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PREVALENCE OF MALARIA AND UTILIZATION OF INSECTICIDES TREATED NETS (ITNS) AMONG PREGNANT WOMEN IN YOLA NORTH LOCAL GOVERNMENT AREA ADAMAWA STATE, NIGERIA

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ABSTRACT

Malaria presents a major threat to public health throughout endemic countries of tropical and sub-Saharan Africa. A cross sectional survey was designed to study the prevalence of malaria and utilization of ITNs among pregnant women in Yola north local government area Adamawa State. Structured questionnaire was used to collect information from 1,254 pregnant women who come for ANC for the first visit. Five (5) miles of blood were drown from each consented participant for parasitological and serological analysis which resulted to a malaria prevalence of 15.6%. Highest prevalence of 7.7% was recorded in age group 15-23 years and lowest in age group ≥38 years. For stage of pregnancy, highest prevalence was recorded in third trimester (7.6%) and lowest in first trimester (3.0%). In terms of knowledge of the causes of malaria, more than 60% had correct knowledge that malaria is caused by infected female *Anopheles* mosquito bites. Most common malaria signs and symptoms observed were fever (53.4%) and headaches (24.7%). On the malaria prevention measures use, commonest method use was ITNs (42.3%) and followed by environmental sanitation (25.5%). In terms of utilization of ITNs the previous night before the survey, 78.8% pregnant women reported that they had slept under the ITNs last night while 12.2% reported not using an ITNs the night before the survey. Even though, malaria prevalence recorded was relatively low, there is a need for more awareness creation on modes of transmission and early detection of malaria to mitigate the adverse effects of malaria infection among pregnant women.

Keywords: Malaria, Prevalence, Pregnant women, Yola

INTRODUCTION

Malaria has been described as entirely preventable and treatable blood-borne mosquitoes' transmittable disease. It is transmitted by the bite of an infected female Anopheles mosquito. However, despite continuous global efforts at all levels of health care to achieve global control, it still remains endemic in tropical and subtropical region, though with decreasing trend (World Health Organization [WHO], 2020). Malaria remains a wide spread health threat to humanity, affecting more than halve of the entire humanity. Human malaria is caused by the infection of at least one of the five Plasmodium species, including Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae, and Plasmodium knowlesi: a zoonotic malaria which naturally infect macaques' monkeys such as the long-tailed and pig-tailed macaques (Srinivas, 2015). Falciparum is the most virulent. It was estimated that more than 50% of the population in endemic African region experience at least one episode of malaria yearly. World Health Organization projected that in 2020, there were an estimated 56 malaria cases for every 1000 people at risk of the disease (WHO, 2019). Nigeria has the world's highest total number of people affected by malaria. With over 50 million cases reported each year, Nigeria accounts for 27 percent of the malaria global burden and 23 percent of global deaths (Khetsuriani et al. 2023; Oyeyemi & Etim, 2020; Chukwuocha et al., 2019; Onyiah et al., 2018). Malaria is most severe among pregnant women and children under-five in Nigeria, accounting for 95,000 annual child deaths - the leading cause of child mortality (Dasgupta et al., 2021). There is a much higher prevalence of malaria among anaemic children under-five than non-anaemic children (Ugwu & Zewotir, 2020; Morakinyo et al, 2018). The under-fives and pregnant women are particularly vulnerable to the disease because of undeveloped immunity in them and reduce immunity due to psychological changes that normally takes place in a women during pregnancy respectively. Malaria often contributes to neonatal and maternal. The aim of this research was to carry out an epidemiological study on malaria, hepatitis B and coinfections among pregnant women in Yola North Local Government Area, Adamawa State.

MATERIALS AND METHODS

Study Area

The study was conducted in Yola-North Local Government Area which has a population of 336,648 (NPC 2006) and it is located in central zone of Adamawa State which lies between latitudes 9º, 11'N to 9ºN and longitudes 12º 20'N to 12º 39'N covering a tropical climate marked by dry and rainy season. Maximum temperature in Yola-north can reach 40ºC around April and minimum temperature could be as low as18.3ºC between December and early January. Relative humidity in the areas is about 26% in the month of January while February is the lowest, with high relative humidity valves of 58, 69, 79, 79, 77, and 66 respectively could be recorded during the month of May to October, particularly during the month of July and August as the peak with about 80% relative humidity (Adebayo, 1999). Yola-north is both an administrative center and agrarian community. The major occupations of resident are civil servant, farmers and traders. The common agricultural products cultivated in this area include; vegetables, rice, maize and most farmers use refuses as fertilizers on their vegetable farms. Their major sources of drinking water are table, sachet and borehole water. Yola north is an endemic area for malaria with transmission all year round and peak during the rainy season. The town has River Benue that provides a breeding ground for the vector. Moreover, socio-economic crisis and the collapse of health services among others in the geopolitical zone have left a

good number of pregnant women with limited access to antenatal health services and poor environmental hygiene.

Determination of Sample Size

The sample size for this study was determined using the formula suggested by (Lwanga & Lemeshow 1991) adapted by Enock et al. (2021). It stated that for a population greater than 10,000, the following formula is applicable

$n = \frac{z^2pq}{d^2}$

where

n = The desired sample size (when population is greater than 10,000)

z = The normal standard deviation, usually set at 1.96 which corresponds to 95 percent confidence level.

P = Proportion in the target population estimated to have a particular characteristic. If there is no reasonable estimate, then use 50% (0.5). However, in this study, HBV and malaria prevalence of 8.7% (Yim et al. 2021) and 8% (Tesfu et al. 2022) respectively among pregnant women were used to determine the sample size.

q = 1.0-p

d = Degree of accuracy desired usually set at 0.05

Using the above formula,

$n = \frac{z^2pq}{d^2} = \frac{(1.96)^2 \times 0.08(1-0.08)}{(0.05)^2} = 113$

Therefore, a total of 1,254 pregnant women were sampled; 114 from each of the 11 PHCCs located in all the ward headquarters in Yola north local government, Adamawa State). *Ethical Clearance:* Approval was sought and obtained from the State Ministry of Health Yola and the managements of each sampling primary health care centers. Consent letter was administered to each of the participating subjects after clearly informing them about the objectives as well as the aim of the research. They were also informed of their right to participate or withdraw from the research before, during and even after the research with no consequence. They were also educated on the confidentiality of the results of the research.

Research Design and Sample Population

The study was conducted from October, 2021 to June, 2023. For good representation, 1 primary health care center was selected from each of the 11 wards in Yola North Local Government Area to participate in the study. All the pregnant women attending ANC in Ward head quarter phccs for the first time during the present pregnancy were eligible for the study. Healthy pregnant women who have not consented for their blood to be collected were excluded in the study.

Blood Sample Collection

Five milliliter (5ml) of blood was collected via venipuncture with the help and assistance of 2 Medical Laboratory Scientists using the vacutainer needle. The blood collected was placed in ethylene diamine tetra-acetic acid (EDTA) and will be taken to the respective laboratories for serological analysis and parasitological examinations.

Thick film staining and observation

Giemsa stain (3%) of pH7.0 was poured on each thick blood smear and allowed to stand for 30-40 minutes on a staining rack (Cheesbrough, 2006). The stained films were then washed using buffered distilled water. The slides were drained on a filter paper and air-dried. The stained slides were examined microscopically for malaria parasites using oil immersion (x100) objective as described by Cheesbrough 2006). The number of asexual malaria parasite found on the slide were counted per 200 leucocytes and recorded

Parasite Density Determinations

Parasite densities were recorded as a ratio of parasites to WBCs in thick films. Plasmodium parasites were counted against 200 WBC on the thick films. Five hundred WBCs were counted where less than nine parasites were counted after counting against 200 WBC. Parasite densities (parasite/µl of whole blood) were then calculated as follows:

$$= \frac{\text{Number of parasites counted}}{\text{WBC counted}} \times \frac{\text{WBC count}}{\mu\text{l of participant}}$$

RESULTS AND DISCUSSION

Table1 shows malaria prevalence of 15.6% out of the total 1254 pregnant women recruited for the study.

Table 1: Prevalence of malaria, hepatitis B and coinfection among pregnant women in Yola north L.G.A. Adamawa State

Variables	Malaria	
	Frequency	**Percentage (%)**
Positive	195	15.6
Negative	1059	84.4
Total	**1254**	**100**

Prevalence of malaria among the respondents

Malaria disease is dangerous especially in infection with P. falciparum is more hazardous during pregnancy (Rogerson, Desai, Mayor, Sicuri, Taylor & Eijk, 2018). Pregnancy increases the risk of severe disease for women infected with malaria due to immune suppression (Chua, et al. 2021). In this current study, an overall prevalence of 15.6% was recorded out of total 1254 pregnant women sampled. The 15.6% malaria prevalence reported in this study was similar to other studies carried out among pregnant women by Tegegne, et al. (2019) in India, Gontie et al. (2020) in west Ethopia and Dosoo, Chandramohan & Atibilla (2020) in Ghana with malaria prevalence of 12.72, 11.4, 10.2 and 20.4% respectively. Related studies of malaria prevalence by Lopez-Perez, et al. (2016) in Colombia, Oyerogba, et al. (2023) in Nigeria, Duguma, et al. (2023) in southwest Ethopia et al. (2019) in north easterm Nigeria recorded a lower malaria prevalence of 5.8%, 8.7%, 7.2% and 4.3% among pregnant woman. In contrast to the15.6% malaria prevalence reported in this study, prevalence rates of 40, 41 and 26% where reported by Muhammad, et al. (2016) in north easterm Nigeria, et al. (2019) in southern Nigeria and Mangugho, et al. (2023) in north western Uganda respectively. The variations in malaria prevalence rate reported in this study compare to other similar studies across different part of the world could be attributed to differences in geographical location, atmospheric conditions at a particular time across the globe which favour the breading of mosquitoes (Abah & Udoidang 2019).

Also, table 2 displays the prevalence of malaria in relation to obstetric data. With respect to age (years), highest malaria prevalence (7.7%) was recorded in age group 15-23 years and

least (0.3%) in age group ≥38 years. Age group 24-30 years and 31-37 years recorded malaria prevalence of 4.3% and 3.2% respectively. There was significant association between age and malaria infection (p=0.001). Considering stage of pregnancy, third trimester recorded highest malaria prevalence of 7.6% followed by second trimester (5.0%) and least (3.0%) in first trimester with highly significant association (p=0.000). In terms of parity, malaria prevalence was recorded in the order 4.5%. 3.3% and 7.7% for primigravidae, secungravidae and multigravidae with significant association (p=0.002).

Table 2: Prevalence of malaria in regards to obstetric characteristics in Yola north L.G.A. Adamawa State

Variables	Number Examined (%)	Malaria infection		χ^2	p-value
		Pos. (%)	Neg. (%)		
Age					
15-23	516(41.1)	97(7.7)	419(33.4)	15.752	**0.001**
24-30	510(40.7)	54(4.3)	456(36.4)		
31-37	200(15.9)	40(3.2)	160(12.8)		
≥ 38	28(2.2)	4(0.3)	24(1.9)		
Total	**1254(100)**	**195(15.6)**	**1059(84.4)**		
Stage of pregnancy					
First trimester	230(18.3)	37(3.0)	193(15.4)	21.313	**0.000**
Second trimester	580(46.3)	63(5.0)	517(41.2)		
Third trimester	444(35.4)	95(7.6)	349(27.8)		
Total	**1254(100)**	**195(15.6)**	**1059(84.4)**		
Parity status					
Primagravidae	450(35.9)	57(4.5)	393(31.3)	12.110	**0.002**
Secungravidae	320(25.5)	41(3.3)	279(22.2)		
Multigravidae	484(38.6)	97(7.7)	387(30.9)		
Total	**1254(100)**	**195(15.6)**	**1059(84.4)**		

Pearson Chi-square (χ^2), P<0.05 is considered significant, Pos.= positive, Neg.= negative, % = percentage

Prevalence of malaria according to age

Age group 15-23 years recorded highest malaria prevalence of 7.7% while age range ≥38 years had the least malaria prevalence of 0.3%. This report agrees with findings of Fana et al. (2015) who reported highest malaria prevalence of 51.6% among age groups 14-20 years and least prevalence of 30.6% among age range 35-41years and Damen and Daminabo (2017) with prevalence of 2.0% among age group 20-23 years and lowest prevalence of 0.4% among age group 36-39 years. Also, Pindar et al. (2023) reported highest malaria prevalence of 56.34% among younger pregnant women with age group 21-30 years while age group 51-60 years had lowest prevalence of 0.2% which is consistent with the current report in this study. However, Muhammad and Ismail (2022) conducted a similar study of malaria prevalence among pregnant women attending Kwadon Primary Health Care Yamaitudeba Local Government Area Gombe State where highest prevalence of 40.00% was reported among older pregnant women (≥36 years) and age group 10-15 years had least prevalence of 14.29%. Other authors who reported inconsistent prevalence of malaria among pregnant women include Ekwebene, et al. (2021) with highest prevalence of 33.0% (age group 28 -31 years) and lowest prevalence of 2.3% among group 16-19 years and Abigail, Aminu and Abdullahi (2021) with highest prevalence of 42.9% reported among age range 36-40 years while those in age group 21-26 years had least prevalence of 12.5%. The differences in prevalence among these age groups may be attributed to the level of acquired immunity which increase with age and this could confer protection against malaria infection as they advance in age (Rogerson et al. 2018). The highest prevalence of malaria in this age group (15-23 years) may also be because most of the women got pregnant for the first time and there are physiological and immunological changes that could predispose them to be more vulnerable to malaria infections especially infection with p. falciparum (Deress and Girma, 2019). This finding is consistent with global reports regarding adolescent pregnancy, which noted that younger mothers often face an increased risk of health-related problems associated with lack of sufficient education

Prevalence of malaria according to parity

In regard to parity, the present study reported highest malaria prevalence rate of 7.7% among multigravidae and lowest malaria prevalence rate of 3.3% among primigravidae. This report is almost in line with similar study by Simon-Oke, et al. (2019) who reported a malaria prevalence rate of 41.7% among multigravidae and 37.5% among primigravidae in Ekiti, Southwestern Nigeria. Also, Enock et al. (2020) reported malaria prevalence rate of 26.7% among multigravidae and 21.6% among primigravidae. In contrast to in this current study, Fana et al. (2019) reported highest prevalence rate of 18.2% among primigravidae and lowest prevalence rate of 12.9% among multigravidae in semi urban community of northwestern Nigeria but no significant association between parity and occurrences of malaria (p>0.05). Another study that appeared to be inconsistent with the findings from this present study was carried out by Cisse, et al. (2014) in India who reported highest malaria prevalence rate of 28.8% among primigravidae and lowest rate of 11.2% among multigravidae. Multigravidae was more vulnerable to malaria infection than primigravidae in this study by having the highest prevalence rate with significant association (x^2 = 2.110, df =2, p = 0.002). This may be as a result of low level of specific immunity to malaria infection and the immunological changes in host during pregnancy.

Prevalence of malaria according stage of pregnancy

Pregnant women in their first trimester usually have more changes of severe malaria infection. According to the present study, malaria prevalence rate of 7.6% was recorded among pregnant women in third trimesters. Contrary to report in this study, Muhammed and Ismail (2020) and Enoch et al. (2020) reported highest malaria prevalence rate of 27.9% and 28.57%

respectively among pregnant women. Moreover, Gontie et al (2020) reported highest malaria prevalence of 2.7% and 20.9% among pregnant women in their third and second trimesters respectively.

Table 3 presents malaria knowledge and preventive measures use in regards to malaria infection among pregnant women. Most important malaria factors such as mode of transmission, common symptoms, effects on pregnancy and prevention measures use were all highly significantly associated with malaria infection (p=0.000). However, in the study, causes of malaria recorded no association with malaria infection (p=0.065). As presented in table 3 with respect to causes of malaria, highest prevalence of 7.7% was recorded among those who stated that malaria is cause by an infected female Anopheles mosquito whereas, least prevalence of 0.2% was recorded among those who stated that malaria is cause by staying under the sun. The reason for high prevalence for malaria among those with correct knowledge of the cause of malaria could be that they not translate the knowledge into good practices. In terms of malaria mode of transmission, highest prevalence (10.0%) was recorded among those who are aware that malaria is transmitted through mosquito bites and least (0.3%) was recorded among those who said that malaria is transmitted in the air. In view of common malaria symptoms, prevalence of 9.6% was recorded among those who asserted that the common symptom is fever and 0.3% was also recorded among those we agreed that common symptoms for malaria is chills. Considering effects of malaria in pregnancy, those who asserted that malaria affects baby in the womb, risks miscarriage, low birth weight and vulnerability to other diseases recorded prevalence of 6.6%, 2.8%, 4.7%, and 1.4% respectively. Additionally, in terms of prevention measures use, highest malaria prevalence of 39.0% was observed among those who use chemicals/insecticide in preventing malaria follow by 5.8%, 4.6% 0.9% and lowest prevalence of 0.3% among those who use ITNs, environmental sanitation, protective clothing and taking antimalarial drugs respectively.

Table 3: Association of Malaria Knowledge and Preventive Measures Use in Regards to Malaria Infection among Pregnant Women in Yola North L. G. A. Adamawa State

Variables	Categories	Malaria		Total(%)	χ^2	P-value
		Pos. (%)	Neg. (%)			
Causes of malaria/transmission	Mosquito bite	126(10.0)	794(63.3)	920(73.4)	21.765	**.000**
	Stagnant water	64(5.1)	200(15.9)	264(21.1)		
	Staying under the sun	1(0.1)	26(2.1)	27(2.2)		
	I don't know	4(0.3)	39(3.1)	43(3.4)		
Common malaria symptoms	Headache	44(3.5)	266(21.2)	310(24.7)	8.740	.068
	Vomiting	13(1.0)	127(10.1)	140(11.2)		
	Fever	120(9.6)	550(43.9)	670(53.4)		
	Joint pain	14(1.1)	77(6.1)	91(7.3)		
	Chills	4(0.3)	39(3.1)	43(3.4)		
Effects of malaria in pregnancy	Affect baby in the womb	83(6.6)	567(45.2)	650(51.8)	22.330	**.000**
	Risk of miscarriage	35(2.8)	205(16.3)	240(19.1)		
	Low birth weight	59(4.7)	171(13.6)	230(18.3)		
	Vulnerability to other diseases	18(1.4)	116(9.3)	134(10.7)		
Malaria prevention measure use	Use of ITNs	73(5.8)	457(36.4)	530(42.3)	20.88	**.000**
	Use of protective clothing	11(0.9)	129(10.3)	140(11.2)		
	Environment sanitation	58(4.6)	262(20.9)	320(25.5)		
	Spray chemicals/insecticides	49(39.0)	163(13.0)	212(16.9)		
	Taking antimalarial drugs	4(0.3)	48(3.8)	52(4.1)		

Pearson Chi-square (χ^2), P<0.05 is considered significant, Pos.= positive, Neg.= negative, % = percentage

Malaria knowledge and preventive measures use

On the malaria prevention measures use by the pregnant women in this study, common methods used were ITNs (42.3%) and environmental sanitation (25.5%). These two methods are proven to be effective in prevention of malaria as use of ITSs provides barrier to coming into contact with the female *Anopheles* mosquitoes while environmental sanitation clears the breeding sites for the mosquitoes. However, the use of IPTp which is highly recommended by WHO as one of the recent preventive measure against malaria was not common (4.1%) among pregnant women as reported in this study. Other prevention measures studied in this current study includes use of protecting clothing (11.2%) and spray of chemicals/insecticides (16.9%). In a study carried out by Yaya, et al. (2017), a majority of the women (84.7%) reported taking antimalarial drugs during pregnancy which is higher than what is obtainable (4.1%) in this current study. Similar to findings in this study, Abdirahman, et al. (2022) reported malaria prevention strategies used by pregnant women which involved mosquito repellant (12.2%) and protective clothing (15.5%). Therefore, a timely intervention strategy is mandatory and should focus on the WHO recommended three-pronged approach for malaria prevention in pregnancy, which includes ITNs, IPTp and case management to achieve optimum reduction in malaria among pregnant women. In addition to this, because a small portion of pregnant women

use IPTp as a measure for malaria prevention, health care providers should work on since the administration of SP to the pregnant women has already demonstrated significant reductions in the morbidity and mortality of malaria in pregnancy. In respect to malaria knowledge of sign and symptoms among the participants, the most frequently reported included fever (53.4%) and headaches (24.7%). Other sign and symptoms were vomiting (11.2%), joint pain (7.3%) and chills (4.4%). Relatively, Yaya et al. (2017) reported fever and vomiting as the most common symptoms of malaria and nearly 10% and 28% symptoms such as jaundice and headache respectively. Correspondingly, the most frequently reported signs and symptoms of malaria included headaches (78%), fever (54%), feeling cold (60%) and vomiting (30%). Approximately 63% of the participants were able to correctly identify three or four of the symptoms (Manana, et al. 2017). Consistent with the report of this current findings, most common sign and symptoms of malaria reported (34%) were headache and fever (Ikegbunam, et al. 2022). However, presentation during pregnancy depends on the stability of transmission in the area the pregnant women resides. In areas of episodic transmission, where women have developed little immunity can become quite sick if infected wi The prevalence of ITN ownership among the studied pregnant women was 88.4%. The majority (55.9%) who own an ITN obtained it during public malaria campaigns. Other sources of ownership were; during ANC visit (19.2%), during child immunization (8.0%), purchased in the market (9.5%) and other sources (7.4%). The 88.4% of ITN ownership in this study correspond with similar studies among pregnant women reported by Taremwa et al. (2017), Munisi, et al. (2019) and Forty and Keetile, (2022) in Malawi (80.00%), in Southwestern Uganda (84.00%) and in Malawi (64%) respectively. Similarly, an ownership prevalence of 83.2% among pregnant women in Nigeria (Duut, and Alhassan, 2022) and 69.3% in Ghana (Okafor and Ogbonnaya, 2020) which corroborates with ITN ownership prevalence of 88.4% reported in this study. However, ITN ownership of 88.4% documented in this present survey is higher than report by Ogomaka and Obeagu, (2021) who reported ownership of 42.2% among pregnant women in Orlu L.G.A Imo State, Nigeria, 38.6% in Abia State Nigeria (Ezeigbo, et al. 2016) and 44% in Guinea (Diallo, et al. 2023). Though it may be argued that for sustainability, government and donor agencies cannot perpetually fund free distribution of nets. However, this assumption is supported by findings from various studies where free distribution has been shown to result in greater ownership, better usage and increased socioeconomic equity distribution that achieve by selling ITNs (Aderibgibe, et al. 2014).

In table 4, logistic regression presents ownership and utilization of ITNs among the study participants according to PHCCs. Yelwa phcc had highest ITNs ownership of 98.2% while Rumde and Nassarawo phccs had lowest ITNs ownership of 78.9% each with significant association (p=0.000). In terms of frequency of usage of ITNs, 86.0% of pregnant women who own ITNs in Luggere phcc use them so often. However, lowest frequency of 62.3% ITNs usage was recorded among participants in Yelwa phcc with significant association (p=0.004). In terms of using ITNs, 99.1% of pregnant women slept under ITNs the previous night while 42.1% of pregnant women from Doubeli recorded lowest percentage with significant association (p=0.000).

Table 4: Level of Ownership and Utilization of ITNs According to PHCCs among Pregnant Women in Yola north L. G. A. Adamawa State

Name of PHCC	Ownership of ITNs		p-value	Frequency of using ITNs		p-value	Use ITNs previous night		p-value
	Yes (%)	No (%)		Often(%)	Occasionally (%)		Yes (%)	No (%)	
Ajiya	103(90.4)	11(9.6)	**0.000**	73(64.0)	41(36.0)	**0.004**	50(43.9)	64(56.1)	**0.000**
Alkalawa	100(87.7)	14(12.3)		86(75.4)	28(24.6)		63(55.3)	51(44.7)	
Doubelli	105(92.1)	9(7.9)		82(71.9)	32(28.1)		48(42.1)	66(57.9)	
Gwadabawa	97(85.1)	17(14.9)		75(65.8)	39(34.2)		85(74.6)	29(25.4)	
Jambutu	102(89.5)	12(10.5)		84(73.7)	30(26.3)		95(83.3)	19(16.7)	
Limawa	102(89.5)	12(10.5)		71(62.3)	43(37.7)		105(92.1)	9(7.9)	
Luggere	101(88.6)	13(14.4)		98(86.0)	16(14.0)		107(93.9)	7(6.1)	
Malamre	107(93.9)	7(6.1)		88(77.2)	26(22.8)		113(99.1)	1(0.9)	
Nassarawa	90(78.9)	24(21.1)		79(69.3)	35(30.7)		108(94.7)	6(5.3)	
Rumde	90(78.9)	24(21.1)		84(73.7)	30(26.3)		106(93.0)	8(7.0)	
Yelwa	112(98.2)	2(1.8)		76(66.7)	38(33.3)		108(94.7)	6(5.3)	
Total	**1109(88.4)**	**145(11.6)**		**896(71.5)**	**358(28.5)**		**988(78.8)**	**266(21.2)**	

PHCC: primary health care, ITNs: Insecticide treated nets, %: percentage, p-value <0.05 is considered statistically significant.

The survey found out that 896 (71.5%) of pregnant mothers reported using ITNs. The highest and lowest values were seen in Luggere Phcc 98(86.0%) and Limawa Phcc 71(62.3%). This utilization is similar to that of other nations like the Democratic Republic of the Congo (71.4%) Reported by Inungu, et al. (2022), Muzambique (68.4%) reported by Moon, et al. (2016) and Ghana (61%) reported by Ernst, Erly, et al. (2017) but lower than report in other malaria-endemic nation like Ethiopia (39.9%) as documented by Tesfaye, et al. (2022). However, a logical argument would be that different countries have varied malaria management tactics since they have diverse malaria risk levels due to varying climatic and geographic conditions. Additionally, the time of year during which data was gathered may be a factor, since more people use mosquito nets when malaria transmission is at its highest, which typically coincides with wet/rainy seasons (Karema, et al. (2020). This emphasizes how important it is to maintain bed net availability, early procurement, and education/sensitization on mosquito bed net usage. Prior studies, and this study descriptive results have shown that access remains a major impediment to the use of mosquito bed nets; consequently, a readily available supply greatly enhances their use (Bhatt, et al. 2015).

In terms of usage of ITN prior to the survey, more than seven out of ten (78.8%) pregnant women reported that they had slept under the ITNs last night while 12.2% pregnant women

reported not using an ITN the night before the survey. The report of pregnant who slept under ITN previous night before the survey is comparable with 82.2% in Estern Ethopia (Tesfaye et al. 2022), 71.4% in Democratic Republic of the Congo (Inungu, et al. 2017) and 70% in South-Eastern Nigeria (Okafor and Ogbonnaya, 2020). However, the result is lower than other report of researches conducted in Zambia (50.8%) by Mwangu, et al (2022), in Southern Ethopia (56.89%) by Nadew, et al. (2022) and in Myanmar (46.6%) by Maung et al. (2018). was reported among pregnant women in Zambia Mwangu, Mapuroma and Ibisomi 2022). Similarly, lower rates of 18.4% (Aung, Win and Show, 2022) and 21.1% (Ngouakam, et al. 2021) of pregnant women were reported in Myanmar and Bonassama who slept under ITNs previous night, in contrast to the finding of this study. The differences in the usage rate between the present study and others could be explained by the difference in the cultural beliefs and the study population. More so, the differences in the usage rate in the various study populations mentioned earlier may reflect the availability and the level of compliance and awareness of the use of ITNs for the prevention of malaria (Ajegena and Oti, 2020). The non-usage of an ITN among few respondents (12.2%) in this study may be attributed to many factors, including the heat or elevated night temperature, fear of chemical and non-accessibility to ITNs due to high cost (Koenker, et al. 2019).

CONCLUSION

Malaria prevalence was low among the pregnant women studied. Pregnancy increases the risk of severe disease for women infected with malaria due to immune suppression. The presence of malaria has been known to influence the progression of either malaria, hepatitis b or both diseases. In regard to obstetric characteristics, age, parity and stage of pregnancy had significant association with malaria ($p<0.05$). Comparatively, malaria knowledge on cause/mode of transmission, signs and symptoms, effect in pregnancy and preventive strategies used was high among the study participants. The appropriate use of insecticide-treated nets (ITNs) has been regarded as a successful, cost-effective, and efficient method of controlling malaria. This explains why the Federal Government of Nigeria and non-governmental organizations (NGOs) embarked on the provision and distribution of ITNs to vulnerable groups and to the entire population at large. This will enhance ITN ownership among pregnant women and eventually increase usage. More awareness campaign should be intensified among pregnant women during ANC visits on the three-fold recommended prevention strategies (use of ITNs, IPTp and SMC) of malaria.

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