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ASSOCIATION OF LIFESTYLE BEHAVIORS WITH SERUM URIC ACID LEVELS AMONG NIGERIAN UNIVERSITY STUDENTS: A CROSS-SECTIONAL STUDY

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Abstract

Lifestyle behaviors including physical activity, dietary habits, alcohol consumption, and cigarette smoking influence serum uric acid levels. However, the collective impact of these factors among young Nigerian adults remains poorly characterized. This study investigated the association between lifestyle behaviors (physical exercise, alcohol consumption, cigarette smoking) and serum uric acid levels among apparently healthy Medical Laboratory Science students at the University of Jos, Nigeria. Methods: A cross-sectional study of 100 students assessed lifestyle behaviors through structured questionnaires. Serum uric acid was measured using the enzymatic uricase-peroxidase method. Data were analyzed using one-way ANOVA with SPSS version 21. The majority of participants engaged in regular physical exercise (75%), while 21% consumed alcohol and only 3% smoked cigarettes. Mean serum uric acid levels were comparable between exercisers (5.1 ± 1.3 mg/dL) and non-exercisers (5.0 ± 1.9 mg/dL; $p = .813$). Similarly, no significant differences were observed between alcohol consumers (4.9 ± 1.7 mg/dL) and non-consumers (5.1 ± 1.4 mg/dL; $p = .834$), nor between smokers (6.1 ± 2.1 mg/dL) and non-smokers (5.1 ± 1.5 mg/dL; $p = .415$). Among alcohol consumers, 71.4% preferred beer, which has the highest purine content among alcoholic beverages. Despite the lack of statistical significance, smokers had the highest mean uric acid levels (6.1 mg/dL). In this population with low prevalence of risky lifestyle behaviors, physical exercise, alcohol consumption, and smoking did not significantly influence serum uric acid levels. However, the elevated levels observed in smokers and the high prevalence of beer consumption among alcohol consumers warrant further investigation in larger, more representative samples. Health education programs should continue to emphasize lifestyle modification given the well-established long-term risks of hyperuricaemia.

Keywords: Lifestyle behaviors; Physical exercise; Alcohol consumption; Smoking; Uric acid; Nigerian students

Introduction

Serum uric acid is the end product of purine metabolism, derived from both endogenous synthesis and exogenous dietary sources (Martin, 2012). Its regulation involves a complex interplay of genetic factors, dietary intake, renal excretion, and lifestyle behaviors (Christopher & Ernest, 2014). While mild elevations may be asymptomatic, chronic hyperuricaemia is a well-established risk factor for gout, hypertension, metabolic syndrome, and cardiovascular disease (Borghi et al., 2014; Dehghan et al., 2008).

Lifestyle factors exert significant influence on uric acid metabolism. Physical exercise, particularly intense or prolonged activity, can transiently elevate serum uric acid due to increased ATP degradation and purine catabolism (Green & Fraser, 1988). However, regular moderate exercise may have beneficial effects through improved insulin sensitivity and renal function.

Alcohol consumption, especially beer, is an independent risk factor for hyperuricaemia due to its high purine content and its effects on renal uric acid excretion (Yu et al., 2008). Beer contains approximately 44 mg of purines per 100 mL, significantly higher than wine or spirits. Additionally, alcohol metabolism produces lactate, which competes with uric acid for renal tubular secretion, further contributing to hyperuricaemia.

Cigarette smoking has been associated with increased oxidative stress and inflammatory responses, which may influence uric acid metabolism (Borghi et al., 2014). However, the relationship between smoking and uric acid levels remains controversial, with some studies reporting elevated levels and others finding no association.

University students represent a unique population characterized by lifestyle transitions, including changes in dietary patterns, physical activity levels, and the adoption of health-risk behaviors (Chaudhary et al., 2013). Understanding the lifestyle determinants of uric acid levels in this population is essential for developing targeted preventive interventions.

Limited data exist on the association between lifestyle factors and serum uric acid levels among Nigerian university students. This information is critical for:

1. Identifying modifiable risk factors for hyperuricaemia in young adults.

2. Informing health education programs targeting university populations.

3. Establishing baseline data for future intervention studies.

4. Contributing to the development of population-specific clinical guidelines.

This study aimed to determine the frequency and percentage of lifestyle behaviors (physical exercise, alcohol consumption, cigarette smoking) among Medical Laboratory Science students, determine the association of these behaviors with serum uric acid levels and evaluate the combined effect of lifestyle factors on uric acid classification (normal, elevated, reduced).

Materials and methods

Study Design and Population

A cross-sectional study was conducted among 100 apparently healthy Medical Laboratory Science students at the University of Jos, Nigeria. Participants were randomly selected following written informed consent.

Inclusion and Exclusion Criteria

Inclusion: Apparently healthy, consenting Medical Laboratory Science students.

Exclusion: Students with known gouty arthritis, metabolic disorders, or chronic diseases affecting uric acid metabolism and 100 level students who were not on campus at the time of this research.

Data Collection

A structured questionnaire was administered to collect information on:

· Physical exercise: Regular engagement (≥30 minutes, ≥3 times per week).

· Alcohol consumption: Type, frequency, and quantity of alcoholic beverages consumed.

· Cigarette smoking: Current smoking status and frequency.

· Demographic information: Age, gender, academic level.

Laboratory Analysis

Venous blood samples (5 mL) were collected into plain tubes, centrifuged at 3000 rpm for 5 minutes, and serum separated. Uric acid estimation was performed using the enzymatic uricase-peroxidase method (Fossati et al., 1980). Quality control measures included the use of commercial controls and duplicate analyses.

Reference Ranges

Normal reference ranges were defined as:

· Males: 3.4–7.0 mg/dL

· Females: 2.4–5.7 mg/dL

Hyperuricaemia was defined as levels exceeding the upper limit of the sex-specific reference range (Desideri et al., 2014).

Statistical Analysis

Data were analyzed using SPSS version 21. One-way ANOVA was used to compare mean uric acid levels across lifestyle groups. Chi-square tests were employed to assess associations between lifestyle factors and uric acid classification. Statistical significance was set at $p < .05$.

Results

Table 1: Frequency of Lifestyle Behaviors of participants

Lifestyle Behavior	**Category**	**Frequency (n)**	**Percentage (%)**
Physical Exercise	Yes	75	75.0
	No	25	25.0
Alcohol Consumption	Yes	21	21.0
	No	79	79.0
Alcohol Type (among drinkers)	Beer	15	71.4
	Wine	4	19.0
	Spirits	2	9.6
Cigarette Smoking	Yes	3	3.0
	No	97	97.0

Among the 100 participants, the majority (75%) engaged in regular physical exercise. Only 21% reported alcohol consumption, with beer being the most commonly consumed beverage (71.4% of drinkers). Cigarette smoking was reported by only 3% of participants.

Table 2: Mean Serum Uric Acid Levels by Lifestyle Behavior

Characteristics	**Frequency**	**Mean Uric Acid (mg/dL)**	**SD**	***p*-value**	***F*-value**
Physical exercise					
Yes	75	5.1	1.3	.8130	0.2075
No	25	5.0	1.9		
Total	100				
Alcohol intake					
Yes	21	4.9	1.7	.8343	0.1815
No	79	5.1	1.4		
Total	100				
Cigarette Smoking					
Yes	3	6.1	2.1	.4153	0.8867
No	97	5.1	1.5		

Total	100				

No statistically significant differences in mean serum uric acid levels were observed across lifestyle categories ($p > .05$ for all comparisons). However, smokers had the highest mean levels (6.1 ± 2.1 mg/dL), though this was based on a small sample (n=3).

Table 3: Uric Acid Classification by Lifestyle Behaviors

Lifestyle Factor	**Category**	**Normal n (%)**	**Elevated n (%)**	**Reduced n (%)**
Physical Exercise	Yes	63 (84.0)	11 (14.7)	1 (1.3)
	No	20 (80.0)	5 (20.0)	0 (0.0)
Alcohol Consumption	Yes	17 (81.0)	4 (19.0)	0 (0.0)
	No	66 (83.5)	12 (15.2)	1 (1.3)
Cigarette Smoking	Yes	3 (100)	0 (0.0)	0 (0.0)
	No	80 (82.5)	16 (16.5)	1 (1.0)

Analysis of uric acid classification, low: < reduced reference limit normal: males 3.4–7.0 mg/dL; females 2.4–5.7 mg/dL and elevated: > upper reference limit, by lifestyle factors revealed no significant associations ($p > .05$). However, interesting patterns emerged:

· Among smokers (n=3), 100% had normal uric acid levels (none were elevated).

· Among alcohol consumers (n=21), 19% had elevated uric acid compared to 15.2% of non-consumers.

· Among non-exercisers (n=25), 20% had elevated levels compared to 14.7% of exercisers.

Table 4: Distribution of Serum Uric Acid Levels of the Students based on Demographic Characteristics

Characteristics	**Frequency**	**Mean Uric Acid (mg/dL)**	**SD**	***p*-value**	***F*-value**
Gender					
Male	54	5.3	1.5	.5886	0.5329
Female	46	5.0	1.5		
Total	100				
Age group					

≤20	5	5.7	1.4	.8214	0.4804
21–25	55	5.1	1.4		
26–30	24	5.2	1.6		
31–35	9	4.5	1.2		
36–40	4	5.1	1.1		
≥41	3	4.9	2.0		
Total	100				
Level					
200	39	4.9	1.5	.5820	0.7175
300	23	5.5	1.8		
400	23	5.2	1.1		
500	15	4.8	1.3		
Total	100				

This shows that male participants had a slightly higher mean serum uric acid level (5.3 ± 1.5 mg/dL) than females (5.0 ± 1.5 mg/dL). Participants aged ≤20 years had the highest mean uric acid level (5.7 ± 1.4 mg/dL), while 300-level students recorded the highest mean among the academic levels (5.5 ± 1.8 mg/dL). However, these differences were not statistically significant ($p > 0.05$).

Table 5: Comparison of Serum Uric Acid Parameters According to Combined Lifestyle Risk Profile

Parameter	**≥2 Lifestyle Risk Factors (n = 22)**	**0–1 Lifestyle Risk Factors (n = 78)**	**p-value**
Mean serum uric acid (mg/dL)	5.2 ± 1.6	5.1 ± 1.4	>0.05
Frequency of hyperuricaemia, n (%)	4 (18.2%)	12 (15.4%)	>0.05

Participants with multiple lifestyle risk factors (≥2 unhealthy behaviors) comprised 22% of the population. Analysis of this subgroup showed:

· Mean uric acid: 5.2 ± 1.6 mg/dL (comparable to 5.1 ± 1.4 mg/dL in those with 0-1 risk factors)

· Frequency of hyperuricaemia: 18.2% (vs. 15.4% in low-risk group)

· All differences were statistically non-significant ($p > 0.05$)

Discussion

This study provides valuable insights into the association between lifestyle behaviors and serum uric acid levels among Nigerian university students. The absence of statistically significant associations between lifestyle factors and uric acid levels, while unexpected, may be explained by several factors.

The lack of association between physical exercise and uric acid levels contrasts with studies reporting transient exercise-induced elevations (Green & Fraser, 1988). However, this is consistent with findings that exercise effects are short-lived and dependent on intensity and timing of blood sampling. Since participants were not sampled immediately after exercise, the transient elevation would not be captured. Additionally, regular moderate exercise may have long-term beneficial effects through improved insulin sensitivity and renal function, potentially offsetting acute elevations. The relatively high proportion of exercisers (75%) in this population is encouraging and may reflect health consciousness among Medical Laboratory Science students. This high baseline physical activity may have contributed to the overall normal uric acid levels observed.

The lack of association between alcohol consumption and uric acid levels is surprising given well-established literature linking alcohol, particularly beer, with hyperuricaemia (Yu et al., 2008; Song et al., 2018). Several factors may explain this finding:

1. Low Frequency: Only 21% of participants consumed alcohol, limiting statistical power to detect differences.

2. Moderate Consumption: Most drinkers reported occasional rather than heavy consumption.

3. Sampling Timing: Blood samples were not collected immediately after alcohol consumption.

4. Age Factor: Young adults may have more efficient renal handling of uric acid, mitigating alcohol's effects.

The finding that 71.4% of drinkers preferred beer, the beverage with the highest purine content, is concerning and warrants health education interventions.

The very low smoking percentage (3%) precluded meaningful statistical analysis. However, the observation that smokers had the highest mean uric acid levels (6.1 mg/dL) warrants mention. While not statistically significant, this pattern is consistent with some studies reporting elevated uric acid in smokers due to oxidative stress and inflammation (Borghi et al., 2014). Larger studies are needed to definitively characterize this association.

The absence of a dose-response relationship between the number of lifestyle risk factors and uric acid levels suggests that in this young, healthy population, lifestyle factors may have minimal impact on uric acid metabolism. This may reflect the "healthy worker effect," whereby university students are generally young, healthy, and have robust metabolic compensation mechanisms.

The findings contrast with studies from more diverse populations where lifestyle factors show stronger associations with uric acid levels. For example, Song et al. (2018) reported significant associations between alcohol consumption, smoking, and hyperuricaemia in middle-aged and older Chinese adults. The differences likely reflect:

- Younger age and better metabolic health in the present study
- Lower frequency and intensity of risk behaviors
- Population-specific genetic and dietary factors

Despite the lack of statistical significance, the findings have important implications for health promotion:

1. Lifestyle Education: The high prevalence of beer consumption among drinkers highlights the need for education about alcohol's effects on uric acid metabolism.

2. Screening: Even in the absence of overt lifestyle risk factors, 16% of participants had hyperuricaemia, supporting routine uric acid screening.

3. Modifiable Risk Factors: While not significant in this study, lifestyle factors remain modifiable risk factors with well-established long-term health impacts.

4. Combined Interventions: Health promotion programs should address multiple lifestyle behaviors simultaneously for maximum effectiveness.

Conclusion

In this population of apparently healthy Nigerian university students, lifestyle behaviors including physical exercise, alcohol consumption, and cigarette smoking did not significantly influence serum uric acid levels. The absence of statistical significance may reflect the relatively young age, good metabolic health, and low percentage of high-risk behaviors in the study population. However, the elevated levels observed in smokers and the high percentage of beer consumption among alcohol consumers warrant further investigation. Despite the lack of significant findings, health education programs should continue to emphasize lifestyle modification given the well-established long-term risks of hyperuricaemia. Routine uric acid screening in university populations may facilitate early identification of at-risk individuals regardless of lifestyle profile.

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Conflict of Interest

The author declares no conflicts of interest.

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