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Quantitative Evaluation of Serum Uric Acid among Pregnant Women Infected with Malaria Parasite in Bayelsa State

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Abstract **Original Research Article**

Malaria is a parasite disease transmitted through the bite of the female Anopheles mosquito, which is active between dusk and sunrise. Severe malaria during pregnancy can cause fetal loss and a high maternal mortality rate due to hypoglycemia and acute respiratory distress syndrome. Uric acid is the byproduct of purine metabolism, and an excessive quantity causes endothelial dysfunction, which can lead to hypertension and vascular disease. The purpose of this study was to determine blood uric acid levels in pregnant women infected with the malaria parasite. A cross-sectional, observational study design was used, and the research was carried out at Niger Delta University Teaching Hospital in Okolobiri, Bayelsa State, Nigeria. A total of 30 participants participated in this study; 15 pregnant women with and without malaria parasites in their blood specimens were obtained from both groups, and thick blood films were created with it and left to dry overnight then treated with Giemsa stain, which was allowed to air-dry. The sample findings were evaluated using Microsoft Excel's student t-test. The study found that pregnant women with the malaria parasite (5.16±2.26) had a statistical p-value of 0.111, while pregnant women without the parasite (5.26±1.86) had a p-value of 0.11. As a result, the presence of uric acid in the serum of pregnant women infected with the malaria parasite appears not to affect predisposing symptoms or treatment outcomes.

Keywords: *Pregnant Women, Malaria Parasite, Uric Acid, Serum.*

INTRODUCTION

Malaria during pregnancy is a severe public health problem in endemic tropic and subtropical regions, causing significant fetal and mother morbidity and mortality. It is well understood that blood uric acid levels fluctuate in normal pregnancy (Bauserman *et al*., 2019). Standard therapies for malaria include artemisinin-based combination therapy (Bunu *et al*., 2023a; Ebeshi *et al*., 2023) and natural medicinal herbs (Ogechukwu *et al*., 2021). Uric acid is the byproduct of purine metabolism, and an excessive level causes endothelial dysfunction, which may lead to hypertension and vascular disease. An elevated uric acid level in pregnant women is not only an indicator of illness severity, but it also plays a direct role in disease etiology because uric acid negatively affects both the placenta and the maternal vasculature (Yu & Cheng, 2020; Sanchez-Lozada *et al*., 2020). During pregnancy, uric acid levels initially fall between 25-35% due to the effects of estrogen-expanded blood volume and increased glomerular filtration rate; however, concentrations gradually rise to those observed in non-pregnant women by term gestation; a prospective follow-up study found that high serum uric acid is associated with higher malaria parasites in pregnant women (Bainbridge & Roberts, 2008; Corominas *et al*., 2022).

The liver, intestines, muscles, kidneys, and vascular endothelium are the primary sites of endogenous uric acid synthesis (Chaudhary *et al*., 2013). Many enzymes are involved in the conversion of adenine and guanine, two purine nucleic acids, to uric acid (Jin *et al*., 2012; Maiuolo *et al*., 2016). Initially, adenosine monophosphate (AMP) is converted to inosine via two different mechanisms: first, an amino group is removed by deaminase to form inosine monophosphate (IMP), followed by dephosphorylation with nucleotidase to form inosine, or first, a phosphate group is removed by nucleotidase to form adenosine, followed by

deamination to form inosine (Jin *et al*., 2012; Camici *et al*., 2018). Nucleotidase converts guanine monophosphate (GMP) into guanosine. Purine nucleoside phosphorylase (PNP) converts the nucleosides inosine and guanosine into the purine bases hypoxanthine and guanine. Hypoxanthine is then oxidized to xanthine by xanthine-oxidase (XO), and guanine is deaminated to provide xanthine by guanine deaminases. Xanthine oxidase oxidizes xanthine again to produce uric acid (Jin *et al*., 2012; Cicero *et al*., 2023). The typical level of uric acid in human blood is 1.5 to 6.0 mg/dL in women and 2.5 to 7.0 mg/dL in males. When uric acid levels exceed 6.8 mg/dL, crystals develop as monosodium urate (MSU). Due to a lack of the uricase enzyme, humans are unable to oxidize uric acid to the more soluble molecule allantoin.

Uric acid concentrations can be determined in serum, plasma, urine, and exhaled breath condensate (Barr, 1990). Determination of uric acid concentration includes phosphotungstic acid methods (PTA) (Lesciotto *et al*., 2020), uricase methods (Zhao *et al*., 2009), high-performance liquid chromatography methods (Bunu *et al*., 2020; Bunu *et al*., 2022), dry chemistry systems (Bürgi *et al*., 1992), biosensor methods (Mandal, 2015), and other spectroscopic techniques (Bunu *et al*., 2020a; Vaikosen *et al*., 2023; Vaikosen *et al*., 2023a). Diuretics, alcohol, heredity, hypothyroidism, immune-suppressing medicines, niacin, obesity, psoriasis, a purine-rich diet, renal insufficiency, tumor lysis syndrome, and other factors can all contribute to high uric acid levels in the blood (Spahis *et al*., 2015). Wilson's illness and Fanconi syndrome are among the most common causes of low uric acid levels. Because of its significant antioxidant capabilities, uric acid inhibits lipoxygenase activity and acts as a substrate for the enzyme cyclooxygenase (Sautin & Johnson, 2008; Bunu *et al*., 2023). Arachidonic acid is thus able to reach the parasites and mediate their demise, acting as an efficient *schistosomicide in vitro* and *in vivo* in mice, *hamsters*, and *S. mansoni*-infected children (Tallima & El-Ridi, 2017). Patients with multiple sclerosis had low plasma uric acid levels, which resulted in a decrease in antioxidant molecules (Fabbrini *et al*., 2014). Prevention and treatment of Plasmodium falciparum-infected malaria during pregnancy are critical components of prenatal care in endemic areas (Perlmann & Troye-Blomberg, 2000). The purpose of this study is to comparatively assess the serum uric acid levels of pregnant women infected and those not infected with the malaria parasite.

METHOD

Study Design and Population

A cross-sectional observational study design was used in this investigation. The study was conducted at Niger Delta University Teaching Hospital (NDUTH) in Okolobiri, Yenagoa, Bayelsa State. A practical sampling technique was employed to collect a sample of 15 plasmodium-parasitized pregnant subjects and 15 non-malaria-parasitized pregnant ladies from NDUTH in Bayelsa State, Nigeria. The study was approved by the research and ethics committee of Bayelsa State College of Technology's Medical Laboratory Department, with approval number CERT/MLT/16/296. Consent to conduct the research was obtained from the research institution first, and then from the subjects before collecting samples.

Sample Collection

The samples were obtained in the morning between 8:00 and 10:00 a.m., before to breakfast. About 5ml of blood was collected via venous punctures with a 5ml sterile syringe and needle, dispensed into a clean dry tube, allowed to clot for about 15 minutes at room temperature, centrifuged at 3000 pm for 5 minutes, and the scrum was harvested into clean dry crew-capped EDTA bottles.

Laboratory Analysis

Carawas Method: Uric acid was oxidized by uricase to allantoic acid and hydrogen peroxide TBHB + 4-aminoantipyrine + hydrogen peroxide, in the presence of peroxides produces an avionelmine dye that was measured at 520 nm in a UV-Visible spectrophotometer (Bunu *et al*., 2020a; Dode *et al*., 2023). Sample results obtained were analyzed using Microsoft Excel utilizing student t-test.

RESULTS AND DISCUSSION

This study had 30 participants: 15 with malaria parasites (50%) and 15 without (50%) (Table 1). Participants' ages (years) ranged from 18 to 49, with the maximum frequency between 35 and 44 (Figure 1). The presence of uric acid in pregnant women with and without malaria parasites was investigated. In this study, the mean and standard deviation of serum uric acid in pregnant women with and without malaria parasites were compared; there was no significant difference in serum uric acid between the two groups, as evidenced by the p-value of 0.111, which is greater than 0.05.

Table 1: Demographic Data of Participants

Variables	Frequency (N)	Percentage (%)
Pregnant women affected with the malaria parasite	15	50
Pregnant women without malaria parasite	15	50

Fifteen (15) pregnant women infected with the malaria parasite and fifteen pregnant women without the malaria parasite at the time of sample collection were randomly selected for the study.

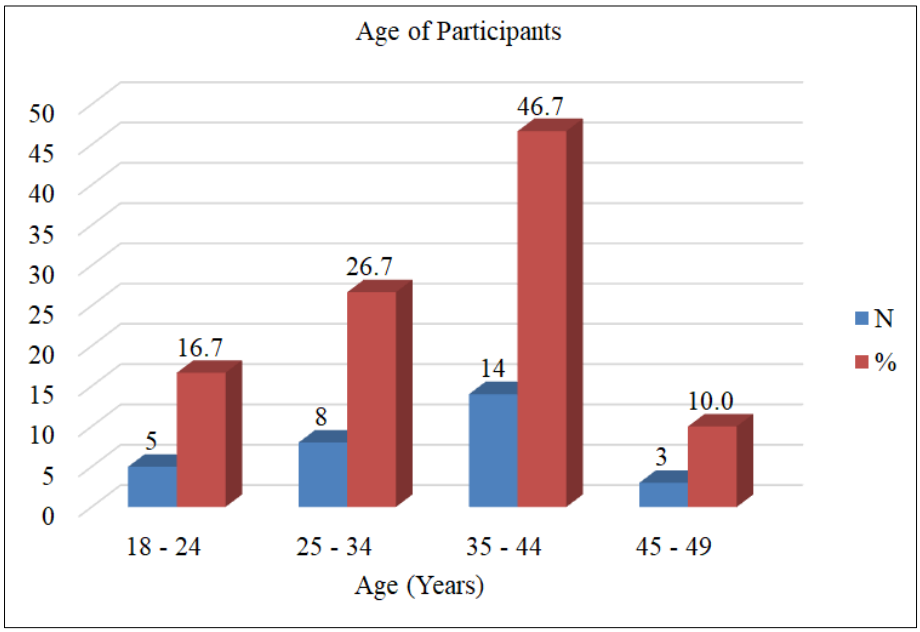

Figure 1: The age group of study participants (N=Frequency, %=Percentage). The age distribution among the women randomly selected for the study. The highest age range was between 35 – 44 years of age (46.7%), while the lowest range was observed among those between 45 – 49 years of age (10%), respectively.

Table 2: Comparison analysis of uric acid in pregnant women with and without malaria parasite respectively

Parameter	Subject	Meant ±SD	P. value	Result
Serum uric acid	Pregnant women with the malaria parasite	5.16±2.62	0.111	Not Significant
Serum uric acid	Pregnant women without malaria parasite	5.26± 1.86	0.111	Not Significant

The statistical probability (p-value) was set at ≤0.05, thus any p-value <0.05 was regarded statistically significant, while p-value >0.05 was termed not significant. Hence, the test results obtained among the group showed no significant statistical correlation.

Malaria in children and pregnant women is a serious public health problem in endemic tropic and subtropical countries, as well as a major source of fetal and maternal morbidity and mortality, which is accompanied by an increase in uric acid levels in pregnant women (Charles *et al*., 2024). Malaria is one of the most common and dangerous diseases known to man, particularly in tropical and subtropical climates. It affects three million pregnant women in developing countries each year, causing poor birth outcomes, maternal anemia, and deaths. The high amount of uric acid in pregnancy-induced hypertension has been attributed to its reduced degradation in the liver; it initially lowers between 25.35% due to the actions of estrogen, which expands blood volume and increases the glomerular filtration rate. This study compared pregnant women with malaria parasites (5.16±2.62) to those without (5.26±1.86) (Table 2). The difference was not significant (p-value = 0.111), indicating that there was no statistically significant effect on serum uric acid in pregnant women infected with the malaria parasite.

CONCLUSION

We discovered in this study that serum uric acid had no significant effect on pregnant women infected with malaria parasites. As a result, the presence of uric acid in the blood of pregnant women infected with malaria parasites may have little effect on malaria management and treatment outcomes in this population.

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