

Sokoto Journal of Medical Laboratory Science 2025; 10(2): 76 - 81**SJMLS - 10 (2) - 009****Assessment of Haematological Indices and Age-related Risk factors among Malaria Parasitized Pregnant women attending antenatal Clinics in Benin City**

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Abstract

Malaria remains a significant global health challenge, particularly affecting vulnerable populations such as pregnant women in endemic regions, contributing substantially to maternal morbidity and mortality despite concerted efforts to control the disease. The study aims to assess the hematological parameters and age-related risk factors among infected malaria pregnant women in Benin City. One hundred and ten (110) malaria-infected pregnant women constituted the subjects for this case-control study while 110 uninfected pregnant women were recruited as controls. A structured questionnaire was used to gather sociodemographic, clinical, and obstetric data. Malaria parasite density was determined and confirmed using a light microscope, blood smear-staining techniques, and rapid diagnostic tests (RDT). A total of 220 infected and uninfected pregnant women aged between 30.19±5.43 and 31.19±5.55 years, were assessed. The pregnant women who were infected versus uninfected had a total granulocyte count of 58.37±11.59 versus 67.1±3.39 (p-value = 0.001). The lymphocyte counts in women infected versus uninfected with *P. falciparum* were 28.43±7.85 versus 40.52±3.01 (p-value = 0.001). The mid-levels in infected versus uninfected pregnant women, with a value of 13.11±6.37 versus 15.5±6.01 (p-

value = 0.005). The Platelet levels in infected versus uninfected pregnant women, with values of 238.55±68.53 versus 211.66±97.17 (p-value = 0.001). Additionally, the packed cell volume was significantly lower among the malaria-infected subjects compared to the uninfected controls (32.57±4.25 versus 41.10±2.56; p-value = 0.001). The haemoglobin level was significantly lower among the malaria-infected pregnant women compared to the uninfected controls (10.43±1.33 versus 13.10±1.32; p=0.001). The younger expectant mothers were at a higher risk of malaria and anaemia compared to older pregnant women. A successful public health education program tailored to this vulnerable population must be created, and hospitals or healthcare facilities should implement routine Intermittent Preventive Treatment for malaria in pregnancy (IPTp) which involves the administration of antimalarial drugs at specific intervals to pregnant women in areas with moderate to high malaria transmission.

Keywords: malaria, haematological indices, pregnancy, age-related risk factors

Introduction

Malaria poses a major threat to public health, especially for expectant mothers in the tropical regions of the world (Nwonwu *et al.*, 2009).

Compared to other species of the parasite, *Plasmodium falciparum* is the primary cause of malaria infections acquired during pregnancy (Omo-Aghoja *et al.*, 2008). Because pregnancy causes physiological changes and immune suppression, the rate of infection is double that of non-pregnant women (Lindsay *et al.*, 2000). Pregnancy infections caused by *P. falciparum* may have serious negative effects on the mother and foetus if proper treatment is not received (McGregor, 1984). Malaria in low-endemic regions, like Southeast Asia and can occasionally be severe or complex (McGregor, 1984). Compared to age-matched controls, pregnant women are more likely to get malaria and to have it more severely (Ramsay, 2003).

Malaria infection causes red blood cells (RBCs) to undergo a variety of morphological changes, such as changes in size, shape, and surface properties (Fleming, 2021). After invading red blood cells and going through multiple developmental phases and nuclear divisions, the merozoites finally burst the RBCs, producing eight to thirty-two secondary merozoites. By infecting fresh RBCs, these merozoites can perpetuate the cycle (Fleming, 2021).

Age-related variations in how the body reacts to haematological alterations in malaria are important considerations. Because their immune systems are still developing and their baseline haematological parameters are lower, malaria infections in pediatric populations especially in newborns and young children can result in more serious haematological consequences. Increased vulnerability to severe malaria syndromes, higher parasitemia levels, and more severe anaemia can all arise from this (Fleming, 2021). In addition, the objective of this present study was to estimate the haematological parameters and age-related risk factor among infected malaria pregnant women attending antenatal clinics in south-southern, Nigeria.

Materials and Methods

Study Area

The research was conducted at Faith Mediplex Hospital, Benin City, Nigeria. Faith Mediplex Hospital, Benin, City is a non-government-owned general hospital, which serves as a secondary healthcare facility in Benin City, Edo State.

Study design and population

This study was a hospital-based cross-sectional study involving infected malaria pregnant women as well as healthy pregnant women. A total of two hundred and twenty participants were selected for the research. One hundred and ten infected malaria pregnant women and one hundred and ten uninfected pregnant women were recruited as controls. A structured designed questionnaire was used to gather socio-demographic, clinical, and obstetric data from 110 pregnant women during antenatal care sessions at Faith Mediplex Hospital, Benin City, from April to June, 2024. Samples were collected every Wednesday biweekly. Before sample collection, informed consent was obtained from all study subjects who participated in this study.

Sample size determination

The minimum sampling size was determined using the statistical formula: $N = (Z^2 \times p \times q) / D^2$ (Daniel, 1999).

Where, $q = (1-p)$

N = Sample Size

p = Proportion in the target population estimated to have a particular characteristic = 7.7 % (Chimere *et al.*, 2009).

Z = Confidence interval of 95% which is equivalent to Confidence of 1.96

D = Desired level of Size Significance (5%)

$N = 1.96^2 \times 0.07 \times (1-0.07) / 0.05^2$

$N = 3.8416 \times 0.077 \times 0.93 / 0.0025 = 110$

Inclusion Criteria

All gravidae women (aged 30.19 ± 5.43) who registered for antenatal care with signs of malaria infection within the past 48 hours, particularly having an axillary temperature of 37.5°C or higher, also, they were permanent residents of the study area who had consented to participate.

Exclusion Criteria

All gravidae women who had taken antimalaria drugs in the last four weeks before the study period was excluded from this study. Also, pregnant women with pre-existing medical conditions that may affect haematological parameters (such as; cancer and chronic illnesses) were excluded from this study.

Ethical approval

Ethical approval for this study was obtained from Faith Mediplex Hospital Ethics committee (FMH/vol.12/2023/88). Prior to the collection of samples, participants were informed about the study. Consent for participation was obtained both orally and in writing. The identities of the patients from whom samples were collected remained confidential at all times.

Sample collection

Five (5) milliliters of venous blood were drawn from each participant and placed in an Ethylene Diamine Tetraacetic Acid (EDTA) bottle for complete blood count.

Full Blood Count (FBC)

The ADVIA® 2120i Haematology system (Siemens, UK) was used to automatically measure the haemoglobin, red blood, white blood, and platelet counts. An experienced Medical Laboratory Scientist on duty double-checked the cell count.

Microscopy

A grease-free microscopic slide, a thick film was made. The film was left to air-dried. Giemsa stain (10%) was applied to the film and left for 20 minutes. For three to five minutes, it was rinsed in buffered water. After then, the film was tilted and let to air dry. The slide was examined using a 40X magnification microscope, with a 100X oil immersion lens for viewing and also, parasite density was counted.

Statistical analysis

The data were presented as mean $\pm$ standard deviation, which was calculated using statistical software for social sciences (SPSS, Version 20.0), with a significance level of $p \leq 0.05$.

Results

The age group of infected and uninfected malaria pregnant women were (30.19 $\pm$ 5.43) and (31.19 $\pm$ 5.55) years (p -value=0.010) respectively (Table 1). The study's findings, as demonstrated indicated that pregnant women 26–30 had the highest occurrence of malaria parasite infection, accounting for 44 (40.3%) malaria-infected women. The age group 31–35 followed closely behind with 24 (21.2 %) malaria-infected women and aged between 20–25 years and 36–40 years had 17 (15.5 %)

respectively, whereas the lowest prevalence was observed among women aged 41–45, with 8 (7.2.6%) malaria-infected women. Nevertheless, the observed difference in the rate of malaria infection with age was statistically significant (Figure 1). The pregnant women who were infected versus uninfected had a total granulocyte count of 58.37 $\pm$ 11.59 versus 67.1 $\pm$ 3.39 (p -value = 0.001). The lymphocyte counts in women infected versus uninfected with *P. falciparum* were 28.43 $\pm$ 7.85 versus 40.52 $\pm$ 3.01 (p -value = 0.001). The monocyte mid-levels in infected versus uninfected pregnant women, with a value of 13.11 $\pm$ 6.37 versus 15.5 $\pm$ 6.01 (p -value=0.005). There was a statistically significant difference in the platelet count of the malaria-infected pregnant women versus the uninfected pregnant women (238.55 $\pm$ 04.00 versus 68.53 $\pm$ 54.65; p = 0.001). A statistically significant difference was observed between the haemoglobin levels (10.43 $\pm$ 1.33 versus 13.10 $\pm$ 1.32; p = 0.001) and packed cell volume (32.57 $\pm$ 4.25 versus 41.10 $\pm$ 2.56; p =0.001) of the malaria-infected pregnant women when compared to uninfected pregnant women.

Discussion

The malaria parasitized pregnant women had a low haemoglobin and packed cell volume level when compared to uninfected pregnant. Anaemia is a common complication that often occurs in cases of malaria infection, especially among pregnant women living in areas of high transmission. Although the precise pathogenesis of malaria infection during pregnancy is not fully understood, it is generally attributed to the parasite's target being the red blood cells (RBC), resulting in their destruction, the increased removal of both infected and uninfected cells, compromised bone marrow function, and the level of parasitemia (White, 2018; Abbas *et al.*, 2021; Saleh *et al.*, 2023). Analysis of the result from this study indicates that the packed cell volume of malaria-infected pregnant women was relatively low (PCV < 33) compared to uninfected pregnant women. Also, the haemoglobin is also low (HGB < 11). These findings align with the previous studies which show the haemoglobin level was lower in infected pregnant women when compared to uninfected pregnant women (Ndamukong-Nyanga *et al.*, 2020; Binuyo *et al.*, 2022; Yusuf *et al.*, 2023). Furthermore, the finding of this study agrees with a separate investigation carried out in Sokoto, Nigeria, who documented that the reduced packed cell volume (PCV) levels reflect anemia resulting primarily from the mechanical



destruction of partitioned red blood cells, the nutritional status of pregnant women with infections, and the spleen's removal of segregated and defected cells (Erhabor *et al.*, 2019).

The study's findings, as demonstrated indicated that pregnant women 26–30 had the highest occurrence of malaria parasite infection, accounting for 44 (40.3%) malaria-infected women. The age group 31–35 followed closely behind with 24 (21.2%) malaria-infected women and 20–25 years and 36–40 years had 17 (15.5%) respectively, whereas the lowest prevalence was observed among women aged 41–45, with 8 (7.26%) malaria-infected women. Nevertheless, the observed difference in the rate of malaria infection with age was statistically significant. This study demonstrates a contrast to the studies conducted by the researchers, who concluded that the occurrence of malaria is not influenced by age (Ohalet *et al.*, 2020; Umar *et al.*, 2022; Bolaji *et al.*, 2023; Okoroiwu, 2023). They also revealed that the use of insecticide-treated bed nets significantly impacts the decrease in malaria infection for their ages. One possible explanation for this association is that nets effectively reduce human-mosquito contact, which can prevent malaria infections. This study concurred with the previous studies who discovered that pregnant teenagers and young adult women had a higher vulnerability to malaria infection than older expectant mothers (Mangusho *et al.*, 2023). It is further explained that older women acquire immunity to malaria over time due to frequent

infections, leading to lower levels of malaria parasites in adult women (Mangusho *et al.*, 2023).

Conclusion

In this study, malaria parasitaemia and anaemia were prevalent health issues linked to pregnancy. The younger expectant mothers exhibited a higher vulnerability to malaria and anaemia compared to their older aged pregnant counterparts of reproductive age. Pregnant women should always undergo routine checkups and screen for malaria parasites.

Recommendations

The prescription of IPT and folic acid tablets during pregnancy can effectively prevent malaria and anaemia. Community health education, including early antenatal registration. This should be offered to pregnant women of childbearing age in order to improve their understanding and attitudes regarding malaria and anemia.

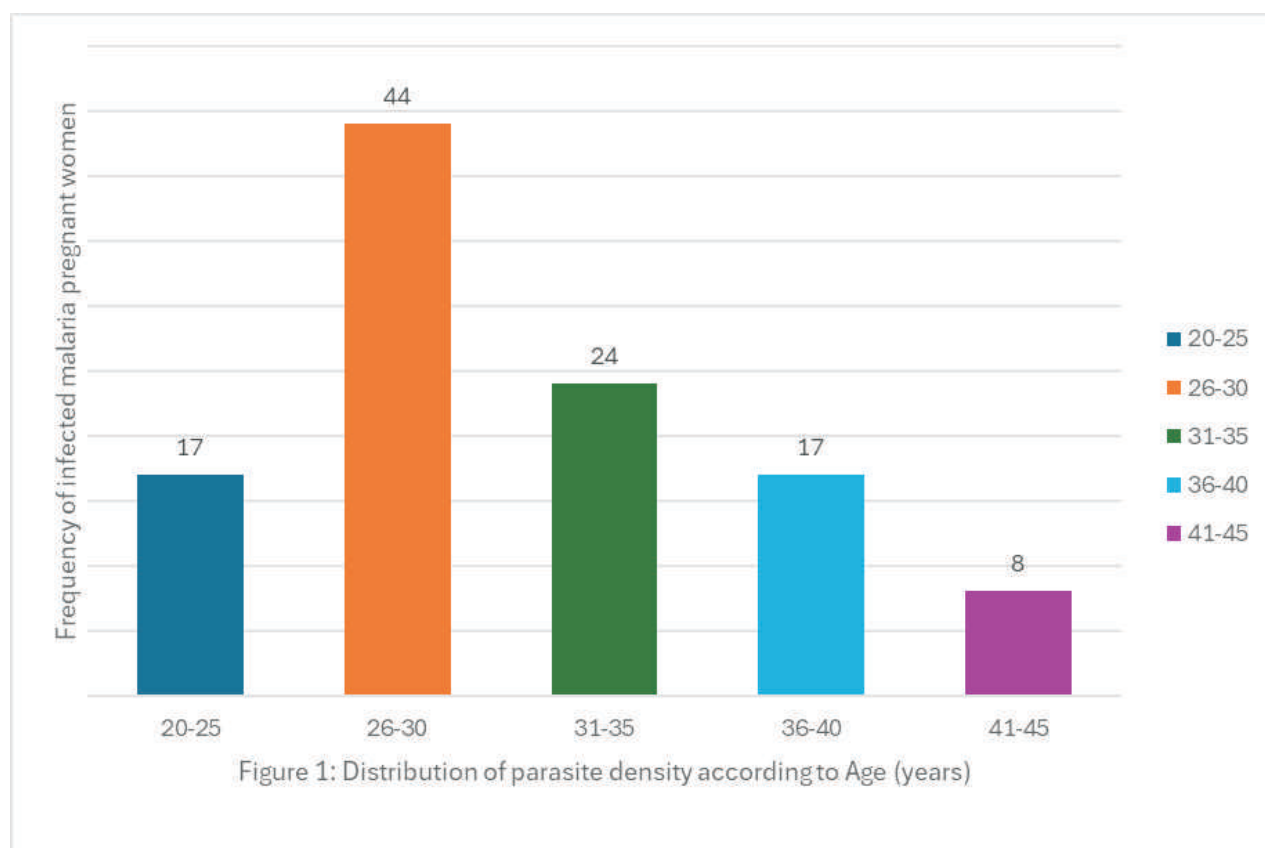
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Table 1: Mean and standard deviation of hematological indices among pregnant women and non-pregnant women

Parameters	Infected women	Pregnant	Uninfected pregnant women	p-value
Age (years)	30.19±5.43		31.19±5.55	0.010
Granulocytes (%)	58.37±11.59		67.10±3.39	0.001
Lymphocytes (%)	28.43±7.85		40.52±3.01	0.001
Mid (%)	13.11±6.37		15.51±6.01	0.005
Pack cell volume (PCV) (%)	32.57±4.25		41.1±2.56	0.001
Haemoglobin (%)	10.43±1.33		13.10±1.32	0.001
Platelet (%)	238.55±68.53		211.66±97.17	0.001

p-value < 0.05 was considered as significant



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