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Prevalence of hyperuricemia and its risk factors in healthy male adults from Abakaliki metropolis, Nigeria

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ABSTRACT

Aim: To estimate the prevalence of hyperuricemia and some risk factors among men in Abakaliki metropolis, Ebonyi State Nigeria. **Method:** A total of 288 males within the ages of 18-75 years participated in the study. The body mass index (BMI) was calculated from weight and height measurements. Serum uric acid level was measured by enzymatic colorimetric method. **Result:** The prevalence of hyperuricemia in the study population was 35.8% with serum uric acid level of 7.62 ± 1.49 mg/dl. There was significant positive relationship between uric acid concentration and age ($R = 0.307$; $p < 0.01$) and BMI ($R = 0.204$; $p < 0.05$). In the hyperuricemic group, mean uric acid concentration was significantly greater in the obese and overweight groups compared to the normal weight group. Data also indicated significantly greater uric acid level in the elderly ($p < 0.001$) and middle-aged ($p < 0.001$) compared to the young adults in 'all subjects' data but not in the hyperuricemic group. The odds of hyperuricemia was higher in overweight/obese subjects compared to the normal weight group ($p < 0.05$) and in older subjects of age ≥ 36 yrs compared to younger adults of ages 18-35 yrs ($p < 0.001$). **Conclusion:** This study indicated a relatively high prevalence of hyperuricemia in adult males in Abakaliki metropolis Eastern Nigeria. Our data also suggested that overweight/obese and older adult males are at greater risk of hyperuricemia compared to normal weight and younger adults respectively.

KEY WORDS: Prevalence, hyperuricemia, men, uric acid, risk factor, Abakaliki, Nigeria

INTRODUCTION

Hyperuricemia a predisposing condition for gout [1] is defined as elevated blood uric acid. Uric acid (UA) is the final product of purine metabolism in humans. Hyperuricemia results from overproduction of uric acid and/or inefficient excretion of uric acid, which accounts for > 90% of cases or medications that impair renal urate clearance. [2-4] Hyperuricemia is intricately linked with the metabolic syndrome (hypertension, glucose intolerance, dyslipidemia, truncal obesity, increased risk of cardiovascular disease) [5-9] and there is mounting evidence that hyperuricemia itself may be an independent risk factor for cardiovascular disease. [10] Elevated UA level is strongly linked to cardiovascular disease (CVD). [5, 11]

A previous study in Niger Delta region of Nigeria has reported a hyperuricemic prevalence of 25% in male [12]. In Seychelle, a cross-sectional health examination survey showed that the prevalence of hyperuricemia was 35.2% in men [13]. The prevalence of hyperuricemia in US has been estimated as 21.2% in men [14], while a pooled prevalence of hyperuricemia in Chinese male was reported as 21.6% [15]. A study in Turkey showed hyperuricemic prevalence of 19% in men [16], but in Nepal, a prevalence of 21.42% was reported [17]. In Thailand prevalence of hyperuricemia is estimated as 18.4% in men [18].

Risk factors associated with hyperuricemia include hypertension [9, 19, 20], body weight [21-23], smoking and elevated serum triglycerides [22]. A positive association has shown to exist between plasma uric acid and the incidence of type 2 diabetes [22] while some studies showed no association [24]. Other studies have also shown that serum uric acid level varies with sex and increases with age and weight and affected by alcohol consumption [23, 24, 25].

There is paucity of information on the prevalence of hyperuricemia and its association with age and body weight in Nigeria and Africa at large. Hyperuricemia leads to gout and often mismanaged leading to mortality; obesity is one component of metabolic syndrome and a risk factor for CVD; while old age is associated with a decline in renal function and metabolism. In view of the above facts, we aimed to estimate the prevalence of hyperuricemia in male adult population in Abakaliki metropolis of Eastern Nigeria and the association between uric acid levels and age and body mass index.

METHODS

Subjects

Two hundred and eighty eight (288) apparently healthy male residents in Abakaliki metropolis, Ebonyi State, Nigeria participated in the study. Participants with history of diabetes mellitus, kidney failure and hypertension were excluded. The participant's biometric data like weight, height, age, blood pressure were taken. The participants were within the age range of 18-75 years and had BMI of 15.57-40.43 kg/m2. Their consent was sought after explaining the purpose of the research. This study was approved by the ethical committee of Medical Laboratory Science of Ebonyi State University, Nigeria.

Blood collection and analysis

Five (5) ml of blood sample was collected from each participant into plain containers for serum uric acid analysis. The sample was separated and serum used for serum uric acid analysis. Enzymatic colorimetric method by Randox was used for serum uric acid assay. Our definition of hyperuricemia was a serum uric acid level > 7.0 mg/dl.

Data analysis

Descriptive data was expressed as mean ± standard deviation for continuous variables and as percentages for categorical variables. Comparative analysis involving two variables was performed using independent sample t-test, while those involving more than two variables were done using one-way ANOVA. Correlation analyses between two variables were determined using Pearson's bivariate correlation test. Multivariate regression test was used to determine age or BMI adjusted correlations between variables. Logistic regression analysis was used for the analysis of associations between hyperuricemia and the categorical variables of age and BMI. Statistical significance was set at $P<0.05$. All statistics were done using IBM/SPSS for Windows (Version 20.0, IBM Corporation, New York, USA).

RESULT

Table 1 shows the mean age, weight, height, body mass index (BMI) of both hyperuricemic and normouricemic subjects. Data indicated significantly greater ($p < 0.001$) age in hyperuricemic subjects compared to the normouricemic group. In contrast, no significant differences were observed in weight ($p = 0.069$), height ($p = 0.224$) and BMI ($p = 0.149$) between the two groups.

Descriptive data indicates that of the study population (n = 288), 35.8% (n = 103) were hyperuricemic (mean uric acid conc., 7.62 ± 1.49 mg/dl) while 64.2% (n = 185) were normouricemic (mean uric acid conc., 4.01 ± 1.28 mg/dl). The incidence of hyperuricemia was significantly lower ($p<0.01$) compared to that of normouricemia (Figure 1).

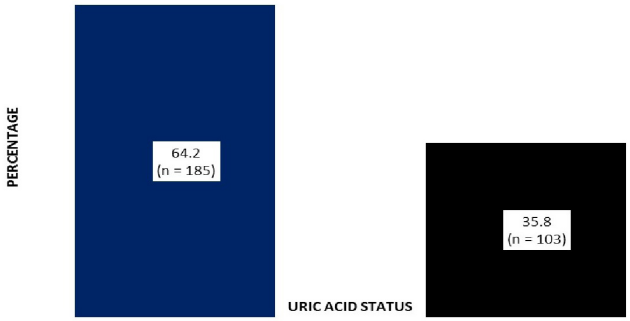

Figure 1. Frequency distribution of uric acid status of subjects in the study population (n = 288)

Table 1. Demographic and baseline characteristics of the hyperuremic subjects compared to their normal control.

VARIABLES	NORMAL URIC ACID (N = 185)	HYPERURICEMIA (N = 103)	t-STATISTICS	P-VALUE
Age (yrs)	32.32 ± 14.10	45.83 ± 12.99	-8.01	0.000*
Weight (kg)	58.14 ± 10.42	60.43 ± 9.81	-1.82	0.069
Height (meter)	1.59 ± 0.07	1.60 ± 0.07	-1.22	0.224
Body Mass Index (kg/m^2)	22.97 ± 3.78	23.68 ± 4.38	-1.45	0.149

*Significant difference. Data is expressed as mean ± standard deviation.

Table 2. Correlation analyses between uric acid level and age and body mass index of hyperuricemic subjects and the entire study population.

	UNADJUSTED CORRELATION		ADJUSTED CORRELATION	
	Coefficient	p-value	Coefficient	p-value
Hyperuricemic subjects				
Uric acid vs. BMI	0.255	0.009*	0.204	0.040*
Uric acid vs. Age	0.341	0.000*	0.307	0.002*
All subjects				
Uric acid vs. BMI	0.166	0.005*	0.099	0.095
Uric acid vs. Age	0.421	0.000*	0.402	0.000*

Table 2 shows the relationships between uric acid level and age and body mass index of hyperuricemic subjects and the entire study population. Pearson's bivariate test indicated significant associations ($p < 0.01$ or $p < 0.001$) between uric acid and age and body mass index in hyperuricemic subjects and in the combined data of all subjects (control and hyperuricemic). Age adjusted correlation between uric acid and BMI indicated significant association in the hyperuricemic subjects ($p < 0.05$) but not in the combined data ($p = 0.095$). However, uric acid and age indicated significant association in the hyperuricemic subjects ($p < 0.01$) and in the combined data ($p < 0.001$) after adjusting for BMI.

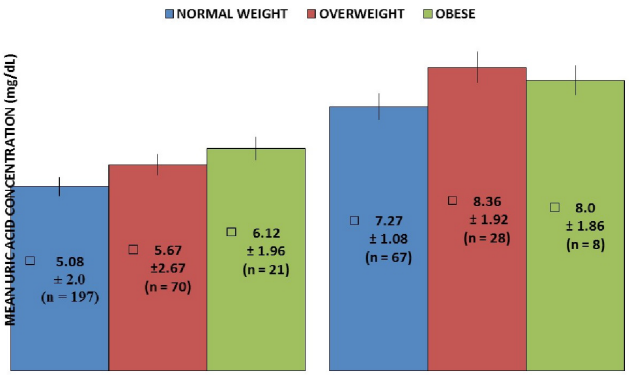

Figure 2. Uric acid level according to BMI categories of subjects.

Figure 2 shows the uric acid concentrations of subjects according to their BMI categories. Descriptive data indicates the mean uric acid concentration in combined subjects as well as the hyperuricemic group data for normal weight (5.08 ± 2.0 and 7.27 ± 1.08 mg/dL), overweight (5.67 ± 2.67 and 8.36 ± 1.92 mg/dL) and obese (6.12 ± 1.96 and 8.0 ± 1.86 mg/dL) groups respectively. One-way analysis of variance (ANOVA) indicated no significant differences amongst the different BMI categories ($P = 0.174$) in the 'all subjects' data. However, in the hyperuricemic group, mean uric acid concentration was significantly greater ($p<0.05$) in the obese and overweight groups compared to the normal weight group. In contrast, no significant difference was observed between the overweight and obese groups.

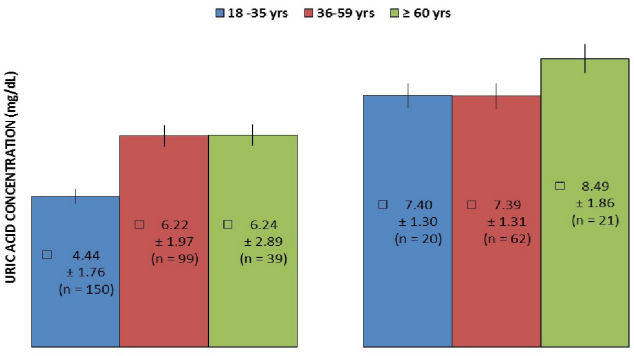

Figure 3. Uric acid level according to age categories of subjects

Figure 3 shows the uric acid concentrations of subjects according to their age categories. Descriptive data shows the mean uric acid concentration in combined subjects as well as hyperuricemic group data for young adults – 18-35 yrs (4.44 ± 1.76 and 7.40 ± 1.30 mg/dL), middle aged group – 36-59 yrs (6.22 ± 1.97 and 7.39 ± 1.31 mg/dL) and elderly - ≥ 60 yrs (6.24 ± 2.89 and 8.49 ± 1.86 mg/dL) groups respectively. One-way analysis of variance (ANOVA) indicated significantly greater uric acid level in the elderly ($p < 0.001$) and middle-aged ($p < 0.001$) compared to the young adults in 'all subjects' data. However, in the hyperuricemic group, mean uric acid concentration there was lack of significantly differences between the young adult group compared to the middle-aged ($p = 1.00$) and elderly groups (0.053) respectively. In contrast, significant difference was observed between the elderly and the middle aged groups (8.49 ± 1.86 vs. 7.39 ± 1.31 mg/dl; $p = 0.010$).

Table 3. Logistic regression between incidence of hyperuricemia and selected risk factors

	UNADJUSTED OR (CI); *p-value*	ADJUSTED OR (CI); *p-value*
Age group	9.81 (5.48 – 17.54); *0.000*	9.87 (5.50 – 17.70); *0.000**
BMI category	1.27 (0.76 – 2.12); *0.362*	1.02 (1.00 – 1.04); *0.021* ‡

*Adjusted for BMI; ‡ Adjusted for age. Data for age category 18-35 yrs and BMI category <25 kg/m2 were coded as 0 - 'not at risk' groups; age ≥36 yrs and BMI ≥ 25 kg/m2 were coded as 1 'at risk groups'. The outcome variable was coded as 1 for 'hyperuricemia' and 0 for 'normo-uricemic control'.

We performed logistic regression analysis to evaluate the odds of developing hyperuricemia according to BMI and age statuses of subjects. The age-adjusted logistic regression analysis (Table 3) revealed that subjects who were overweight/obese were at higher risk of hyperuricemia than those with normal body weight ($p < 0.05$). A BMI-adjusted logistic regression also indicated that older subjects of age ≥ 36 yrs were at greater odds of developing hyperuricemia compared to younger adults of 18 - 35 yrs of age ($p < 0.001$).

DISCUSSION

The principal findings of the present study indicated a high hyperuricemic prevalence of 35.8% in males and significant associations between uric acid level and age on one hand and uric acid level and BMI on the other hand in the hyperuricemic males.

There are limited studies on prevalence of hyperuricemia in Nigeria and Africa. However, a lower hyperuricemic prevalence of 25% in males has been reported in a previous study carried out in Niger Delta region of Nigeria [12]. Another study [13] carried out in Seychelle, an African country indicated a hyperuricemic prevalence of 35.2% in

men similar to our present finding. The possible reasons for the greater prevalence of hyperuricemia in males in the present study relative to that obtained from the Niger Delta region of Nigeria could be linked to poverty, under-educated, alcohol and unhealthy feeding habit as obtained from the questionnaire. It has been reported that alcoholic consumption is the most important cause of hyperuricemia [26].

Similarly high hyperuricemic prevalence in males have also been reported in non-African countries such as Ukraine (32%) [27]; Japan (34.5%) [28]; Chinese living in Qingdao (32.1%) [21]. These previous findings of high prevalence of hyperuricemia in males of non-African origin therefore counter the assertion that black population is a high-risk group for hyperuricemia [13, 29, 30]. The finding of Alderman MH, [31] which indicated that African population and Caucasian population have similar uric acid levels further buttresses the above point. However, lower prevalences of hyperuricemia in males have been found in other non-African countries such as United States of America, 21.2% [14], China, a pooled prevalence of 21.6% [15], Northern and Northeaster Chinese, 21% [32], Nepal, 21.42% [17], Turkey, 19% [16], Thailand, 18.4% and Saudi Arabia 8.42% [33].

Our study indicated significant association between age and uric acid levels in the hyperuricemic male as well as when the entire subjects' data was pooled together (Table 2). Similarly, the older adults (≥36 yrs) were at greater risk of hyperuricemia compared to younger adults of 18-35 yrs of age (Table 3). In addition, older adults indicated significantly greater uric acid levels compared to the younger adults (Fig 3). The increase in serum uric acid level with age may be related to normal and efficient purine metabolism and reduced excretion of its by-product, uric acid, by the kidneys which function declines with age. Our finding is in agreement with some studies showing age as a risk factor for high blood uric acid level. [15, 25, 27, 34- 36]. Though age has been implicated in high blood uric acid level, however, gout has also been reported to have occurred at a younger age [37]. Hyperuricemia may occur in young age as a result of congenital defects ranging from Lesch-Nyhan syndrome or Kelly-Seegmiller syndrome–recessive to X-linked hypoxanthine guanine phosphoribosyl transferase (HGPT) deficiency. In contrast, our finding disagrees with result of Ling Qiu et al, [32] which states that "as age increased, uric acid level decreased in men".

Furthermore, the present study indicated significant and positive correlation between body mass index and blood uric acid level in hyperuricemic males. Logistic regression analysis also revealed that after adjusting for body mass, overweight/obese males were at greater risk of hyperuricemia (Table 3). This finding is in agreement with previous studies [21-23, 33, 35, 36] that also demonstrated significant and positive relationship between serum uric acid and body weight. Similarly, obesity has been associated with hyperuricemia in previous studies [38, 39]; this could be as a result of increase in Xanthine oxidoreductase (XOR) in obese individuals. Previous studies [40, 41] have shown that serum uric acid concentration is independently associated with the serum leptin concentration, thus suggesting that leptin could be a pathogenic factor responsible for hyperuricemia in obese patients.

CONCLUSION

This study indicated a high prevalence of hyperuricemia in a male adult population in Abakaliki metropolis Estern Nigeria. Our data also suggested that overweight/obesity and old age are associated with the incidence of hyperuricemia in these men. In view of the growing incidence of metabolic syndrome worldwide and the potential link to hyperuricemia, more emphasis should be placed on the evolving morbidity prevalence of hyperuricemia in our country.

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