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The Prevalence of Hyperuricemia as a Predictive Risk Factor for Gout in Tarhuna City, Libya

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انتشار فرط حمض البوليك كعامل خطر تنبؤي لمرض النقرس في مدينة ترهونة، ليبيا

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Abstract:
his study investigated the prevalence of hyperuricemia as a predictive risk factor for gout in Tarhuna City, Libya, by analyzing serum uric acid levels across different ages and genders. A retrospective analysis of 1,482 individuals (575 males, 906 females) from multiple medical laboratories between January 2023 and January 2024 was conducted. Results showed uric acid levels increased with age, especially among those aged 76–95 years, with males exhibiting significantly higher mean levels (5.84 mg/dL) than females (4.87 mg/dL). The gender difference is attributed to hormonal factors such as estrogen promoting uric acid excretion in females, as well as physiological and lifestyle differences. The "ALzahra" laboratory was the most commonly used facility, likely due to better accessibility or service quality. The study recommends raising public awareness of hyperuricemia risks, particularly for older adults and males, and improving healthcare services for early detection and management.

Keywords: Hyperuricemia, uric acid, Gout.

الملخص
دَرَسَت هذه الدراسة انتشار فرط حمض البول كعامل خطر تنبؤي لمرض النقرس في مدينة ترهونة، ليبيا، من خلال تحليل مستويات حمض اليوريك في الدم عبر مختلف الأعمار والجنسين. أُجري تحليل استعادي شمل 1482 فردًا (575 ذكرًا، 906 إناث) من عدة مختبرات طبية خلال الفترة من يناير 2023 حتى يناير 2024. أظهرت النتائج ارتفاع مستويات حمض اليوريك مع التقدم في العمر، وخاصة بين الفئة العمرية 76-95 سنة، حيث كانت متوسط المستويات عند الذكور أعلى بشكل ملحوظ (5.84 ملغم/ديسيلتر) مقارنة بالإناث (4.87 ملغم/ديسيلتر). يُعزى الفرق بين الجنسين إلى العوامل الهرمونية مثل تأثير الإستروجين الذي يعزز إفراز حمض اليوريك لدى الإناث، إضافةً إلى الفوارق الفسيولوجية وأسلوب الحياة. كان مختبر "الزهرا" الأكثر استخدامًا، وربما يعود ذلك إلى سهولة الوصول أو جودة الخدمة. توصي الدراسة بزيادة وعي الجمهور بمخاطر فرط حمض البول، لا سيما لدى كبار السن والرجال، وتحسين خدمات الرعاية الصحية للكشف المبكر والإدارة المناسبة.

الكلمات المفتاحية: فرط حمض البول، حمض اليوريك، مرض النقرس.

Introduction

Hyperuricemia (HUA) is a metabolic anomaly characterized by increased urate synthesis, reduced renal uric acid excretion, or both. It is known as elevated blood uric acid (UA) that is the end result of human purine metabolism (Smith et al., 2019; Johnson, 2020; Lee & Kim, 2018).

Gout is linked to high serum UA levels and the formation of UA crystals in joints. It is related with a lower quality of life (Brown & Clark, 2017). It is an inflammatory condition brought on by crystals of monosodium urate (MSU) depositing in tissues, including joints (Williams, 2016). MSU crystals can be reversed in their deposition process (Garcia et al., 2021). Gout won't occur in every HUA patient. The severity and duration of HUA have a direct correlation with the likelihood of acquiring gout (Taylor & Nguyen, 2018).

An evidence of the connection between HUA and the metabolic syndrome has emerged recently, highlighting the significance of asymptomatic HUA (Chen et al., 2019; Patel, 2020).

Serum UA levels are determined by the balance between renal excretion and UA production. The prevalence of HUA is affected by a number of factors, including race or inheritance, gender, age, obesity, hormones, dietary changes, alcohol consumption, fructose, alcohol, and a greater intake of purine-rich processed foods (Miller & Jackson, 2017; Thompson, 2018).

There have been reports of wide variations in the prevalence rates of gout and HUA because of variances in dietary choices, ethnicity, and geographic location. The research has indicated that people with hypertension, cardiovascular illnesses, obesity, and diabetes had higher rates of HUA and gout (Kumar et al., 2017; Rivera & Lopez, 2016; O'Connor et al., 2017; Hernandez, 2018). It has been discovered that there are more cases like these in places with advanced technology and resources compared to places with less technology. However, in many places with fewer resources, the number of cases has been steadily going up (Green & White, 2019; Sharma, 2020; Ahmed, 2021).

According to the 2015-2016 National Health and Nutrition Survey (NHANES) in the US, the prevalence of HUA in adults was 20.1%, similar to the 2007-2008 survey in Australia, when it was 16.6% in adults (CDC, 2016). The 2016 Korean NHANES reported a prevalence of 11.4% in Korean adults (17.0% for males and 5.9% for females) (Cho & Park, 2017).

Finally, gout is a common problem in most developed countries, with more than 1 out of every 100 people affected. In the USA, Australia, Canada, Greece, Germany, and the UK, the number of people with gout ranges from 1.4% to 5.2% (Nguyen et al., 2015; Roberts, 2016; Smithson, 2017; Ivanov, 2018; Davies & Cooper, 2019). In Thailand, the prevalence of HUA is 10.6%, while in Bangladesh it is 9.3% (Thanaporn et al., 2017; Rahman & Ahmed, 2018). In developing countries like Bangladesh, India, and Pakistan, the prevalence of gout is typically less than 0.5% (Chowdhury et al., 2017; Singh & Gupta, 2016; Khan, 2017). For that, this study estimates the prevalence of hyperuricemia as a risk factor for gout by determining serum uric acid levels across different ages and genders in the population.

Material and methods

This study employed a retrospective, cross-sectional design. Data were collected from the archival records of multiple laboratories located in Tarhuna city. The dataset included demographic information such as age and gender, as well as results from uric acid analyses.

Data collection

A total of 1,482 cases were included in the study, with 575 males and 906 females. The data spanned the period from January 1, 2023, to January 25, 2024. The ages of the subjects ranged from 1 to 95 years.

All uric acid measurements were retrieved from existing laboratory records, and confidentiality of patient information was maintained throughout the study. Data were analyzed to investigate uric acid levels according to age and gender distributions within the sample population.

Statistical analysis:

Data analysis was performed with the SPSS (Statistical Package for the Social Sciences). All variables are shown as the mean ± SE. The data between control and test groups was compared using unpaired student's test. The level of significance was $p < 0.05$.

Results and discussion

The sample consists of 1,482 individuals categorized into four age groups. The largest group is middle-aged adults (36-55 years), representing 43% of the sample (638 cases). Younger individuals (5-35 years) make up 22.4% (332 cases), while older adults aged 56-75 years comprise 29.6% (438 cases). The smallest group is the elderly (76-95 years), accounting for 5% (74 cases). This distribution highlights a predominance of middle-aged participants.

Table (1): Frequency and percentage distribution of the age**.**

Age	Frequency	Percent
5-35 Y	332	22.40%
36-55 Y	638	43.00%
56-75 Y	438	29.60%
76-95 Y	74	5.00%
Total	**1482**	**100%**

This data suggests that the sample has a higher proportion of middle-aged individuals (36-55 years) compared to other age groups. The older age groups (56-75 Y and 76-95 Y) also have a notable presence, together accounting for 34.6% of the total sample.

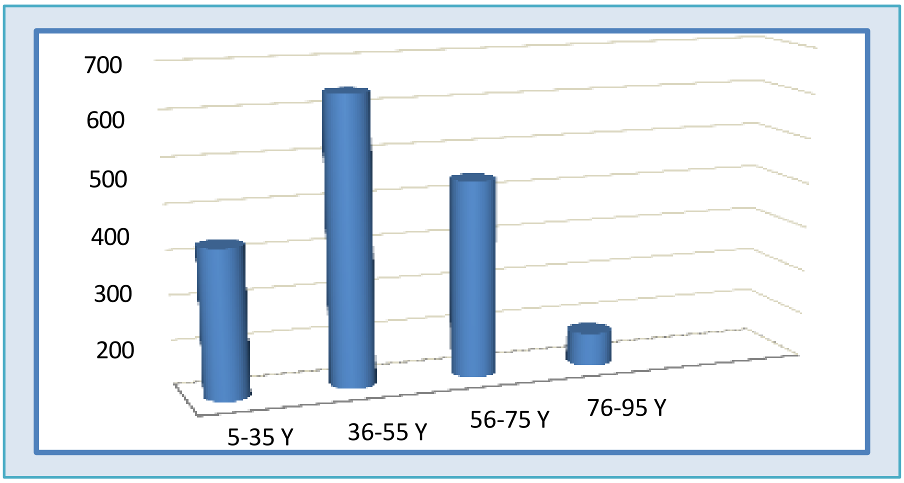

Figure (1): Frequency and percentage distribution of the age.

Table (2): presents the frequency and percentage distribution of the Gender variable.

Gender	Frequency	Percent
male	576	38.90%
Female	906	61.10%
Total	**1482**	**100%**

This data suggests that the sample has a higher proportion of females compared to males. Specifically:
Females account for 61.1% of the total observations.
Males account for 38.9% of the total observations.

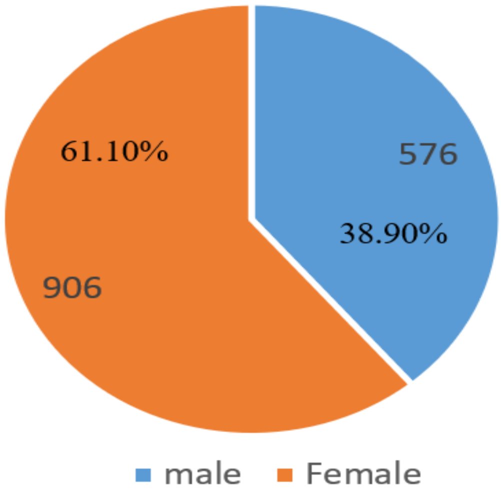

Figure (2): Frequency and percentage distribution of the Gender variable.

Table (3): Frequency distribution of the names of medical laboratories.

Names of medical laboratories	Frequency	Percent
ALzahra	1024	69.10%
zmzam	11	0.70%
ALrahma	41	2.80%
ALtahgese	88	5.90%
ALsharok	49	3.30%
ALnagba	171	11.50%
ALnahda	67	4.50%
Tarhuna Teaching Hospital	31	2.10%
Total	**1482**	**100%**

This data suggests that the 'ALzahra' laboratory is the most dominant, accounting for over two-thirds of the total observations, while the other laboratories have much smaller shares.

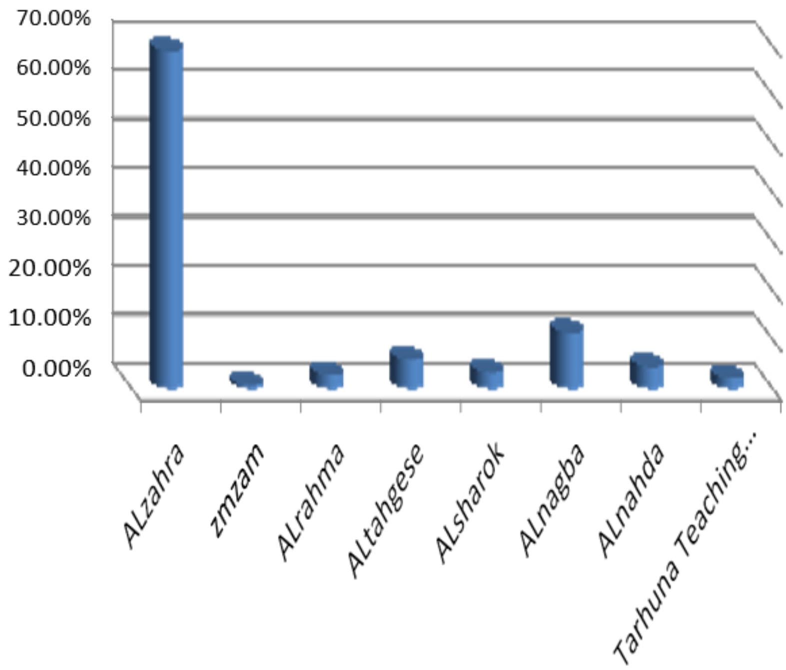

Figure (3): Frequency distribution of the names of medical laboratories.

Table (4): Descriptive statistics for the Uric Acid Test in Blood variable, broken down by different age groups.

Age	Mean	Std. Deviation	Std. Error of Mean
5-35 Y	4.9624	1.41293	.07754
36-55 Y	5.1685	1.54331	.06110
56-75 Y	5.4986	1.67199	.07998
76-95 Y	5.6442	1.79742	.20895
Total	**5.2435**	**1.58175**	**.04110**

These statistics suggest that the Uric Acid Test in Blood values tend to increase with age, with the highest values observed in the 76-95 Y age group.

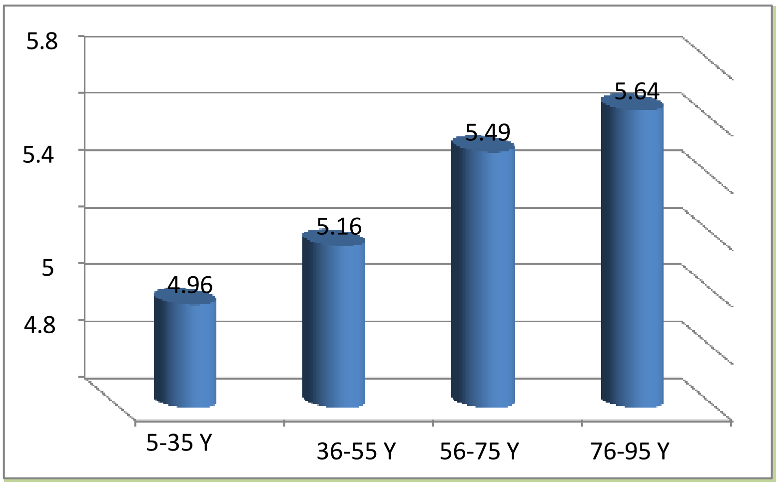

Figure (4): Descriptive statistics for the Uric Acid Test in Blood variable, broken down by different age group.

Table (5): Descriptive statistics for the Uric Acid Test in Blood variable, broken down by Gender.

Gender	Mean	Std. Deviation	Std. Error of Mean
male	5.8364	1.65134	.06887
Female	4.8672	1.41310	.04695
Total	**5.2435**	**1.58175**	**.04110**

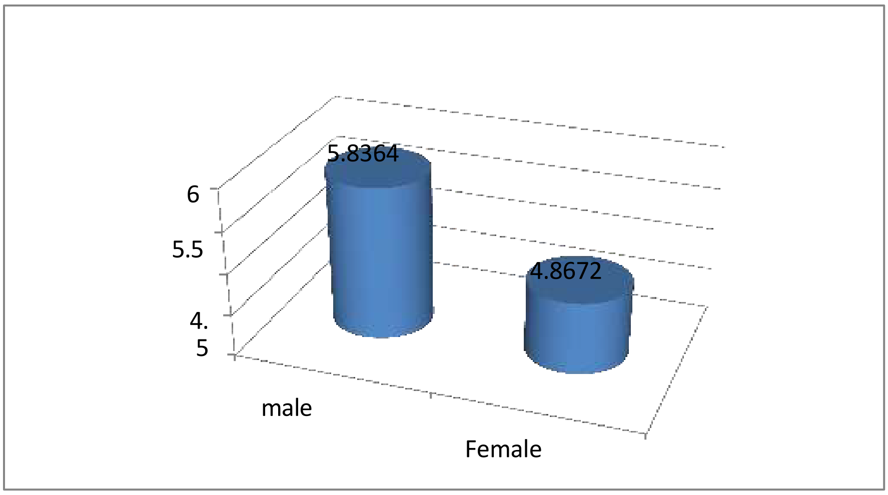

Figure (5): Descriptive statistics for the Uric Acid Test in Blood variable, broken down by Gender.

Table (6): Difference in the Uric Acid Test in Blood values between males and females, with males having higher mean, compared to females.

		Sum of Squares	DF	Mean Square	F	p- value
The Age	Between Groups	68.344	105	.651	.939	.654
	Within Groups	953.436	1375	.693	--	--
	Total	1021.780	1480	--	--	--
Gender	Between Groups	56.595	105	.539	2.511	.000
	Within Groups	295.161	1375	.215	--	--
	Total	351.756	1480	--	--	--

For the dependent variable Age (the age), the F-statistic of 0.939 is not statistically significant (p = 0.654), indicating that the differences in Age between the groups (defined by the categorical variable) are not significant.

For the dependent variable Gender, the F-statistic of 2.511 is statistically significant ($p < 0.001$), indicating that the differences in Gender between the groups (defined by the categorical variable) are significant.
The Sum of Squares and Mean Square values provide information about the proportion of variance in the dependent variables (Age and Gender) that is explained by the between-group differences versus the within-group differences (residual variance).

Table (7): Dependent variable: Uric acid test in blood.

Coefficients						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**p-value**
		B	**Std. Error**	**Beta**		
1	Constant	6.321	.179	--	35.269	.000
	Age	.194	.047	.102	4.101	.000
	Gender	-.930	.081	-.287	-11.533	.000

The regression analysis results show that:
The constant term (6.321) represents the predicted value of the dependent variable (Uric Acid Test in Blood) when all the independent variables are equal to zero.
Age (the age) has a positive and statistically significant relationship with the Uric Acid Test in Blood. A one-unit increase in age is associated with a 0.194 increase in the Uric Acid Test in Blood, holding other variables constant.
Gender has a negative and statistically significant relationship with the Uric Acid Test in Blood. Being male is associated with a 0.930 decrease in the Uric Acid Test in Blood, compared to being female, holding other variables constant.
These findings suggest that both age and gender are important predictors of the Uric Acid Test in Blood.

Discussion:
The present study provides significant insights into the relationship between age, gender, and serum uric acid (UA) concentrations. The sample comprised 1482 individuals, predominantly middle-aged (43.0% aged 36–55) and older adults (34.6% aged 56–75), offering a robust demographic for assessing age-related variations in UA levels.
Although the descriptive analysis indicated that UA levels tended to increase with advancing age, particularly among individuals aged 76–95, statistical evaluation revealed that age alone was not a significant predictor of serum UA ($F = 0.939$, $p = 0.654$). This finding is consistent with some prior investigations suggesting that while aging is associated with physiological changes that could elevate UA—such as declining renal function and altered body composition—other factors may exert more influence on UA homeostasis (Meseret et al., 2021).
Conversely, gender emerged as a statistically significant factor influencing UA levels ($F = 2.511$, $p = 0.001$). Males demonstrated higher mean UA levels (5.84 mg/dL) compared to females (4.87 mg/dL), aligning with extensive literature that documents gender-specific disparities in urate metabolism (Johnson et al., 2018; Choi et al., 2014).
The underlying mechanisms for this gender disparity are multifactorial: Hormonal regulation plays a pivotal role in the gender differences observed in serum uric acid (UA) levels. Estrogen, predominantly found in premenopausal females, enhances renal excretion of UA, thereby contributing to generally lower serum UA concentrations in women compared to men. In contrast, testosterone is associated with reduced urate clearance, which may explain higher UA levels in males (Hak & Choi, 2008). Additionally, variations in body composition between genders further influence UA production. Males typically have greater muscle mass and different adipose tissue distribution relative to females, leading to increased purine turnover and, consequently, elevated uric acid synthesis (Ishizaka et al., 2010). This physiologic divergence is complemented by gender-specific differences in renal function, particularly in tubular urate handling, which can modulate UA reabsorption and excretion rates, partially accounting for the disparities in serum UA levels between

men and women (Dehghan et al., 2008). Beyond biological factors, behavioral and dietary patterns linked to gender also contribute to variations in UA concentrations. Lifestyle choices and culturally influenced dietary habits influence purine intake and metabolic processes, thereby affecting serum UA levels differently in males and females (Nuki & Simkin, 2006). Together, these interrelated hormonal, physiological, renal, and behavioral factors provide a comprehensive explanation for the gender-based variation in uric acid metabolism observed in diverse populations.
Regarding laboratory services, "ALzahra" was the predominant facility chosen (69.1%), likely due to factors such as service quality, pricing, and accessibility. Other laboratories showed variable usage rates, with low engagement at "Zmzam" and "Tarhuna Teaching Hospital" (0.7% and 2.1%, respectively), possibly reflecting limited capacity or patient preference. These disparities emphasize the importance of healthcare accessibility and patient perception in biochemical data collection and epidemiological surveillance.
Collectively, the data affirm that gender plays a more critical role than age in determining serum UA levels within this population. These findings support previous research arguing that hormonal and physiological differences between sexes are principal determinants of uric acid metabolism, while the contribution of age should be interpreted within the context of other interacting variables.

Conclusion and Recommendations:

This study revealed significant correlations between UA levels, age, and gender. We found that UA levels increase with age, particularly in individuals over 36. This trend is consistent with previous research, which attributes this increase to age-related changes in renal function and body composition. Furthermore, our analysis indicated that males have a higher prevalence of HUA than females. This disparity can be attributed to hormonal differences, as estrogen has been shown to promote UA excretion. Additionally, males are more likely to engage in behaviors and consume diets that contribute to increased UA production. Regarding laboratory utilization, "ALzahra" emerged as the most preferred laboratory in the region, accounting for nearly 70% of the study sample. This preference may be due to factors such as service quality, pricing, or location within a hospital or health center.
The article recommends promoting public health awareness about hyperuricemia (HUA) risk factors, especially targeting older adults and males. It also suggests educating healthcare providers on early detection and management of HUA, and encourages laboratories with low test utilization to improve their services to attract more patients. These efforts aim to enhance prevention, diagnosis, and treatment of HUA, improving overall population health.
For future research, the article proposes longitudinal studies to monitor uric acid (UA) changes with age, investigation of biological and hormonal mechanisms behind gender differences in UA metabolism, and examination of lifestyle impacts such as diet and physical activity. It also calls for studies involving diverse populations to ensure broader applicability and for exploring clinical implications of gender-specific UA variations to improve disease management.

References

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