

Seasonal variation of serum uric acid level in a normal population in Mosul city

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ABSTRACT

Uric acid is an unwanted product that is found in the blood. It results from the breakdown of matters “purines” which is part of many foodstuffs. High amounts of uric acid in the blood can cause crystals precipitation in the joints, which lead to gout, but small number of people with high uric acid levels develop gout. To estimate the serum uric acid level in a normal population in Mosul city, and to evaluate if there is seasonal variation of serum uric acid level. One hundred healthy volunteers; 56 male (56%) and 44 female (44%); collected and subjected for detailed history taking and clinical examination in Ibn-Sena Teaching Hospital and private clinic, during the period (April 2018–April 2020). Blood sample were aspirated monthly; from the same volunteer, through out the year. The blood sample were tested for serum uric acid; blood urea and serum creatinin in Ibn-Sena Teaching Hospital Laboratory and AL-Mansoor private Laboratory in Mosul City. Body mass index (BMI) was calculated for each subject; below normal weight (< 18.5%); normal weight (19-24.9%); over weight (25-29.9%). Eating habit for each volunteer (vegetarian, non vegetarian). The study reveals that, the serum uric acid level is higher in male than in the female throughout the year; this variation is highly significant, the serum uric acid level for the 100 healthy volunteers through out the four season in a year (Winter; Spring; Summer and Autum) show high level in Summer and Autum season than the other seasons, Winter and Spring, this difference is highly significant. The serum uric acid level according to the body mass index (BMI); (below normal weight; normal weight and over weight) for the 100 vlunteers; through out the year show significant difference between them. The blood urea in four seasons through out of the year for the 100 volunteers show no significant. The serum creatinine in four seasons for the 100 volunteers is not significant.



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1. INTRODUCTION

Uric acid is normally found in the blood as a waste product, it results from a breakdown of “purines” substance which is a part of many foods and drinks. There is considerable variation in the level of serum uric acid level in males and females; The normal blood uric acid level in humans is approximately 4 mg/dL (0.24 mmol/L. [1].

Certain factors affecting the level of serum uric acid level in the body such as age, sex, body mass index, nature of the diet, and socioeconomic class; also high protein diet, hyperlipidemia, atherosclerosis, diabetes mellitus, kidney disease, primary hypertension, diuretic medications; drinking too much alcohol; genetics (inherited tendencies), Hypothyroidism; Immune-suppressing drugs, obesity; psoriasis, tumor lysis syndrome; chemotherapy or radiation treatment for cancer has a positively correlation with serum uric acid levels [2- 6]. Season and weather may have a role in physiology on precipitation of urate crystals and high level of uric acid during Summer [7], [8]. Uric acid levels in the blood naturally fluctuate; When it's level is more than (7.2 mg\dl) of blood, it called hyperuricemia which may be lead to gout [9]. When there is a hyperuricemia, the excess uric acid can deposit in joints where it can form uric acid crystals, precipitation in the kidney causing renal stones (uric acid stones). It is possible to have hyperuricemia but not have a gout; so most people with hyperuricemia do not have gout symptoms. Among people who have gout, nearly (14%) have a kidney stone; Most of the time, a high uric acid level occurs when the kidneys don't eliminate uric acid efficiently [10]. Uric acid is a potent non enzymatic endogenous antioxidant in the body; it is the most abundant scavenger of free radicals in humans. Elevation of serum uric acid concentration occurs as a physiologic response to increased oxidative stress [11- 13]. In plasma, uric acid, albumin and ascorbic acid accounts for more than 85% of total antioxidant capacity, Uric acid is a major contributor to total radical trapping capacity (TRAP) accounting between 38-47% of the entire total in contrast to vitamin C and vitamin E which contributes 13-17% and 2-8% respectively [14]. Uric acid spares ascorbic acid by changing its electron content, uric acid was shown to reduce oxidative damage to DNA by reacting with guanyl radical [15- 17].

The higher serum uric acid concentration seemed associated with elevated total serum antioxidant capacity among individuals with atherosclerosis; hyperuricemia may be a compensatory mechanism to counteract oxidative damage related to atherosclerosis and aging in humans [18- 20].

2. Material and Method

2.1 Material

One hundred healthy volunteers; 56 male (56%) and 44 female (44%); collected and subjected for detail history taking and clinical examination in Ibn-Sinna Teaching Hospital and private clinic, during the period (April 2018–April 2020). Blood sample were aspirated monthly; from the same volunteer, through out the year. The blood sample were tested for serum uric acid; blood urea and serum creatinin in Ibn-Sinna Teaching Hospital and AL-Mansoor private laboratory in Mosul City. Body mass index (BMI) were calculated for each subject; below normal weight (< 18.5%); normal weight (19 - 24.9%); over weight (25-29.9%). Eating habit (vegetarian, non vegetarian), socioeconomic state (Low, intermediate, highlevel). Volunteers with cardiovascular; renal, gout, hypertension, diabetes mellitus diseases, pregnant women, history of hyperuricemia were excluded from our study.

2.2 Methods

Blood sample were aspirated monthly from volunteers who agreed to participate in this study and tested for the serum uric acid, blood urea and serum creatinin in Ibn-Sina Teaching Hospital and AL-Mansoor private laboratory; using the manual method for serum uric acid test [21], [22], blood urea and serum creatinine [(23), [24]

2.3 Statistical analysis

By determining the mean, standard deviation (S.D), Standard Error of Mean (S.E.M), t -value, p- value. All statistical tests were 2-sided and a $P < 0.05$ was recognized as the statistically significant.

3. Results

Uric acid is normally found in the blood as a waste product; It result from a breakdown of “purines” substance which is a part of many foods and drinks. The present study includes 100 healthy volunteers; 56(56%) male and 44(44%) female, the serum uric acid level is higher in male than in the female through out the year; this variation is highly significant (p- value is < 0.0001), as shown in table (1).

Table (1): Serum uric acid level for the 100 healthy volunteers male and female through out the year.

Month	Male 56 (56%)	Female 44(44%)	P-value
	Serum uric acid level (mg\dl) Mean±SD	Serum uric acid level (mg\dl) Mean±SD	
Jan.	4.67±0.25	3.38±0.13	<0.0001
Feb.	4.62±0.28	3.35±0.14	<0.0001
March	4.52±0.28	3.39±0.17	<0.0001
April	4.50±0.30	3.29±0.13	<0.0001
May	4.72±0.28	3.62±0.14	<0.0001
June	5.92±0.31	4.64±0.11	<0.0001
July	6.02±0.36	4.69±0.13	<0.0001
Aug.	5.99±0.30	4.66±0.13	<0.0001
Sept	5.43±0.21	4.28±0.18	<0.0001
Oct.	5.43±0.21	4.28±0.15	<0.0001
Nov.	5.37±0.18	4.21±0.26	<0.0001
Dec.	4.68±0.21	3.42±0.17	<0.0001

The serum uric acid level for the 100 healthy volunteers through out the four season in a year (Winter; Spring; Summer and Autumn) show high level in summer and Autumn season than the other seasons (Winter and Spring), this difference is highly significant (p-value= 0.0001) as shown in table (2).

Table (2): Serum uric acid for 100 volunteers in four seasons.

Season	Serum uric acid (mg\dl) Range	Serum uric acid level (mg\dl) Mean±SD	95% CI of mean	P-value
Winter	3-6	4.10±0.6	4.02-4.17	0.0001
Spring	3-6	4.07±0.68	4.00-4.15	0.0001
Summer	4-7	5.40±0.70	5.32-5.48	0.0001
Autumn	3-6	4.90±0.60	4.83-4.97	0.0001

The blood urea (mean) in four seasons through out of the year for the 100 volunteers are shown in figure (1). The p – value is not significant.

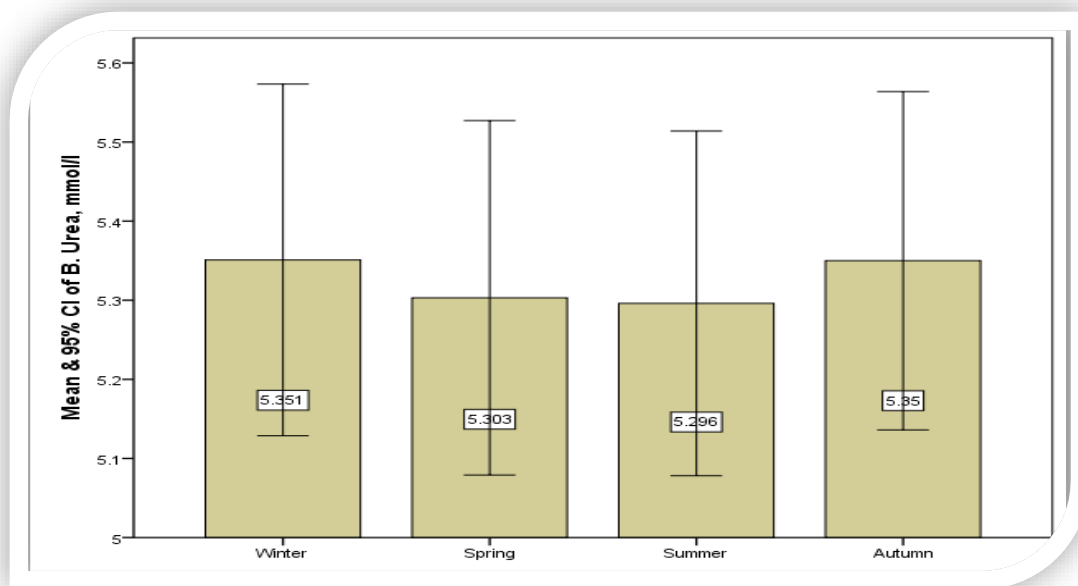


Figure (1): Blood urea in four seasons through out of a year for the 100 volunteers.

The serum creatinine (rang, mean and 95% CI of mean) in four seasons (Winter, Spring, Summer and Autumn) for the 100 volunteers, as shown in table (32); p-value is not significant).

Table (3): Serum creatinine in four season (Winter; Spring; Summer and Autumn) for the 100 volunteers.

Season	Serum creatinine (mg\dl) Range	Serum creatinine (mg\dl) Mean±SD	95% CI of mean	P-value
Winter	25-99	64.08±19.37	60.24-67.92	0.8
Spring	25-99	64.74±19.62	60.85-68.63	NS
Summer	22-97	64.74±19.62	60.85-68.63	NS
Autumn	23-98	63.91±18.87	60.17-67.65	NS

The serum uric acid level according to the body mass index (BMI); (below normal weight; normal weight and over weight) for the 100 vlunteers; through out the year show significant difference. The p-value<0.05), as shown in table (4).

Table (4): Serum uric acid level according to the body mass index (BMI); below normal; normal and over weight.

Month	Body mass index (BMI)			P-value
	Below normal weight	Normal weight	Overweight	
	Serum uric acid level (mg\dl) Mean±SD	Serum uric acid level (mg\dl) Mean±SD	Serum uric acid level (mg\dl) Mean±SD	

Jan.	4.70±0.115	4.05±0.691	4.57±0.186	0.03
Feb.	4.60±0.115	4.01±0.685	4.50±0.237	0.05
March	4.45±0.173	3.96±0.616	4.60±0.155	0.01
April	4.53±0.377	3.91±0.650	4.53±0.225	0.01
May	4.80±0.115	4.18±0.603	4.70±0.089	0.01
June	5.75±0.173	5.30±0.690	5.97±0.361	0.03
July	5.85±0.058	5.37±0.722	6.20±0.322	0.01
Aug.	6.00±0.115	5.32±0.685	6.27±0.459	0.001
Sept.	5.25±0.058	4.87±0.611	5.53±0.103	0.01
Oct.	5.15±0.058	4.87±0.611	5.53±0.225	0.02
Nov.	5.45±0.173	4.79±0.609	5.50±0.237	0.003
Dec.	4.85±0.058	4.06±0.669	4.57±0.082	0.01

Serum uric acid level according to the Eating Habit (vegetarian; non vegetarian) through out the year show significant difference, The p – value is <0.5, as shown in figure (2).

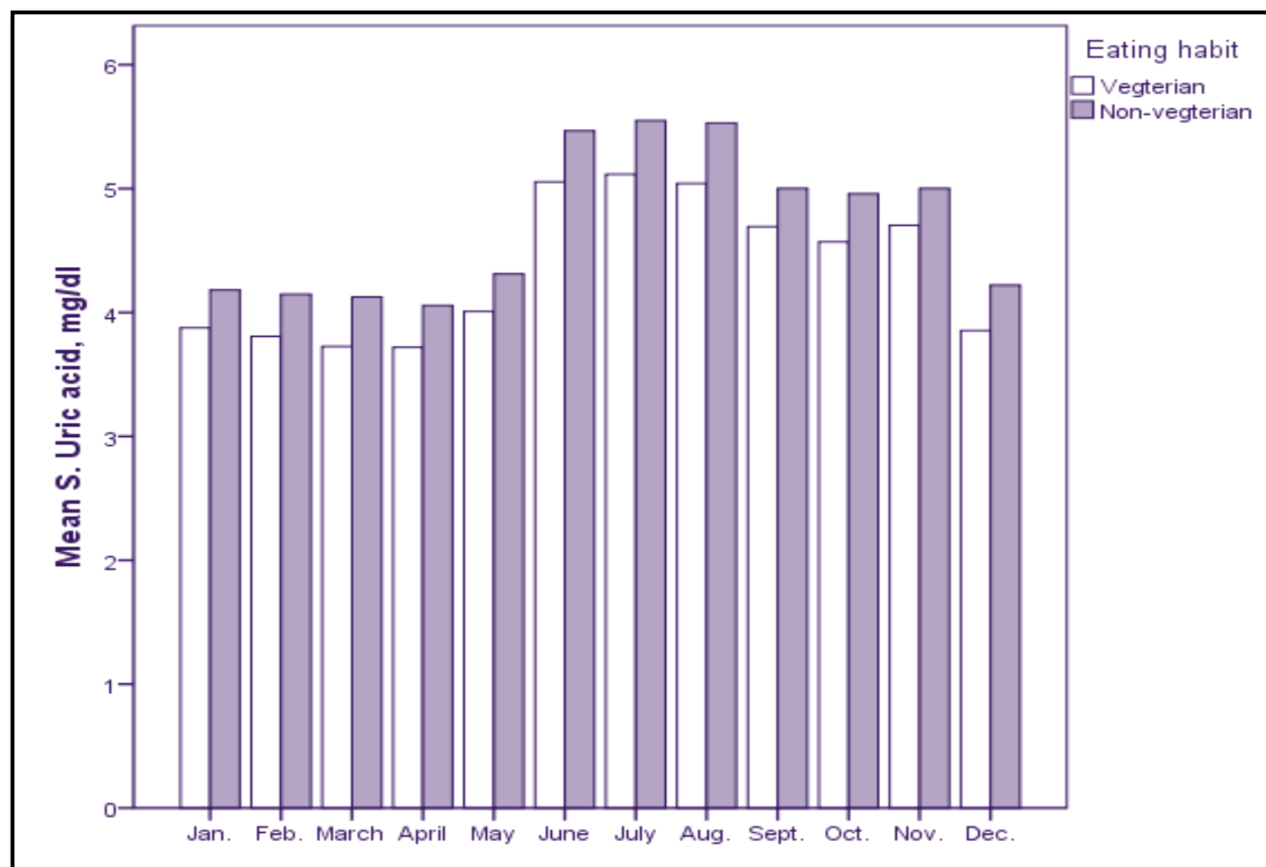


Figure (2): Serum uric acid level according to the eating habit (vegetarian, non vegetarian).

4. Discussion

Uric acid is normally found in the blood as a waste product from degradation of purines, This study was

conducted to estimate the seasonal effect on the level of SUA in normal population throughout the year. The results of current study show the serum uric acid level for the 100 healthy volunteers through out the four season in a year (Winter; Spring; Summer and Autumn). The serum uric acid level is higher in Summer and Autumn season; incomparison with the other seasons (Winter and Spring) and this difference is highly significant, it show a seasonal variation of $(4.07 \pm 0.68 \text{ mg/dl})$ level in Spring lower than that in summer $(5.40 \pm 0.70 \text{ mg/dl})$, and this is agrees with the other study [8], [25] studied the level of uric acid in patient with gout which showed high levels of uric acid during summer time [26].

The high level of urate during May, June and July months may be due to dehydration which caused by excessive sweating because of high temperature in Mosul city (up to $45-49^{\circ}\text{C}$) which concentrate serum uric acid [27]. The present study shows that the SUA level increases significantly starting from June towards July and August in association with all BMI groups (below normal, normal and overweight subjects and higher level of SUA was seen in subjects with high BMI. The findings consistent agree with other study which reveal positive correlation between SUA and BMI [28], [29]. This may be due to excessive secretion of uric acid from adipose tissue in overweight and obese subjects. The diet habits (vegetarian and non-vegetarians) of volunteers significantly corelated with serum uric acid level ($p < 0.001$), the serum uric acid level increased with increasing total meat or sea food and the mean serum uric acid level of vegetarians is lower than of non-vegetarians; and this result agree with other study [29].

5. Conclusion

The uric acid level varies with season, lower level was shown in winter season in comparison with the summer season and this should be taken in consideration when we do the serum uric acid in normal healthy and patients with gout. Higher level of uric acid is seen in overweight and non-vegetarians subjects, so the weight, BMI and diet type and habits affect the serum uric acid level.

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