

Practice of preventive measures and factors associated with malaria in pregnancy among pregnant women in Ibadan, Nigeria: A community-based cross-sectional study

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ABSTRACT: Malaria in pregnancy can have devastating consequences on both the mother and her unborn baby. However, it can be prevented if a pregnant woman is well-informed as well as practices preventive measures conscientiously. This assessed the knowledge of malaria and its preventive measures, preventive measure practices, and factors associated with the practice of preventive measures against malaria in pregnancy among pregnant women receiving skilled antenatal care. This study adopted a descriptive cross-sectional design. The study was conducted among pregnant women attending selected antenatal clinics in Ibadan, Southwestern Nigeria. A simple random sampling was used to select 188 pregnant women who participated in the study. A validated self-reported questionnaire was used for data collection, and the results were analysed using the Statistical Package for the Social Sciences (SPSS) version 25. Ethical approval was obtained for the study. The study revealed that 150(79.8%) tested negative for malaria. Additionally, the majority of the respondents have a good knowledge (60%) of malaria and its preventive measures, and practised good preventive behaviours (57.4%). Furthermore, some factors such as the presence of stagnant water ($p=0.002$), overgrown weeds or bushes ($p=0.015$), and staying outside late at night ($p=0.008$) were identified as significant risk factors contributing to the occurrence of malaria in pregnancy. Interventions towards addressing the identified barriers to good preventive practices should be implemented, while encouraging better knowledge and preventive practices.

Keywords: Malaria, maternal health, Nigeria, pregnancy, prevention.

INTRODUCTION

Malaria is a protozoan disease caused by *Plasmodium spp* parasites. However, *Plasmodium falciparum* causes the most febrile diseases, and it is common and the deadliest in Sub-Saharan Africa (WHO, 2023). Infected mosquitoes, called “malaria vectors,” bite mostly between nightfall and dawn. *Plasmodium* is a parasite responsible for causing malaria, which infects the red blood cells and is spread by a female *Anopheles* mosquito (Abubakar *et al.*, 2021). According to the literature, two types of malaria can occur during pregnancy: placental malaria (PM) and gestational malaria (GM) (Das *et al.*, 2024). Without timely and appropriate intervention, malaria in pregnancy can have devastating consequences, including severe anaemia,

maternal death, stillbirth, premature delivery, and low-birth-weight babies (Surakat *et al.*, 2023). The main burden of malaria infection during pregnancy results from infection with *Plasmodium falciparum*. Pregnant women are known to be more susceptible than non-pregnant women to malaria, and this susceptibility is greatest in the first and second pregnancy (Surakat *et al.*, 2023). Maternal death may result either directly from severe malaria or indirectly from malaria-related severe anaemia (Surakat *et al.*, 2023).

According to a report from World Malaria Day in 2024, it was stated that pregnant women face heightened risks, as pregnancy reduces immunity to malaria, making them

more susceptible to infection and severe disease. Gender inequalities, discrimination, and harmful gender norms further increase their vulnerability (WHO, 2024).

The World Health Organisation reported that an estimated 2.1 billion malaria cases and 11.7 million malaria deaths were averted in the period 2000–2022. About 96% of malaria deaths globally were in 29 countries, and Nigeria bears the greatest burden of malaria in the world, accounting for 31%, by WHO sub region prevalence of exposure to malaria during pregnancy in 2022 was highest in west Africa (39.3%) and central Africa (40.1%), and lower in the east and southern Africa subregion (27.0%) (WHO, 2023). Globally, malaria is responsible for over 10,000 maternal deaths and 200,000 neonatal deaths yearly. Nigeria is highly endemic, with almost 100% of its population at risk, especially pregnant women. Malaria in pregnancy is a serious challenge in Nigeria, as a large number of pregnant women who present themselves for antenatal care have malaria parasitemia along with its attendant anaemia (Smith *et al.*, 2022).

The National Malaria Elimination Programme (NMEP), in line with WHO recommendations, promotes several preventive strategies, including the use of insecticide-treated nets (ITNs), intermittent preventive treatment with sulfadoxine-pyrimethamine (IPTp-SP), indoor residual spraying, and environmental management (Federal Ministry of Health [FMoH], 2020). However, the actual uptake and consistent use of these preventive measures among pregnant women remain suboptimal due to a combination of personal, socio-economic, and systemic factors (Peter *et al.*, 2022).

Additionally, factors such as maternal age, parity, level of education, household income, cultural beliefs, and access to quality antenatal care (ANC) services significantly influence the knowledge, attitude, and practice (KAP) of malaria prevention strategies (Attah *et al.*, 2022). Despite ongoing health education and malaria prevention campaigns, many pregnant women in Nigeria, including those in Ibadan, still experience poor adherence to preventive measures, highlighting the need for more localised and context-specific data (Okafor *et al.*, 2019).

Therefore, there is a need to investigate the current preventive practice level, knowledge and the factors associated with Malaria in pregnancy among pregnant women in Ibadan. By addressing these gaps in knowledge and understanding, this study aims to contribute to the development of targeted interventions that promote better maternal and fetal health practices and ultimately improve the overall well-being of pregnant women.

METHODOLOGY

Study area

This study was conducted in Ibadan North Local Government. Ibadan North Local Government is one of the 11 Local Government Areas of the Ibadan Metropolitan

area. Ibadan North Local Government Area consists of 12 political wards, each of which has a primary health care Centre. The selected primary health care included: Agbowo, Sango, Bodija, Oniyanrin and Idi Ogungun Primary Health Care Centres. The study locations were chosen to represent a broad cross-section of the local government where pregnant women are exposed to malaria infection.

Study design

A cross-sectional descriptive study design was adopted for the study. This study design is meant to assess the preventive practice measures being practised by pregnant women and factors associated with malaria in pregnancy among the pregnant women at the study setting. The occurrence of malaria in pregnancy.

Sample size determination

The sampling formula was used for this study, which was formulated by Taro Yamane, a statistician, in 1967 (Yamane, 1967).

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = the sample size, N = population under study, e = the margin of error, which is 95% or 0.05, N = The number of pregnant women in all Primary health care centres, N = 300

Hence,

$$n = 171.4 \text{ Approximately } 171$$

Adjusting the sample size for a 10% non-response

$$10\% \text{ of } 171 = 17.1$$

$$n = 171 + 17.1$$

$$n = 188$$

Inclusion criteria: The inclusion criteria consist of all pregnant women aged 18 years and above who are attending antenatal clinics at the selected primary health centres, are available and willing to participate in the study, and have provided informed consent.

Exclusion criteria: Pregnant women who are below 18 years old, those who did not give their consent to the study, and those who are not mentally stable and ill

Sampling technique

A five-stage multistage sampling technique was used for this study:

Stage 1: Purposive sampling techniques, selection of Ibadan North local government from all the local governments in Ibadan.

Stage 2: Purposive sampling approach to select the political wards where there are health centres.

Stage 3: Simple random sampling approach to select 5 PHCs out of the available health centres in the political wards:

Stage 4: Stratified sampling techniques to select pregnant women according to the population of the selected PHC.

Stage 5: Proportionate allocation of Sampled Participants Across the 5 PHC based on the inclusion criteria of the study in order to determine the level of preventive practice against malaria in pregnancy and to assess the factors associated with malaria in Pregnancy in Ibadan.

Data collection

The survey's data collection began in January 2025 to March 2025 and involved administering a self-reported questionnaire to pregnant women in the selected primary health care centres in Ibadan North Local Government Area of Ibadan, Nigeria. The questionnaire was designed to capture participants' demographic information, occurrence, knowledge, preventive practice and factors associated with malaria in pregnancy.

The questionnaire was both in English and Yoruba forms and it consisted of five main sections, which included demographic information and obstetrics history, collecting details such as age, gender, education level, and occupation, providing a basis for understanding variations in occurrence across demographic groups, second section contains questions that will reveal the knowledge of malaria in pregnancy among the respondents, third section contain questions that will identify preventive practices against malaria in pregnancy among the respondents, fourth section contains questions that will identify their factors associated with malaria in pregnancy among the respondents.

The questionnaire included both closed and dichotomous questions to facilitate quantitative analysis and enhance the reliability of responses. Before full deployment, a pilot study was carried out where the questionnaire was pretested on a small sample of respondents in Ajibode primary health care centre to ensure clarity and relevance, with modifications made based on feedback. The Cronbach's alpha coefficient for the reliability analysis was computed and deemed good, with an internal consistency of 0.822 (α) among the questionnaire items.

The questionnaire was administered as a hard copy to the pregnant women in the study areas. Each participant was provided with a brief introduction to the study, and informed consent was obtained prior to the administration of the questionnaire.

The research was performed in conformity with the ethical standards stated in the declaration of Helsinki

World Medical Association Declaration of Helsinki (2001).

All participants were informed of their right to confidentiality and anonymity. The purpose of the study was explained, emphasising that participation was voluntary and that respondents could withdraw at any time without consequence. Data was collected anonymously, with responses recorded into a secure database accessible only to the research team.

Data analysis

Data collected was assessed for normality using the Shapiro-Wilk test and was analysed using both descriptive and inferential statistics using Statistical Package for the Social Sciences (SPSS) Version 25 (IBM Statistics). Descriptive statistics such as percentages, mean, and standard deviation were used to summarise and present the results. Using the average score of 50%, those who had 50% and above were categorised as having good knowledge and good practice, while those who scored below 50% were categorised as poor. This was included under the knowledge result. The Fisher's exact test was also used for sociodemographic variables with frequencies less than 5 to investigate the relationship. Multivariate logistic regression was employed to assess the factors associated with malaria in pregnancy, odds ratios (OR) and 95% confidence intervals (CI) to indicate the strength of associations. Chi-square test was used to investigate the relationship and association between sociodemographic variables and occurrence and preventive practice against malaria in pregnancy. A p-value below 0.05 was deemed statistically significant for all analyses.

Ethical approval

The study was approved by the Oyo State Research Ethics Review Committee, number: NHREC/OYOSHRIEC/10/11/22, dated 10th January 2025.

RESULTS

The study aimed to comprehensively determine the rate of occurrence, assess their knowledge, examine preventive practices, and those factors associated with malaria in pregnancy. Data were collected using self-reported questionnaires. The findings from the selected primary health centres reveal areas that need immediate attention.

Socio-demographic characteristics of the respondents

The results presented in Table 1 show the socio-demographic characteristics of the pregnant women attending antenatal clinics. The majority of the respondents, 102

Table 1. Socio-demographic characteristics of the respondents.

Variables	Frequency (n=188)	Percentages (%)
Age		
Below 15 years	-	-
16 – 30 years	83	44.1
31 – 45 years	102	54.3
46 years and above	3	1.6
Marital status		
Single	17	9.0
Married	147	78.2
Separated	22	11.7
Widowed	2	1.1
Religion		
Islam	100	53.2
Christianity	88	46.8
Ethnicity		
Hausa	12	6.4
Igbo	28	14.9
Yoruba	148	78.7
Occupation		
Employed (Government and Private)	58	30.9
Self-employed	118	62.8
Unemployed	12	6.4
Level of education		
Primary education	4	2.1
Junior secondary school	15	8.0
Senior secondary school	107	56.9
Tertiary education	62	33.0
Residence		
Urban	188	100.0
Rural	0	0.0
Annual income		
No income	12	6.4
Below 50,000 naira	42	22.3
51,000 – 100,000 naira	86	45.7
101,000 – 150,000 naira	26	13.8
Above 150,000 naira	22	11.7

(54.3%), were aged between 31 and 45 years. Marital status showed that most participants were married 147(78.2%). Educational levels varied, with 107(56.9%) having completed senior secondary school and 62(33.0%) having tertiary education. All respondents resided in urban areas. Income levels among the participants showed that 86(45.7%) earned between 51,000 and 100,000 naira

annually. From an obstetric perspective, 103(54.8%) of the pregnant women were between 13 and 18 weeks of gestation. Gravidity showed that 66(35.1%) of the women were pregnant for the second time. Antenatal care attendance was high, with 167(88.8%) attending all required visits. Most women 133(70.7%) attended their first antenatal visit between 13 and 28 weeks of pregnancy.

Table 1. Contd.

Variables	Frequency (n=188)	Percentages (%)
OBSTETRICS HISTORY		
Gestational age (Weeks of Pregnancy)		
Less than 12 weeks	11	5.9
13 – 18 weeks	103	54.8
29 – 40 weeks	74	39.4
Gravidity (No of pregnant)		
One	40	21.2
Two	66	35.1
Three	55	29.3
Four	18	9.6
Five and above	9	4.8
Parity (No of children)		
None	52	27.7
One	58	30.9
Two	42	22.3
Three	17	9.0
Four	12	6.4
Five and above	7	3.7
Attended All ANC visits		
Attended	167	88.8
Not Attended	21	11.2
Number of Antenatal Visits		
< four times	114	60.6
> four times	74	39.4
Gestational age at 1st visit		
< 12 weeks	17	9.0
13-28 weeks	133	70.7
29-40 weeks	38	20.2
What is the name of the Antenatal Clinic you are attending and the ward		
Agbowo	42	22.3
Idi-ogungun	36	19.1
Oniyarin	37	19.7
Bodija	40	21.3
Sango	33	17.6

Occurrence of malaria in pregnancy

The results, as presented in Table 2, reveal that the majority of the respondents 170(90.4%), had been tested for malaria only once during their pregnancy. Among those tested, 38(20.2%) received a positive result. All those who tested positive 188(100.0%) received treatment for malaria. When asked about possible signs and symptoms of malaria during pregnancy, all participants 188(100.0%)

reported experiencing headaches, nausea, vomiting, anorexia, weakness in the joints, and body pain.

Knowledge of malaria and its preventive measures

The results presented in Table 3 show that the majority of the participants 104(55.3%) received information on malaria in pregnancy during antenatal care visits.

Table 2. Occurrence of Malaria in pregnancy.

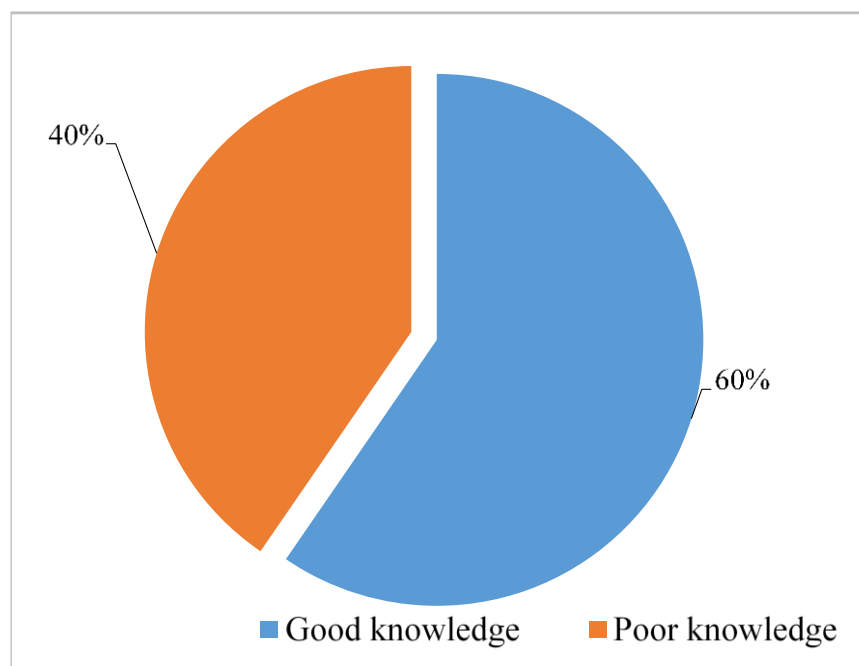
Variables	Frequency (n=188)	Percentages (%)
How many times have you been tested for Malaria during this pregnancy?		
Once	170	90.4
Twice	18	9.6
What was the result?		
Positive	38	20.2
Negative	150	79.8
How many times did the result come out positive? (n=38)		
Once	28	73.7
Twice	10	26.3
The test was conducted in which settings?		
Antenatal clinic	171	91.0
Home	17	9.0
After tested positive, did you receive any treatment for Malaria? (n=38)		
Yes	38	100.0
No	-	-
Possible signs and symptoms of Malaria in pregnancy		
Headache		
Yes	188	100.0
No	0	0.0
Nausea and vomiting		
Yes	188	100.0
No	0	0.0
Weight loss		
Yes	159	84.6
No	10	5.3
I don't know	19	10.1
Anorexia		
Yes	188	100.0
No	0	0.0
Weakness of joint		
Yes	188	100.0
No	0	0.0
Body pain		
Yes	188	100.0
No	0	0.0

However, they have limited knowledge of the causative organism of malaria. Only 106(56.4%) correctly identified *Plasmodium falciparum* as the causative agent. Similarly, 97(51.6%) correctly identified the *female*

Anopheles mosquito as the vector. Overall, 60% of them had good knowledge of malaria in pregnancy and its preventive measures (Figure 1).

Table 3. Knowledge of malaria and its preventive measures among participants.

Variables	Frequency (n=188)	Percentage (%)
Have you ever heard of 'Malaria in pregnancy'?		
Yes	188	100.0
No	0	0.0
If yes, from what source? Choose any of your of the options		
Antenatal clinic	104	55.3
Internet	11	5.9
Radio	2	1.1
Healthcare professionals	71	37.8
The causative organism of Malaria in pregnancy is?		
Salmonella typhi	29	15.4
Plasmodium Falciparum	106	56.4
I don't know	53	28.2
The vector for Malaria in Pregnancy is?		
Bed bug	33	17.6
Female Anopheles Mosquito	97	51.6
I don't know	58	30.9

**Figure 1.** Knowledge of malaria and its preventive measures among participants.

Preventive measures against malaria in pregnancy

Results presented in Table 4 show that a majority of the participants 123(65.4%), reported using Insecticide-Treated Nets (ITNs) every night, 70(37.2%) use insecticides/mosquito repellants every day. Environmental

hygiene practices were widely adopted, as 171(91.0%) of the participants regularly cleared stagnant water and maintained cleanliness to prevent mosquito breeding. However, only 82(43.6%) reported using intermittent preventive treatment in pregnancy with Sulfadoxine-pyrimethamine. Overall, 108(57.4%) of the participants

Table 4. Preventive measures against malaria in pregnancy.

Variables	Frequency (n=188)	Percentages (%)
Do you sleep under insecticide-treated nets?		
Yes, every night	123	65.4
Yes, sometimes	65	34.6
Reason for not sleeping under insecticide-treated Nets? (n=65)		
Uncomfortable	46	70.8
Use of other preventive measures	19	29.2
How often do you apply Insecticide or Mosquito repellent?		
Daily	70	37.2
Occasionally	89	47.3
Never	29	15.4
Do you clear stagnant water and keep your environment clean to prevent mosquitoes?		
Yes	171	91.0
No	17	9.0
Do you cover yourself with wrapper while sleeping?		
Yes	169	89.9
No	19	10.1
Do you take IPTp-SP doses (Intermittent preventive treatment in pregnancy with Sulfadoxine-pyrimethamine)?		
Yes	82	43.6
No	9	4.8
I don't know what IPT is	97	51.6
If yes, how many doses? Pls indicate (n=82)		
1 dose	36	43.9
2 doses	20	24.4
3 doses	26	31.7
Have you sought advice or guidance on malaria prevention during your antenatal visits?		
Yes	111	59.0
No	77	41.0

have good practice of malaria in pregnancy preventive measures (Figure 2)

Factors associated with malaria in pregnancy

A large percentage of the participants 122(64.9%), reported the presence of stagnant water and overgrown weeds or bushes around their houses, while 140(74.5%) agreed that staying outside late at night increases exposure to mosquito bites (Table 5).

The presence of stagnant water (OR = 3.49, $p = 0.002$) significantly increases the likelihood of malaria infection.

Overgrown weeds or bushes (OR = 2.34, $p = 0.015$) and staying outside late at night (OR = 3.00, $p = 0.008$) are also strong risk factors. Living in malaria-prone areas increases risk (OR = 2.58, $p = 0.010$). Attending antenatal care (OR = 0.30, $p = 0.001$), sleeping under ITNs (OR = 0.41, $p = 0.005$), and using mosquito repellents (OR = 0.47, $p = 0.012$) significantly reduce malaria risk (Table 6).

Hypothesis testing

There is a significant association between parity and the practice of preventive measures against malaria in pregnant women attending the antenatal clinic. The chi-



Figure 2. Preventive measures practice among pregnant women in Ibadan.

Table 5. Factors associated with malaria in pregnancy as reported by pregnant women in Ibadan, Nigeria.

Variables	Yes [F (%)]	No [F (%)]
Presence of stagnant water around the house	122 (64.9)	66 (35.1)
Overgrown weeds or bushes around the house	122 (64.9)	66 (35.1)
Staying outside late in the night	140 (74.5)	48 (25.5)
Living in an area known for Malaria transmission	68 (36.2)	120 (63.8)
Attending antenatal care and health education	188 (100.0)	-
Sleeping under insecticide-treated nets	111 (59.0)	77 (41.0)
Application of mosquito repellents or other protective measures	72 (38.3)	116 (61.7)

Table 6. Logistic regression output on the factors associated with malaria infection.

Variable	Coefficient	Odds Ratio	p-value
The presence of stagnant water around the house	1.25	3.49	0.002
Overgrown of weeds or bushes around the house?	0.85	2.34	0.015
Staying outside late in the night	1.10	3.00	0.008
Living in an area known for Malaria transmission	0.95	2.58	0.010
Attending antenatal care and health education	-1.20	0.30	0.001
Sleeping under insecticide-treated nets	-0.90	0.41	0.005
Application of mosquito repellents or other protective measures	-0.75	0.47	0.012

square test carried out to verify the hypothesis shows a χ^2 -value of 0.0332 and a p-value of 0.005. The conventional significance level adopted is 0.05, and since the p-value obtained is less than the significance level, the null hypothesis is not accepted. Hence, there is a significant association between the parity of pregnant women and the

preventive practice of malaria in pregnancy among pregnant women attending the antenatal clinic (Table 7).

There is no significant association between educational level and knowledge of preventive measures against malaria in pregnant women attending an antenatal clinic. The chi-square test carried out to verify the hypothesis

Table 7. Association between mother's parity and practice of preventive measures.

Variables	Preventive practice of malaria in pregnancy		X ² -value	p-value	Df	
	High	Low				
Parity of Pregnant Women (number of children)	None	30	22	0.033 ²	0.005	5
	One	33	25			
	Two	24	18			
	Three	10	7			
	Four	7	5			
	Five and above	4	3			

Table 8. Association between educational level and knowledge of malaria in pregnancy preventive measures.

Variables	Knowledge of preventive practice of malaria in pregnancy		X ² -value	p-value	Df	
	Good	Poor				
Educational Level of the Pregnant Women	Primary education	2	2	0.322 ²	0.002	6
	Junior secondary school	9	6			
	Senior secondary school	64	43			
	Tertiary education	37	25			

shows a χ^2 -value of 0.3222 and a p-value of 0.002. The conventional significance level adopted is 0.05, and since the p-value obtained is less than the significance level, the null hypothesis is not accepted. Hence, there is a significant association between the education level and knowledge of the preventive practice of malaria in pregnancy among pregnant women attending an antenatal clinic (Table 8).

DISCUSSION

This study adopted a descriptive cross-sectional design to assess the practice of preventive measures against malaria in pregnancy and factors associated with malaria in pregnancy among pregnant women receiving skilled antenatal care.

The research identified that the majority of the respondents were aged between 31 and 45 years. This finding aligns with studies that highlight that women within this age range often have higher fertility rates and increased healthcare awareness compared to younger age groups (Smith *et al.*, 2022). Marital status showed that most participants were married. Similar studies indicate that married women tend to have better antenatal care utilisation, which improves malaria prevention (Okafor *et al.*, 2019). Ethnically, the Yoruba were the majority, reflecting the city's demographic structure. Ethnic background can influence health-seeking behaviours, with cultural perceptions playing a role in malaria prevention (Oyeleye, 2023). Most of the women were self-employed. Employment status affects economic empowerment and

access to healthcare services (Nwosu and Ataguba, 2019). Educational levels varied, with more than half of them having completed senior secondary school and one-third of them having tertiary education. Education is a major determinant of health literacy and malaria prevention knowledge (Oladimeji *et al.*, 2019). Income levels among the participants showed that the majority of them are low-income earners. Low-income women are more vulnerable to malaria as they may lack access to quality healthcare and preventive tools (Oladimeji *et al.*, 2023). Gravidity data revealed that more than one-third of the women were pregnant for the second time. Research suggests that primigravida women (first-time pregnancies) are more susceptible to malaria due to a lack of pre-acquired immunity (Oyerogba *et al.*, 2023). Antenatal care attendance was high; thus, early and frequent antenatal visits are associated with better malaria prevention outcomes (Ndayishimiye *et al.*, 2024).

Consistent with other literature, the majority of the respondents had been tested for malaria only once during their pregnancy. This aligns with findings of a previous study (Oyerogba *et al.*, 2023), which observed that many pregnant women receive limited malaria testing, which may hinder early detection and intervention. Among those tested, very few received a positive result. This is similar to another study (Olukosi *et al.*, 2020), which reported malaria in less than one-fifth of the pregnant women in similar regions of southwestern Nigeria. This suggests that malaria control efforts, such as the use of insecticide-treated nets (ITNs) and intermittent preventive treatment in pregnancy (IPTp), may be effective (WHO, 2021). Among the women who tested positive, most had a single

positive result, whereas very few of them tested positive twice. These findings are in line with a previous study (Olukosi *et al.*, 2020), which noted that recurrent malaria infection during pregnancy is linked to incomplete treatment adherence and increased exposure to malaria vectors. Most malaria tests were conducted at antenatal clinics. This finding is supported by a previous study (Akpan *et al.*, 2023), which found that integrating malaria testing into routine antenatal care increases detection rates and treatment accessibility.

The majority obtained information from antenatal clinics, emphasising the critical role of healthcare facilities in disseminating knowledge. Studies have shown that antenatal clinics serve as a vital platform for health education on malaria prevention (Azuogu *et al.*, 2021). Furthermore, healthcare professionals were another key source of information, as reported by some of the women. This aligns with findings from another study (Oladimeji *et al.*, 2019), which highlighted that medical personnel significantly influence health awareness among pregnant women. However, knowledge of the causative organism of malaria was limited. This gap in knowledge reflects findings from a previous study (Okafor *et al.*, 2019), which reported similar misconceptions among pregnant women in Nigeria. Similarly, just over half of the respondents correctly identified the female *Anopheles* mosquito as the vector responsible for malaria transmission. This finding is consistent with another study (Awoyesuku *et al.*, 2020), which reported that less than three-quarters of pregnant women in southwestern Nigeria correctly identified the malaria vector.

Moreover, almost half of the respondents associated poor environmental hygiene with malaria vector proliferation. This finding corroborates a previous study (Agyemang-Badu *et al.*, 2023), which emphasised that public health interventions must reinforce the role of sanitation in malaria prevention. Most respondents acknowledged sleeping under insecticide-treated nets (ITNs) as an effective malaria prevention strategy. However, more than half of them understood the broader significance of malaria prevention during pregnancy. This aligns with findings from a previous study (Oyerogba *et al.*, 2021), which noted that while ITN usage is relatively well-known, comprehensive malaria prevention knowledge is often lacking. Additionally, these findings are consistent with studies by two researchers who emphasised that insufficient knowledge of malaria's adverse effects could lead to under-utilisation of preventive measures (Sonibare *et al.*, 2020).

The reported widespread use of ITNs in this study is consistent with previous findings (Demoze *et al.*, 2024), which established that ITNs reduce malaria morbidity in pregnant women. However, among those who did not use ITNs consistently, most of them cited discomfort as a primary reason. This challenge aligns with a previous study (Ameyaw *et al.*, 2020), which revealed that factors such as heat, difficulty in setting up the nets, and perceived suffocation hinder regular ITN usage. While this figure is

encouraging, it highlights the need for more proactive engagement by healthcare workers in educating pregnant women about malaria prevention strategies.

A substantial proportion of respondents admitted to staying outside late at night, thereby increasing their exposure to mosquito bites. According to a previous study (Darda *et al.*, 2024), prolonged outdoor activities at night elevate the risk of malaria transmission, as *Anopheles* mosquitoes are primarily nocturnal. Interestingly, more than one-third of the respondents lived in areas known for high malaria transmission. This suggests that malaria infection is not solely restricted to endemic areas but can also affect individuals in urban and peri-urban regions due to poor environmental conditions (Merga *et al.*, 2020). All respondents reported attending antenatal care (ANC) and health education sessions. This is consistent with previous findings (Olafeju *et al.*, 2019), which highlighted the high ANC attendance among pregnant women as a critical opportunity for malaria prevention education. Despite the availability of ITNs, more than half of the respondents reported sleeping under them. This finding aligns with studies by Idachaba *et al.* (2020), which reported that ITN utilisation among pregnant women remains suboptimal due to discomfort, lack of awareness, and misconceptions about its effectiveness. Furthermore, more than one-third of the respondents reported using mosquito repellents or other protective measures. According to a previous study (Adeneye *et al.*, 2020), limited use of mosquito repellents is often due to cost barriers and a lack of awareness about their efficacy.

Conclusion

Strengthening malaria prevention in pregnancy requires a multifaceted approach that includes enhancing health education, improving access to preventive tools and antenatal services, and addressing socio-economic barriers. Efforts should focus not only on increasing knowledge but also on promoting behaviour change through community-based health interventions and continuous engagement during antenatal care.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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