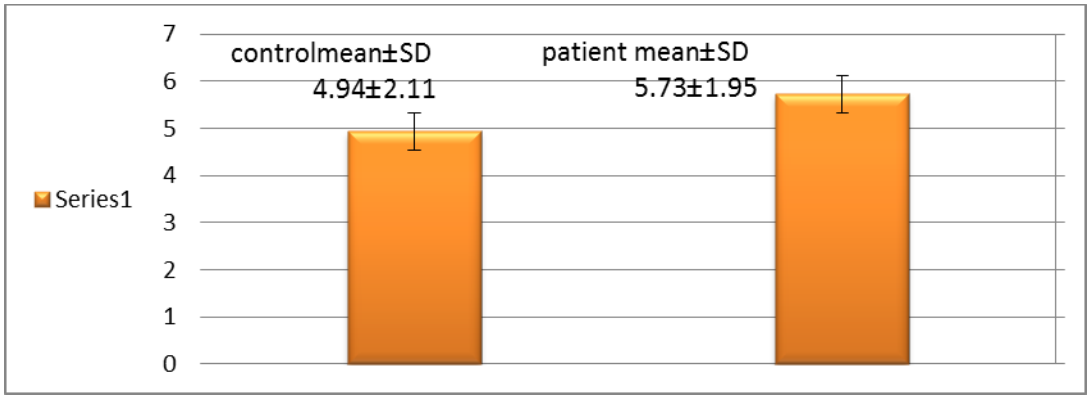

FIG 8. **Mean of the serum uric acid patient and control**

Conclusions and Discussions

The samples have been collected from the age of 4 to 60 years old in shahid Dr. Khalid hospital in Koya, this study demonstrated that 3/4 of the patients which have high urate or uric acid in their serum but in the other patients, the serum uric acid is still remained within the normal range, moreover, in the control group the uric acid in some serum is high but in others is normal nevertheless their urine does not contain urate crystal or have small amount.

In the current study, the uric acid according to the age demonstrated that the urinary and serum uric acid is increased in children (less than 10 years) and old patient (more than 40 years). While in other studies the uric acid level is increasing with age16.

Also, pH has not to affect the level of uric acid, but in other studies, the uric acid level increased with the decrease of pH and vice versa17.

Serum uric acid is increased by dietary intake, for example, eating foods which contain more purine, because purine is the source of uric acid, such as meat18.

Uric acid crystals in urine are increased if the kidney has problems with the function of the proximal tubules and are also elevated when the volume of urine is low because in this case the uric acid is more concentrated13.

A reduction in drinking water has the effect on the more excrete uric acid from the glomerulus of the kidney because the volume of urinalysis is decrease19. In this study, we collect the sample in the winter that people drink a low amount of water in this season and the urinary uric acid is more concentrated in some cases that is why have not to affect the serum uric acid.

In conclusion:

•No significant relationship between urinary and serum uric acid in patients compared to the healthy control group.

•The age, urine pH and the specific gravity of the urine show no significant relationship with serum uric acid.

•Excretion of the urinary uric acid crystals depends on the increase of serum uric acid then increased by some factors as eating the extra amount of meat or genetic factor or use of some drug for the treatment of the specific disease such as chemotherapy.

Also, excretion of a urinary uric acid crystal depends on the circumstance of the glomerulus of the kidney because uric acid is reabsorbed in this portion of the kidney. If it has any problem the uric acid crystal will excessive excrete [10].

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