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Original Research Article

Evaluation of Serum Uric Acid in Patients with Obesity in Nigerian Tertiary Hospital

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Abstract: ***Background*:** Obesity has been recognized as an important risk factor for hyperuricemia although the exact mechanism is not well understood. The goal of this study is to evaluate serum uric acid levels in obese subjects. ***Methods*:** A total of 100 individuals with 50 obese patients and 50 healthy non-obese controls. Serum uric acid, total cholesterol (TC), low density lipoprotein cholesterol (LDL - C), high density lipoprotein cholesterol (HDL - C) and triglycerides (TGs) were measured. Serum uric acid was evaluated using uricase method. The serum TC was estimated using modified Liebermann – Burchard reaction. HDL – C estimation involved a two – staged procedure using Liebermann Burchard reaction, LDL – C was calculated using Friedwald's equation while TGs were estimated using enzymatic methods on commercial kits. ***Results*:** In this study, serum uric acid levels were significantly higher in the obese group compared to healthy controls (510.0 $\pm$ 72.5 Vs 320.0 $\pm$ 34.2: p<0.001). ***Conclusion*:** Hyperuricemia has been observed in patients with obesity and therefore the need to screen all obese patients for serum uric acid levels.

Keywords: Serum Uric acid, T – C, LDL – C, HDL – C, TGs and Obesity.

1. INTRODUCTION

Obesity has become an increasingly important clinical and public health problem globally, affecting more than 100 million patients [1].

Studies in Chinese population reveal that more than half of Chinese adults had either overweight or obese in a recent survey. Overweight and obesity incidence was 34.3 and 16.4% [2]. In Nigeria however, the prevalence of overweight and obesity was 17.5 and 7.1% in a study by Olatunbosun *et al*., [3]. Obesity defined as a body mass index (BMI) of $\geq$ 30kg/m^2 is due to deposition of fat in the fat compartments of the body. This is due to growing trend of sedentary life style and increase consumption of high caloric diet and linked with metabolic complications such as hypercholesterolemia, hyper – insulinemia and dyslipidemia [4].

Insulin resistance, type 2 diabetes, hypertension and hyperuricemia (HUA) are among endocrine disorders that can arise from obesity and metabolic syndrome [5], with a heavy burden on patients, families and the entire public health system.

Serum uric (SUA) is the end-product of purine metabolism in humans [6]. Approximately two –thirds of serum uric acid is produced endogenously, and the

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remaining one – third is due to exogenous dietary purines [7].

Gout, a hyperuricemic state is due to abnormal serum uric acid metabolism and decreased excretion by the kidneys [8]. Elevated serum uric acid (SUA) can lead to gout and is an essential risk factor for obesity resulting in a rising risk for development of metabolic syndrome [9]. Several studies have confirmed that patients with obesity, particularly abdominal obesity, are independent predictors of elevated uric acid development [10].

A cross-sectional study indicates that body mass index (BMI) significantly increases with elevated serum uric acid (SUA) among 27,009 middle-aged and elderly Chinese adults [11].

2. MATERIALS AND METHOD

2.1 Subjects:

This is a case – control study comprising of a total of 100 individuals with 50 obese patients and 50 healthy controls aged 21–60 years as cases and controls respectively, who attend the metabolic clinic at the University of Maiduguri Teaching Hospital from February to July 2022. Both cases and controls were recruited under informed consent with approval from the institution's ethical committee. Patients were excluded if they have liver disease, diabetes mellitus, renal insufficiency, cardiovascular disease, cerebrovascular disease, uric acid-lowering drugs, high purine diet, high fat diet, alcohol, diuretics, pregnant or breast feeding.

Patients and controls were physically examined including blood pressure using accuson's sphygmomanometer, body weight, using OHAUS Pioneer PA 413, height, using Stadiometer, and their body mass index (BMI) was calculated using weight(kg) divided by height (M^2) (BMI = Wt(kg)/height(M^2)). Waist circumference (WC), measured at the level of the umbilicus and hip circumference (HC) measured as the horizontal circumference at the most prominent area of the hip for evaluation of waist to hip circumference ratio (WHCR) as well as the other life style variables were gathered following the standard approach. Fasting serum total cholesterol (T-C), high density lipoprotein (HDL - C), triglycerides (TGs) were evaluated using commercial kits while the low density lipoprotein cholesterol (LDL - C) was calculated using Friedwald's formula. The serum uric acid was evaluated using a commercial kit, measurements of these parameters were preceded by an overnight fast (8 – 12hours).

2.2 Study Design

All subjects were asked to complete a questionnaire comprising of socio-demographic data that involved age, nutrition as well as medications and were on their routine diet.

A fasting venous sample of about 5ml was collected from the ante-cubital vein of each individual using a disposable 5ml syringe and needle and transferred into a plain bottle under aseptic procedure. The samples were transported to the chemical pathology laboratory. Samples were spun using a swinging bucket centrifuge at 3, 000 revolutions per minute (rpm) for 10minutes. The cells were then separated from the serum using a Pasteur pipette. The serum was stored-frozen at -20^0c until time of analysis.

2. 3. Analytical methods

Patients were considered to have hyperuricemia if their serum level of uric acid exceeds 7.0mg/dl (416.4umol/L) in men and > 6.0mg/dI (356.9umol/L) in women [12]. It was estimated using uricase method spectrophotometrically.

Based on diagnostic criteria of obesity, BMI was categorized into four (4) groups: Overweight ($\geq$ 25 – 29.9kg/m^2, class I (30 – 34.9kg/m^2), class II (35 – 39.9kg/m^2) and class III ($\geq$ 40kg/m^2). WC $\geq$ 90cm for men and $\geq$ 80cm for women was used to determine abdominal obesity [13]. T-C is elevated if serum level exceeds 5.7mmol/L TGs are elevated if their serum levels exceed 1.7mmol/L, HDL – C should normally be > 0.9mmol/L, while LDL – C should be < 2.7mmol/L [14].

T–C was estimated using modified Liebermann – Burchard reaction spectrophotometrically. HDL – C was measured similar to T–C involving a two – staged procedure. LDL – C was calculated by Friedwald's formula while TGs were estimated using enzymatic methods.

2.4 Statistical Analysis

IBM SPSS Version 26 (IBM SPSS statistics, Newyork, United States) was used to analyze the data. The differences between batches for anthropometric measurements were assessed using a two – tailed independent sample t – test and a one – way ANOVA. The values in the tables were given as mean and standard deviation ($\pm$SD). Predictive value of < 0.05 was considered statistically significant.

2.5 RESULT

The mean characteristics of their ages in the patients were 40.5 $\pm$ 4.8 while 43.0 $\pm$ 5.2 was obtained in the control group.

The BMI, WHCR were 33.10 $\pm$ 2.90 (p – 0.02) and 0.93 $\pm$ 0.04 (p – 0.03) in the patients and 19.04 $\pm$ 1.3 (p – 0.02), 0.78 $\pm$ 0.05 (p – 0.03) were respectively in the control group and statistically significant (Table I).

Table I: Characteristic of study Population based on Age, BMI and WHCR

S/N	Parameters	Cases (n = 50)	Control (n = 50)	*p* - value
1	Age (years)	40.5 ± 4.8	43.0 ± 5.2	-
2	BMI (kg/m^2)	33.1 ± 2.90	19.04 ± 1.8	0.02
3	WHCR	0.93 ± 0.04	0.78 ± 0.05	0.03

$p < .0.05$ is considered significant

The mean values of serum uric acid (SUA) (µmol/L) was 510.0 ± 72.5, 320.0 ± 34.2 were statistically significant ($p < 0.001$). The mean values of total cholesterol (T-C), LDL – cholesterol, HDL – cholesterol and triglycerides (TGs) respectively were 6.2 ± 1.5 (p – 0.03), 3.9 ± 1.3 (p – 0.02), 0.60 ± 0.02 (p – 0.03), 2.4 ± 0.4 (p – 0.01) in obese patients were statistically significant. The mean values of TC, LDL – Cholesterol, HDL – Cholesterol and Triglycerides were respectively, 4.2 ± 2.1 (p – 0.03), 2.6 ± 1.3 (p – 0.02), 1.4 ± 0.6 (p – 0.03) and 0.8 ± 0.2 (p – 0.01) in the control group (Table II).

Table II: Biochemical parameters of the study population

S/N	Parameters	Cases	Control	*p* – Value
1	Serum Uric Acid (SUA) (µmol/L)	510.0 ± 72. 5	320 ± 34.2	< 0.001
2	Total Cholesterol (T - C) (mmol/L)	6.2 ± 1.5	4.2 ± 2.1	0.03
3	LDL – Cholesterol (mmol/L)	3.9 ± 1.3	2.6 ± 1.3	0.02
4	HDL – Cholesterol (mmol/L)	0.60 ± 0.02	1.4 ± 0.60	0.03
5	Triglycerides (mmol/L)	2.4 ± 0.4	0.8 ± 0.2	0.01

$p<0.05$ is considered significant

DISCUSSION

Obesity has been recognized as an important health problem globally and a risk factor for various metabolic disorders with attendant health consequences and hyperuricemia is one of them [15]. Other disorders associated with hyperuricemia and obesity include diabetes mellitus, hypertension and ischaemic heart disease [16]. Therefore patients with hyperuricemia are more likely to develop diabetes mellitus, hypertension and ischaemic heart disease (IHD) with increase morbidity and mortality than patients with normal serum urates [17].

Our study evaluated serum uric acid in patients with obesity and discovered elevated serum uric acid in the obese patients that is in agreement with a similar study by Chonin *et al*., [7-11].

In a 10 – year follow-up study, BMI increased significantly with serum uric acid levels regardless of race and gender, related to different regions, races and environmental exposures [18].

The mechanism could be related to the effect of estrogen on renal tubular handling of serum uric acid [19]. Hyperuricemia is associated with an increased risk of weight gain, with possible accumulation of visceral fat and the patients with high BMI also have high serum uric acid [20]. The degree of obesity is the most important risk factor for high uric acid due to increase uric acid secretion in adipose tissue in obese patients. In these patients, excessive fat accumulation produces and secretes uric acid leading to hyperuricemia as a result of over secretion. This may explain a possible mechanism that relates BMI and hyperuricemia [20]. This is also demonstrated in our study in which the patients with high uric acid also have elevated BMI although the exact mechanism by which uric acid increases in obesity is not well understood. Many factors such as metabolic syndrome, CKD, and diet can cause HUA [21]. In a study by Liu *et al*., an epidemiologic study, patients with HUA have been seen to have dyslipidemia (reduce HDL-C and increased TG levels) [22]. This is also demonstrated in our study. The possible underlying mechanism is that low HDL – C levels increase the risk of kidney damage leading to decrease uric acid excretion [23]. The elevated levels of SUA in patients with obesity may be due to excessive uric acid production and impaired renal excretion. A study in subjects with visceral fat indicated that increased uric acid levels were strongly influenced by hypersecretion of uric acid with decrease urea excretion and clearance [24]. It has also been observed that, visceral fat accumulation induces a large influx of free fatty acids in circulation leading to stimulation of TGs synthesis and an increase in uric acid production by activating the uric acid synthetic pathway [25].

CONCLUSION/RECOMMENDATION

The results obtained in this study indicate that patients with obesity have been found to have hyperuricemia that could lead to several complications such as chronic kidney disease, Gout, hypertension and loss of mobility. Therefore there is the need to screen all obese patients for serum uric acid levels.

REFERENCES

1. Abarca-Gómez, L., Abdeen, Z. A., Hamid, Z. A., Abu-Rmeileh, N. M., Acosta-Cazares, B., Acuin, C., ... & Cho, Y. (2017). Worldwide trends in body-mass index, underweight, overweight, and obesity

from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128· 9 million children, adolescents, and adults. *The lancet*, *390*(10113), 2627-2642.
2. The state council information office of the People's Republic of China. (2020). Press Briefing for the Report on Chinese Resident's chronic diseases and Nutrition.
3. Olatunbosun, S. T., Kaufman, J. S., & Bella, A. F. (2011). Prevalence of obesity and overweight in urban adult Nigerians. *Obesity reviews*, *12*(4), 233-241.
4. Hossein, P., Bisher, K., & El–Nahas, M. (2007). Obesity and Diabetes Mellitus in developing world – a growing challenge. New England. *Journal of Medicine*, 356, 973.
5. Weihrauch-Blüher, S., Schwarz, P., & Klusmann, J. H. (2019). Childhood obesity: increased risk for cardiometabolic disease and cancer in adulthood. *Metabolism*, *92*, 147-152.
6. Glantzounis, G. K., Tsimoyiannis, E. C., Kappas, A. M., & Galaris, D. A. (2005). Uric acid and oxidative stress. *Current pharmaceutical design*, *11*(32), 4145-4151.
7. Schlesinger, N. (2005). Dietary factors and hyperuricemia. *Curr Pharm Des*, 11, 4133-4138.
8. Terkeltuaub, R. A. (2003). Clinical Practice. Gout. *New England Journal of Medicine*, 349, 1647-1655.
9. Li, F., Chen, S., Qiu, X., Wu, J., Tan, M., & Wang, M. (2021). Serum uric acid levels and metabolic indices in an obese population: A cross-sectional study. *Diabetes, Metabolic Syndrome and Obesity*, 627-635.
10. Rospleszcz, S., Dermyshi, D., Müller-Peltzer, K., Strauch, K., Bamberg, F., & Peters, A. (2020). Association of serum uric acid with visceral, subcutaneous and hepatic fat quantified by magnetic resonance imaging. *Scientific Reports*, *10*(1), 442.
11. Dai, X., Yuan, J., Yao, P., Yang, B., Gui, L., Zhang, X., ... & He, M. (2013). Association between serum uric acid and the metabolic syndrome among a middle-and old-age Chinese population. *European journal of epidemiology*, *28*, 669-676.
12. Sui, X., Church, T. S., Meriwether, R. A., Lobelo, F., & Blair, S. N. (2008). Uric acid and the development of metabolic syndrome in women and men. *Metabolism*, *57*(6), 845-852.
13. Alberti, K. G. M., Zimmet, P., & Shaw, J. (2005). The metabolic syndrome—a new worldwide definition. *The Lancet*, *366*(9491), 1059-1062.
14. Santos, F. S., Rangel, L. G. G., Saucedo, G. P., Rosales, G. V., & Novales, M. G. M. (2006). Hypertriglyceridemia and hypercholesterolemia in human immunodeficiency virus-1-infected children treated with protease inhibitors. *Archives of medical research*, *37*(1), 129-132.
15. Essa, S. A., Ishari, A. K., & Kadhom, Q. I. (2015). Association between serum uric acid and obesity. *J Babylon Univ*, 2, 899–903. http://www.iasj.net/download/f497c0c80cI579e8
16. Akkasilpa, S., Avihingsanon, Y., Hanvivadhanakul, P., & Wonchinsri, J. (2004). Clinical manifestations of patients with hyperuricemia. *J Med Assoc Thai*, *87*(Suppl 2), 41-44.
17. Suliman, M. E., Johnson, R. J., García-López, E., Qureshi, A. R., Molinaei, H., Carrero, J. J., ... & Stenvinkel, P. (2006). J-shaped mortality relationship for uric acid in CKD. *American Journal of Kidney Diseases*, *48*(5), 761-771.
18. Kuo, C. F., Grainge, M. J., Mallen, C., Zhang, W., & Doherty, M. (2015). Rising burden of gout in the UK but continuing suboptimal management: a nationwide population study. *Annals of the rheumatic diseases*, *74*(4), 661-667.
19. Cho, S. K., Winkler, C. A., Lee, S. J., Chang, Y., & Ryu, S. (2019). The prevalence of hyperuricemia sharply increases from the late menopausal transition stage in middle-aged women. *Journal of clinical medicine*, *8*(3), 296.
20. Tamba, S., Nishizawa, H., Funahashi, T., Okauchi, Y., Ogawa, T., Noguchi, M., ... & Matsuzawa, Y. (2008). Relationship between the serum uric acid level, visceral fat accumulation and serum adiponectin concentration in Japanese men. *Internal medicine*, *47*(13), 1175-1180.
21. Dalbeth, N., Gosling, A. L., Gaffo, A., & Abhishek, A. (2021). Gaut Lancet, 397, 1843-1855.
22. Liu, X. Y., Wu, Q. Y., Chen, Z. H., Yan, G. Y., Lu, Y., Dai, H. J., ... & Yuan, H. (2020). Elevated triglyceride to high-density lipoprotein cholesterol (TG/HDL-C) ratio increased risk of hyperuricemia: a 4-year cohort study in China. *Endocrine*, *68*, 71-80.
23. Kawachi, K., Kataoka, H., Manabe, S., Mochizuki, T., & Nitta, K. (2019). Low HDL cholesterol as a predictor of chronic kidney disease progression: a cross-classification approach and matched cohort analysis. *Heart and Vessels*, *34*, 1440-1455.
24. Matsuura, F., Yamashita, S., Nakamura, T., Nishida, M., Nozaki, S., Funahashi, T., & Matsuzawa, Y. (1998). Effect of visceral fat accumulation on uric acid metabolism in male obese subjects: visceral fat obesity is linked more closely to overproduction of uric acid than subcutaneous fat obesity. *Metabolism*, *47*(8), 929-933.
25. Tanaka, K., Ogata, S., Tanaka, H., Omura, K., Honda, C., Osaka Twin Research Group, & Hayakawa, K. (2015). The relationship between body mass index and uric acid: a study on Japanese adult twins. *Environmental health and preventive medicine*, *20*, 347-353.