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Original Research Article

Assessment of the Prevalence of Malaria and Its Associated Risk Factors Among Pregnant Women Attending Antenatal Clinics in Jalingo and Takum Local Government, Taraba State, Nigeria

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ABSTRACT

Malaria infections are co-endemic throughout most of the tropical and sub-Saharan Africa and present a major threat to public health. This study was conducted to determine the prevalence of malaria co-infection in pregnant women attending antenatal clinics in Jalingo and Takum Local government Areas, Taraba State, Nigeria. The study was conducted in Jalingo and Takum Local Governments Areas between September, 2018 to December 2018. A total of five hundred and twenty (520) pregnant women were screened on antenatal day. Prepared thick films using Giemsa staining technique were examined microscopically for the presence of malaria parasites. A questionnaire was also prepared to collect demographic data and some risk factors. The prevalence of Malaria in Jalingo (75.6%) and Takum (79.5%). Malaria infection based on age distribution showed that age group 31-35 had the highest malaria infection (83.6%) while age group < 41 had the least malaria infection (56.5%). This result showed no significant difference between age distribution of malaria Infection based on educational status showed those without Formal Education had the highest prevalence (88.8%) and (19.4%) for Malaria. Occupational related prevalence showed that Traders had the highest prevalence of (86%) and (17.2%) for Malaria $\chi^2_{= 10.346}$ (P.>0.5). pregnancy status also showed varied infection rates, those in their first trimester had the highest prevalence (84.2%) for Malaria but there was no significant difference (P>0.5) between pregnancy status. There was also a significant difference in infection between blood group and Malaria, blood group Ohad the highest prevalence of (90.9%). Association between infection and some risk factors showed that malaria infection is significantly related to fleeting of room with insecticide (O. R= 1.285,), Receive blood transfusion. (O. R=1.645), presences of stagnant water (O. R= 1.170), Malaria control in pregnancy is necessary so as to reduce the incidence of adverse pregnancy complications. The use of long lasting insecticide treated nets should be intensified.

Keywords: Malaria infection, antenatal, pregnant women, Jalingo and Takum, Nigeria.

INTRODUCTION

Malaria is a mosquito-borne disease caused by a protozoan of the plasmodium species. There are four different species of plasmodium that cause malaria, *Plasmodium falciparum* (which is the most fatal), *P. vivax*, *P. malariae*, and *P. ovale*. When initially infected, parasites first enter the liver, then multiply quickly and enter the bloodstream, where they continue to multiply and rupture blood cells. While *P. falciparum* causes the most severe symptoms, *P. vivax* and *P. ovale* can cause chronic malaria (Du Preez, 2016; CDC, 2018). Malaria remains a major health threat worldwide, with pregnant women and children under five bearing the major burden of the infection. In Nigeria, malaria has been known to account for 11.5% of maternal death (Adeleke *et al.,* 2013). *Plasmodium falciparum,* the predominant and most virulent malaria species in Nigeria has been identified as major cause of low birth weight, still births, spontaneous abortion or death of the susceptible pregnant women (Autino *et al.,* 2012).

The complications of malaria and hepatitis B Virus infection are more pronounced among immune -compromised patients such as pregnant women and HIV infected individuals. These infectious diseases cause similar adverse pregnancy outcomes which include spontaneous abortion, still birth or death of the pregnant women (W.H.O, 2015). Therefore, early diagnosis of these deadly infections through screening among the pregnant women is crucial to the ongoing efforts and campaign on the reduction of maternal and child mortality in Nigeria.

HBV stimulates a potent pro-inflammatory Type 1 immune response (Th1), which is of paramount importance for Plasmodium clearance; however, it is also incriminated in disease severity (Gasimand Adam2015). Whilst challenging, data on the effects of HBV on the clinical presentation of malaria are scarce.

Infection due to *Plasmodium falciparum* is a serious public health threat in sub-Saharan Africa. Malaria endemic foci are often times affected by other infectious agents which may contribute to the clinical episodes of the disease (Oyetunde and Angela 2015). Hepatitis B virus is one of such infectious agents that coexist with *P. falciparum* in most endemic areas. Although the accurate infection status due to hepatitis B virus infection is not yet known, an estimated 350 million persons worldwide are chronic carriers (W.H.O., 2018) Since both infectious agents make use of host liver cells for intracellular multiplication, parasites induced direct or immunologically mediated interactions in concurrent infections could potentially escalate or inhibit progression of both infections.

Malaria is a life threatening parasitic disease transmitted by female anopheles' mosquitoes. It is the most highly prevalent tropical disease, recording high morbidity and mortality with high economic and social impact. Malaria needlessly kills 900,000 people each year. In Africa, a child dies from malaria every thirty seconds. Beyond this devastating human toll, malaria undermines the economic potential of local economies and overwhelms public health systems – accounting for up to 40% of health spending in many African countries. As global warming and population displacement trends accelerate, an additional 260-320 million people worldwide could be living in malaria-infested areas by 2080 (Oyetunde and Angela 2015).

Malaria has been recognized as a severe and life-threatening illness for thousands of years. It still is one of the most common diseases affecting humans worldwide (Weatherall, 2010). The major impact of the disease is almost entirely on the developing countries, with the heaviest burden in Africa. Almost half of the total world population is exposed to the risk of contracting malaria. Malaria is a life-threatening disease which in 2010 killed more than 600,000 individuals, mainly children under 5 years of age, and pregnant women. All the clinical symptoms of malaria are the consequence of infection of human erythrocyte by merozoites (Crosnier *et al.*, 2011). Most of the fatal cases, which predominantly occur in *P. falciparum* infections, are due to severe anaemia or cerebral malaria, but different clinical manifestations also exist and vary in severity and outcome, depending on the parasite species, the organ involved and the access to care (Waller *et al.*, 2017).

Principal mode of spread of malaria is by the bites of female *Anopheles* mosquito. Of more than 480 species of *Anopheles*, only about 50 species transmit malaria, with every continent having its own species of these mosquitoes: *An. gambiae* complex in Africa, *An. freeborni* in North America, *An. culicifacies, An. fluviatilis, An. minimus, An. philippinensis, An. stephensi,* and *An. sundaicus*in the Indian subcontinent *An. leucosphyrus, An. latens, An. cracens, An. hackeri, An. dirus* etc., have been identified as the vectors for the transmission of *P. knowlesi* (Singh *et al.*, 2014).

Human malaria occurs by transmission of *Plasmodium* sporozoites via a bite from an infected anopheline mosquito. The sporozoites travel from the salivary glands of the mosquito through the bloodstream of the host to the liver, where they invade hepatocytes. These cells divide many 1000-fold until mature tissue schizonts are formed, each containing thousands of daughters merozoites. This exo-erythrocytic stage is asymptomatic (Milner *et al.*,2014).

The liver schizonts rupture after 6 to 30 days; 98 percent of patients experience liver schizogony by 90 days (there is typically a longer liver phase in species other than *P. falciparum*). This event releases thousands of merozoites into the bloodstream, where they invade red blood cells (the erythrocytic or asexual stage). *P. falciparum* may invade any red cell, while *P. vivax* and *P. ovale* prefer the younger, slightly larger reticulocytes. The merozoites mature successively from ring forms to trophozoites to mature schizonts (asexual forms) over 24 hours (*P. knowlesi*), 48 hours (*P. vivax*, *P. ovale*, *P. falciparum*), or 72 hours (*P. malariae*). Within red blood cells, the parasites digest hemoglobin. As hemoglobin is digested, the toxic metabolite hemozoin (a polarizable crystal) is formed and isolated in the parasite's food vacuole.

An adult female mosquito mates with a male once in her life time. She then stores the sperm for the duration of her life, which is up to 100 days. Within a single feeding, a female has the ability to lay up to 200 eggs or more every 7 days, it can survive without water up to 8 months. There are 2 life cycle stages a mosquito goes through once submerged in water: larva and pupa

Mosquito eggs can easily be mistaken for black dirt stuck to the side of a container and overlooked. But once the eggs are submerged in water, the life cycle begins. The next life stage of a mosquito is the larva; they remain in this state for 5 days. After molting three times, the larva becomes a pupae. Mosquitoes are pupae for up to 4 days. It is within these few days that they develop into adult mosquitoes and emerge out of the pupal skin and to the surface.

Once mosquitoes have emerged from the water, they remain on the surface of the water for a short period of time to dry off their wings and allow their body to harden. In a couple of days, mosquitoes are ready to breed and feed and start the cycle once again. Unfortunately for males, they only live for a week; meanwhile, the females live up to 100 days.

The intracellular parasites modify the erythrocyte in several ways. They derive energy from anaerobic glycolysis of glucose to lactic acid, which may contribute to clinical manifestations of hypoglycemia and lactic acidosis (Milner *et al.*, 2014). Parasites reduce red cell membrane deformability, resulting in hemolysis and accelerated splenic clearance, which may contribute to anemia. Alterations to uninfected red blood cells, such as the addition of *P. falciparum* glycosylphosphatidylinositol (GPI) to the membrane, may play a role in increased clearance of uninfected cells and contribute to anemia.

The habit of most of the anopheline mosquitoes have been characterised as anthropophilic (prefer human blood meal), endophagic (bite indoors), and nocturnal (bite at night) with peak biting at midnight, between 11 pm and 2 am. The blood meal from a vertebrate host is essential for the female mosquitoes to nourish their eggs. The mosquitoes find their host by seeking visual, thermal, and olfactory stimuli and of these; carbon dioxide, lactic acid, skin temperature, and moisture are the more important mosquito attractants. Depending on the strength of these stimuli, the attractiveness of different persons varies, with adults, men, and larger persons being more attractive than others (Benoit *et al.*, 2011; Takem and Alessandro 2013).

Rarely can malaria be spread by the inoculation of blood from an infected person to a healthy person (W.H.O., 2016). In this type of malaria, asexual forms are directly inoculated into the blood and pre-erythrocytic development of the parasite in the liver does not occur. Therefore, this type of malaria has a shorter incubation period and relapses due to persisting exoerythrocytic forms do not occur (Langhorne *et al.,* 2008; Sauerwein *et al.*, 2011). Other modes of transmission of Malaria includes

Statement of the Problem

Malaria is a major public health problem responsible for maternal mortality among pregnant women, low birth weight, still birth, spontaneous abortion and pre-matured birth. Malaria accounts for more cases and deaths than any other country in the world. Malaria is a risk for 97% of Nigeria's population. The remaining 3% of the population live in the malaria free highlands (W. H. O., 2018). There is an estimated 100 million malaria cases with over 300,000 deaths per year in Nigeria. This compares with 215,000 deaths per year in Nigeria from HIV/AIDS. Malaria contributes to an estimated 11% of maternal mortality (Liu *et al.*, 2012; Singh and Sehgal, 2018; W. H. O., 2018).

Nigeria suffers the world's greatest malaria burden, with approximately 51 million cases and 207,000 deaths reported annually (approximately 30 % of the total malaria burden in Africa), while 97 % of the total population (approximately 173 million) is at risk of infection (Dawaki *et al.,* 2016). Moreover, malaria accounts for 60 % of outpatient visits to hospitals and is responsible for approximately 11 % maternal mortality and 30 % child mortality, especially among children less than 5 years (Nas *et al.,* 2017). Since 2008, the National Malaria Control Programme (NMCP) in Nigeria adopted a specific plan, the goal of which was to reduce 50 % of the malaria burden by 2013 by achieving at least 80 % coverage of long-lasting impregnated mosquito nets (LLINs), together with other measures, such as 20 % of houses in targeted areas receiving indoor residual spraying (IRS), and treatment with two doses of intermittent preventative therapy (IPT) for 100 % of pregnant women who visit antenatal care clinics (Nigeria Strategic Plan 2009-2013. Because of these measures, the percentage of households with at least one LLIN increased to over 70 % by 2010, compared to only 5 % in 2008 (National Malaria Programme, 2008 – 2016). Although previous studies have documented a high prevalence of malaria throughout Nigeria (PRESIDENT'S MALARIA INITIATIVE, 2013), there remains a paucity of research on people's knowledge, attitudes, and practices (KAP) towards malaria in the majority of the federation, particularly in Northern Nigeria, (Singh *et al.*, 2014; Aju-Ameh *et al.*, 2016)

Principal mode of spread of malaria is by the bites of female *Anopheles* mosquito. Of more than 480 species of *Anopheles*, only about 50 species transmit malaria, with every continent having its own species of these mosquitoes: *An. gambiae* complex in Africa, *An. freeborni* in North America, *An. culicifacies, An. fluviatilis, An. minimus, An. philippinensis, An. stephensi,* and *An. sundaicus*in the Indian subcontinent *An. leucosphyrus, An. latens, An. cracens, An. hackeri, An. dirus* etc., have been identified as the vectors for the transmission of *P. knowlesi* (Singh *et al.*, 2014).

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MATERIALS AND METHODS

Study Area

The study was conducted among pregnant women attending antenatal clinic in Jalingo and Takum Local Government Areas of Taraba State, Nigeria. Jalingo Local Government Areas is the capital city of Taraba State. It was created out of the former Gongola State in the year 1991, it lies roughly between latitude 8°53′37.2 N and longitude 11°21′346 E. Jalingo has a population of 118,000(National Population Commission 2019) making it the biggest city in Taraba State. It is connected by road to Yola and Wukari. Districts within Jalingo are Kona ward, Suntali, Turaki A, Turaki B Mayo-gwoi, Majidadi, Yelwa, Barade, Kachalla Sembe and Sarkin Dawaki. The major ethnic groups in Jalingo are Kona, Hausa - Fulani and Mumuye. The major occupation of the people includes farming of crops such as groundnuts, maize, rice, sorghum, millet, cassava, and yam which are also produced in commercial quantity. Trading and rearing of cattle, sheep and goats are also known occupations in the area. Similarly, the people undertake other livestock production activities like poultry production, rabbit breeding and pig farming in fairly large scale. Other occupational activities such as pottery, cloth-weaving, dyeing, mat-making, carving and blacksmithing are also carried out in Jalingo. Takum is a Local Government Area in Taraba State, Nigeria. It headquarters is in the town of Takum. It was created out of Wukari Local Government in 1975, at 7°16′00″N9°59′00″E. Takum borders the Republic of Cameroon in the South, Ussa Local Government to the West, Donga Local government to the North, District within Takum is Kwambai, Jenuwa, Rogo, Dutse, Kashimbila, Bete, Chanchanji and Bika. The major ethnic / tribes in Takum are Jukun, Kuteb, Chamba, Tiv, Ichen and Hausa, etc. It has an area of 2,503 km² and a population of 135,349 (National Population Commission, 2019). The climate of the area is tropical with vegetation characterized by a typical guinea savannah. There are two distinct seasons, the wet and dry seasons.

Study Design

This is a cross sectional study carried out among pregnant women attending antenatal session at Jalingo and Takum hospitals and clinics in Taraba State, North-East, Nigeria. All pregnant women who consented were screened for the study.

Permission for the Study

Introductory letter for the study was obtained from Taraba State University, Department of Biological Sciences. Permission was sought from the Management of the Clinics and informed consent was also sought and obtained from the women.

Data Collection

Questionnaires were administered to the participants to obtain information on their age, educational status, occupational status, pregnancy status, marital status, blood group and some risk factors of Malaria. After the questionnaire administration, sterile disposable syringes were used to collect blood (about 5ml) from the veno-punctured vein under aseptic conditions. All the specimens were tested for malaria using thick film.

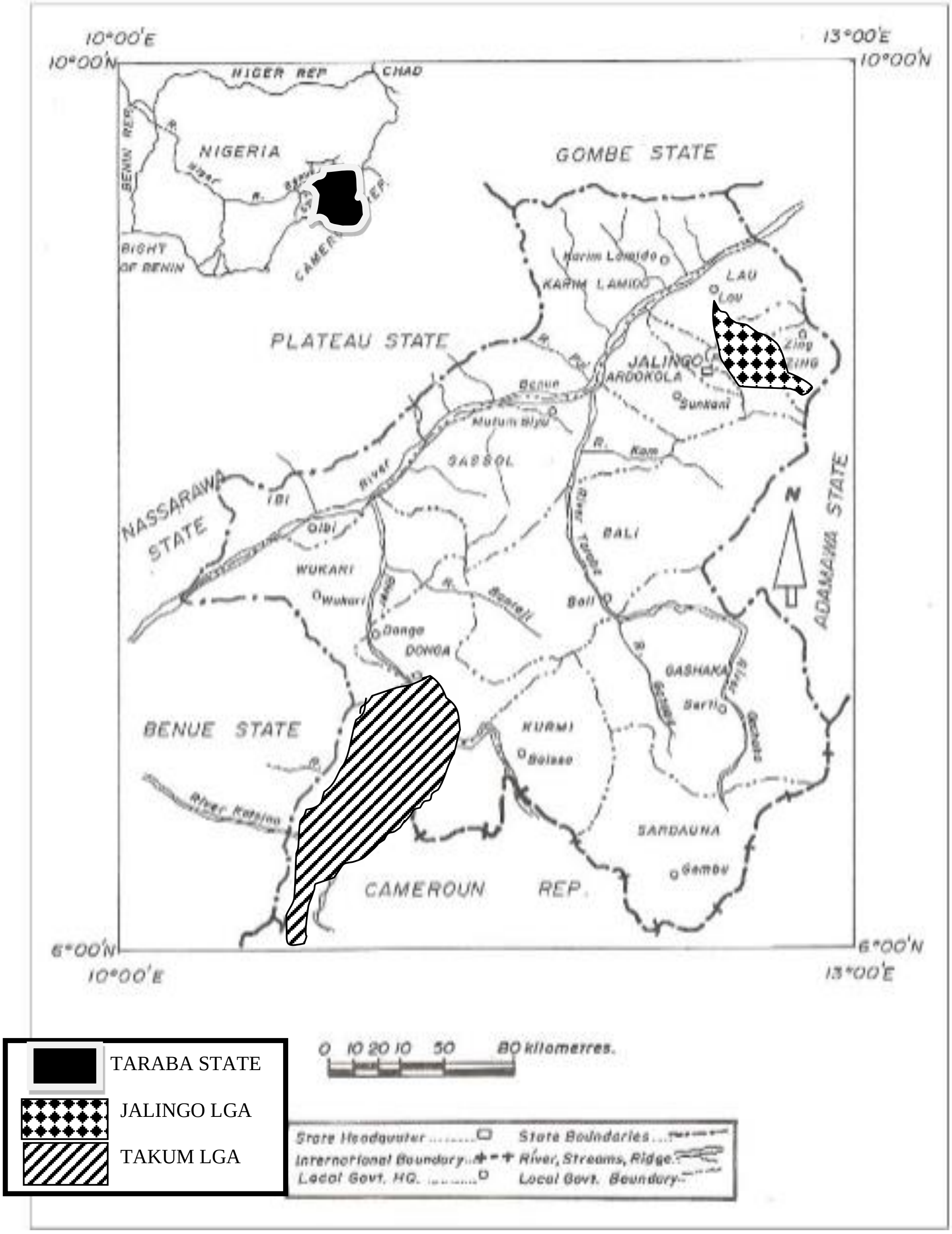

Figure 1: Map of Taraba State showing the study area of (Jalingo and Takum LGAs).
Source: Taraba State Ministry of Lands and Survey,2019.

Study Population

The study population comprised of all consenting pregnant women attending the 8 antenatal clinics on their first booking clinic day and also those that came for routine checkup that have not been screened were enrolled.

520 samples were obtained from Jalingo and Takum with 260 sample from each LGA

The method of Fisher (1935) was used to determine the sample size at 0.05 significant levels.

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

Where,

n = Desired sample size

Z = Standard Normal deviate set at 1.96

P = expected prevalence or proportion (0.05)

q = 1 – p (either the patient have or does not have the characteristics)

d = degree of accuracy set at 0.05.

Therefore,

$$= \frac{(1.96)^2 \times 0.5\ (1-0.5)}{(0.05)^2} = \frac{3.816 \times 0.5 \times 0.5)}{0.0025}$$

The minimum sample size was 384.16≈384

Specimen Collection

After counseling, five (5) mls of whole blood was collected by venipuncture Cheesebrough (2006) into labeled EDTA bottles, for each of the 520 pregnant women. For malaria, little portion of the blood was drop in a clean slide to form a thick film, Giemsa stain was then added to the slide and left for thirty minutes. The slide was then tilted to get rid of the stain, the slide was washed in running tap. The underneath of the slide was finally wiped clean and air dried. Immersion oil was then added to the slide and viewed underx40 magnification of microscope.

1ml of blood in a syringe was dropped on a slide in 3 places (A, B and C). Then a drop of anti-sera in a pippitte was drop on each of the blood in the slide, anti-sera A was drop in A, anti-sera B was drop in B and anti-sera D was drop in C.Mix each of the specimen using a stirrer, then the contents was moved slide backward and forward and observed agglutination. If all the anti-sera's agglutinated to all the 3 blood specimen it means the person is AB blood group, if only B and C blood specimen agglutinated, it means the person is B blood group, if only A and C blood specimen agglutinated it means the person is A blood group, and if only the C blood specimen agglunated it means the person is O blood group.

Data Analysis

All data generated from the different study sides were summarized using frequency tables. Data from questionnaire were coded, ranked and analyzed using SPSS version 20.1 and. Chi-square as the statistical tool were also used.

RESULTS

Age related prevalence of Malaria in Jalingo and Takum LGAs

The rate of infection of malaria was higher among pregnant women in age group 21 - 25 years 154 (79.4%) followed by those in the age group 26 - 30 years 92(81.4%).pregnant women in the 31 - 35 years had infection rate of 61(83.6%) and those in 36 - 40 years recorded infection rate of 53(77.9%) the age group 16 – 20 years had the infection rate of 33(67.3%) and those in the age group 41> had the lower infection rate of 13(56.5%).Chi square statistical analysis reveals that there was significant difference between malaria infection and age group.(χ^2=12.463, p< 0.596).

Table 1: Showing the age-related prevalence of Malaria in Jalingo and Takum LGAs

Age	Jalingo		Takum		Total	
	No. Examined	No.Infected with MP(%)	No. Examined	No.Infected with MP(%)	No.Examined	No.Infected(%)
16-20	21	13(61.9)	28	20(71.4)	49	33(67.3)
21-25	101	79(78.2)	93	75(80.6)	194	154(79.4)
26-30	54	43(79.6)	59	49(83.1)	113	92(81.4)
31-35	37	32(86.5)	36	29(80.5)	73	61(83.6)
36-40	36	26(72.2)	32	27(84.4)	68	53(77.9)
41>	11	06(2.3)	12	07(58.3)	23	13(56.5)
Total	260	199(76.5)	260	207(79.6)	520	406(78.1)

(χ^2=12.463, p< 0.596 df 5)

Key MP = Malaria Parasite

Co- infection of MP and HBV in Jalingo: out of the 260 pregnant women examined, Co-infection is 31(15.6%). Chi square analysis reveals that there is significant difference between Co- infection of MP and HBV in Jalingo. (χ^2=2.851, P >0.243, df1).

Co- infection Takum

Co - infection of malaria infection in Takum: out of the 260 pregnant women examined in Takum Co- infection is 40 (15.4%). Chi square analysis reveals that there is significant difference between Co- infection of malaria infection in Takum and Jalingo. (χ^2=2.929, p>0.246, df1).

Table 2: Showing the distribution of Malaria and Co-infection according to Age in Jalingo

Age	No. Examined	MP+ve(%)		Co-infection (%)
16-20	21	13(61.9)		2(15.4)
21-25	101	79(78.2)		9(11.4)
26-30	54	43(79.6)		10(23.3)
31-35	37	32(86.5)		6(16.2)
36-40	36	26(72.2)		4(18.8)
41>	11	06(2.3)		0(0.0)
Total	260	199(76.5)		31(15.6)

(χ^2=2.851, P >0.243, df1).

Table 3: Showing the distribution of Malaria and Co-infection according to Age in Takum

Age	No. Examined	MP + ve (%)	Co-infection (%)
16-20	28	20(71.4)	2(10.0)
21-25	93	75(80.6)	9(12.0)
26-30	59	49(83.1)	14(28.6)
31-35	36	29(80.5)	8(27.6)
36-40	32	27(84.4)	4(14.8)
41>	12	07(58.3)	3(42.9)
Total	260	207(79.6)	40(15.4)

(χ^2=2.929, p>0.246, df1).

Prevalence of Malaria among pregnant women in relation to educational status in Jalingo and Takum L.G.A

Those with non- formal education had the highest prevalence of 167(88.8%, followed by those that had primary Education with the prevalence of 95(70.1%), then by secondary Education 88(79.3%), Tertiary education had the least infection rate 56(65.1%). Chi square analysis reveals that there is significant difference between prevalence of MP and Educational status. (χ^2=7.94, p<0.381)

Table 4: Showing the prevalence of Malaria among pregnant women in relation to educational status in Jalingo and Takum L.G.A

Educational status	Jalingo		Takum		Total	
	No. Examined	**No. Infected with MP (%)**	**No. Examined**	**No. Infected with MP (%)**	**No. Examined**	**No. Infected (%)**
Non-Formal Edu	80	69(86.3)	108	98(90.7)	188	167(88.8)
Primary Edu	75	51(68)	60	44(73.3)	135	95(70.1)
Secondary Edu	63	51(80.9)	48	37(77.1)	111	88(79.3)
Tertiary Edu	42	28(66.7)	44	28(63.6)	86	56(65.1)
Total	260	199(76.5)	260	207 (79.6)	520	406(78.1)

(χ^2 =7.94, p<0.381, df 3)

Prevalence of Malaria among pregnant women in relation to Occupational status in Jalingo and Takum

The prevalence rate of infection was higher among traders with the prevalence rate of 212(86.9%), followed by House Wife with the prevalence rate of 71(85.5), followed closely by Farmers with the prevalence rate of 70(56.9%) and the least infection was recorded among Civil servant 53(75.7%). Chi square analysis reveals that there is significant difference between prevalence of MP and Educational status. (χ^2=10.346, p<0.476)

Table 5: Showing the Prevalence of Malaria among pregnant women in relation to Occupational Status in Jalingo and Takum

Occupational status	Jalingo		Takum		Total	
	No. Examined	**No.Infected with MP(%)**	**No. Examined**	**No.Infected with MP(%)**	**No.Examined**	**No.Infected(%)**
Civil servant	20	13(65)	50	40(80)	70	53(75.7)
Farmers	55	33(60)	68	37(54.4)	123	70(56.9)
Traders	133	109(81)	111	103(92.8)	244	212(86.9)

House Wives	52	44(84)	31	27(87.1)	83	71(85.5)
Total	260	199(76.5)	260	207(79.6)	520	406(78.1)

(χ^2=10..346, p<0.476, df3)

Prevalence of malaria in relation to pregnancy status in Jalingo and Takum

The trimester distribution of the infection indicates that women in their first trimester had the highest prevalence of 219(84.2%) followed by those in their second trimester with the prevalence of 99(74.4%), while the third trimester had the least infection rate of 88(69.3%).

Chi square analysis reveals that there is significant difference between prevalence of MP and pregnancy status. (χ^2=10.118, p<0.463).

Table 6: Showing the prevalence of malaria in relation to pregnancy status in Jalingo and Takum

Pregnancy status	Jalingo		Takum		Total	
	No. Examined	**No.Infected with MP(%)**	**No. Examined**	**No.Infected with MP(%)**	**No. Examined**	**No.Infected(%)**
First Trimester	134	109(81.3)	126	110(87.3)	260	219(84.2)
Second Trimester	67	48(71.6)	66	51(77.3)	133	99(74.4)
Third Trimester	59	42(71.2)	68	46 (67.6)	127	88(69.3)
Total	260	199(76.5)	260	207(79.6)	520	406(78.1)

(χ^2=10.118, p<0.463, df 2).

Prevalence of malaria infection according to marital status in Jalingo and Takum

The prevalence of Mp according to marital status indicates that out of the 520 women examined, 434 were married, of which 379(87.3%) had been infected with Mp, 86 were not married of which 72 (83.7%) had been infected with Mp. Chi square analysis reveals that there is no significant difference between prevalence of MP and Marital status. (χ ^{2}3.093, p>0.252)

Table 7: Showing the prevalence of malaria infection according to marital status in Jalingo and Takum

Marital Status	Jalingo		Takum		Total	
	No. Examined	**No. Infected with MP (%)**	**No. Examined**	**No.Infected with MP(%)**	**No. Examined**	**No.Infected(%)**
Single	49	43(87.8)	37	29(78.4)	86	72(83.7)
Married	211	156(73.9)	223	178(79.8)	434	334(76.9)
Total	260	199(76.5)	260	207(79.6)	520	406(78.1)

(χ^2=3.093, p>0.252, df1)

Prevalence of malaria in relation to blood group Jalingo and Takum

The highest infection was recorded in pregnant women with blood group O (90.9%), followed by those with blood group B (71.1%) then those with blood group A (74.7%) while the least infection was recorded in those with blood group AB (52.7%). Chi square analysis reveals that there is significant difference between the prevalence of MP and Marital status (χ^2=12.833, p < 0.585).

Table 8: Showing the prevalence of malaria in relation to blood group Jalingo and Takum

Blood group	Jalingo		Takum		Total	
	No. Examined	**No.Infected with MP(%)**	**No. Examined**	**No.Infected with MP(%)**	**No. Examined**	**No.Infected(%)**
A	46	35(76.1%)	53	39(73.6)	99	74(74.7)
B	60	41(68.3%)	68	50(73.5)	128	91(71.1)
AB	29	12(41.4%)	26	17(65.4%)	55	29(52.7)
O	125	111(88.8%)	113	101(89.4%)	238	212(89.1)
Total	260	199(76.5%)	260	207(79.6%)	520	406(78.1)

(χ^2=12.833, p < 0.585, df3).

Relationship between Malaria and risk factors in Jalingo and Takum

The relationship between Malaria and risk factors. Malaria was recorded high among pregnant women that had stagnant water around resident (48.7%), Hospital Admission (44.4%) and farming close to resident (41.9%). Infection rate was low among pregnant women who fleet room with insecticides (32.1%), sleeping under mosquito net (31.9%) and receive blood transfusion (30.8%). Odd ratio shows significant differences between fleeting of room with insecticides (O. R= 0.91.3) and Receive Blood transfusion (O. R= 1.645). However, no significant difference was observed between the prevalence of Malaria and risk factors such as sleeping under mosquito net (O.R =0.823), Stagnant water around resident (O.R = 0.8877), Farming close to resident (O. R= 0.885) and Hospital admission (O. R= 0.91.3)

Table 9: Showing the relationship between Malaria and risk factors in Jalingo and Takum

Risk factors	No. Examined	Response (%)		No.Infection with MP (%)	O.R	P-Value
Sleeping under mosquito net	520	YES	207(39.8)	166(31.9)	0.823	0.605
		NO	313(60.2)	240(46.2)		
Fleeting Room with insecticide	520	YES	201(38.7)	167(32.1)	1.285	0.836
		NO	319(60.3)	239(45.9)		
Stagnant Water resident	520	YES	331(63.7)	253(48.7)	1.170	0.812
		NO	189(36.3)	153(29.4)		
Farming Close to resident	520	YES	279(53.7)	218(41.9)	0.885	0.695
		NO	241(46.3)	188(36.2)		
Receive Blood transfusion	520	YES	186(35.8)	160(30.8)	1.645	0.886
		NO	334(64.2)	246(47.3)		
Hospital Admission	520	YES	294(56.5)	231(44.4)	0.913	0.712
		NO	226(43.5)	175(33.7)		

DISCUSSION

The high prevalence of malaria (73.1%) observed in the present study suggests high endemicity and transmission of malaria in this part of the country and may rank one of the highest prevalence rates previously reported [8-12,14,15]. The high prevalence rate also highlights the increased susceptibility of pregnant woman to malaria infection which has been attributed to pregnancy induced reduction in cellular and humoural immunity [4,5] which is essentially physiological. The increased malaria transmission may be due to lack of or inadequate use of preventive measures such as insecticide treated bed nets (ITNs) by the pregnant women or worsening state of environmental factors which favour the transmission of malaria. Whichever is the case, the adverse effects of increased prevalence of malaria constitutes a major public health problem which makes the realization of the millennium development goals in the state a herculean task if adequate measures are not taken to control the scourge. Malaria is endemic and life-threatening diseases in this part of the world (Helegbe et al, 2018; Anabire et al, 2019). This study presents 75.6% and 79.5% of malaria parasitemia, and 11.9% and 15.3% for co-infection among pregnant women attending antenatal clinics of malaria and in Jalingo and Takum Local Government Areas respectively.

The prevalence of malaria recorded in the study area (75.6% and 79.5%) in Jalingo and Takum respectively could be regarded as being moderately high. This study is in agreement with the 76.0% reported by (Aribodor *et al.*, 2018) in Azia community, Anambra State. It was closer to 73.1% recorded by Uneke *et al.*, (2017), prevalence of malaria among pregnant women attending antenatal in South Eastern, Nigeria. It was also less than 99.0% recorded by Bhalla *et al*. (2018) in Enugu State and 89.3% by Wang *et al*. (2015) in Abakaliki, South eastern Nigeria respectively. The difference between the study locations may be due to differences in environmental factors existing in the different cities used for the study. For instance, the level of environmental sanitation and infrastructural development differ between the major cities where the hospitals are located and this impact negatively on malaria transmission and infection. It is pertinent to note that mosquitoes breed freely in open gutters and drainages and cities with plenty of these environmental defects experience high transmission of malaria and the attendant problems (Uneke *et al.*, 2017).

Co-infection of malaria was significant with educational and occupational status of the participants. Co - infection was higher among the traders as well as among the non-educated. Education creates awareness in protecting one against diseases, the level of sexual transmission is usually high and can expose one to these infections irrespective of the educational status. People in certain occupations are exposed to the risk of malaria than others. Health workers.

The co-infection rate was higher than that of Hodges and Ruppy (2011), who reported 7.81% prevalence of malaria co-infection at General Hospital, Minna, North-Central Nigeria. Mbaawuga *et al.* (2008) and Lokoba *et al*. (2010), observed that history of blood transfusion, alcohol consumption and use of contraceptives has no effect on malaria transmission, but has on this study, infection cuts across all age groups however, high prevalence of malaria was recorded among age 21-30 years. This is because the age groups 21-30 years are more likely to be actively involved in outdoor activities, thereby exposing themselves to mosquito bites leading to malaria transmission hence they are infected more. This agrees with the work of Uneke *et al.* (2017) who recorded high malaria prevalence among those within the age group 20-25 years. This age bracket might have engaged themselves in outdoor activities like sleeping outside at night, farming, fishing and night hawking. The least prevalence was recorded among age group ≤ 20.

omen showing the highest positivity.

In relation to Occupational status, the significant variation in malaria prevalence between the different occupational groups studied indicate that malaria transmission varied among the group since occupation is a measure of one's income, education and socio-economic status. Traders the highest prevalence rate, this could be due to the fact that they are always expose to the risk factors depending on the type of business they engaged themselves, which make them keep late hour at night while some wake up very early in the morning when the mosquitoes are actively biting. Civil servants are more enlighten and take adequate measures to avoid malaria exposure.

Pregnant women are particularly vulnerable to malaria as pregnancy reduces a woman's immunity to malaria making her more susceptible to malaria infection and increasing the risk of illness,

This study also shows that most women infected with malaria are women in their first trimester, which is in contrast with the study of Ejike (2017) who recorded higher prevalence of malaria among pregnant women in their second trimester. The increased prevalence of malaria is believed to result from weak immunity. This situation seems to change during the second and third trimester. This is because the women would have started taken anti malaria drugs for prevention.

Relationship between Malaria and risk factors showed that those who engage in outdoor activities such as farming close to residential areas, living close to stagnant water are at higher risk to malaria attack, those women that sleep under insecticide treated or untreated mosquito nets had not experienced any malaria episode indicating an association between previous malaria episode and possession of mosquito nets. Insecticide treated nets (ITNs) have become quite significant as the most practical method of mosquito control by protecting at-risk individuals from mosquito bites and hence malaria infections (Pennap *et al.*, 2017).

CONCLUSION

Co- infection of malaria infections seem very common among the Jalingo and Takum populace especially in areas where habits such as use of sharing of razor blades, unprotected sexual activity, unsterilized needle, ear-piercing, tooth extraction and blood transfusion are practiced. Despite the fact that the participants were healthy individuals, still malaria infections were recorded. This may be a health risk. Therefore, there is need for screening of all pregnant women and infants born to malaria positive mothers. Government and Non-governmental organizations should intensify efforts to enlighten the general population on the public health importance of the disease, and hepatitis screening should be incorporated into the routine antenatal screening it is good to screen individuals of these infections especially in the rural areas where there is still possibility of upholding some of these practices that encourage spread of these infections.

The study also shows that co-infection had no profound effect on Blood group hence points to possibility of interaction between plasmodium parasite that may lead to decrease severity of malaria infection thereby lowering morbidity and mortality.

Recommendations

From the findings of the study and the conclusion mentioned above, the study made the following recommendations:

1. Provision of mosquito insecticides net should be giving to pregnant women on their first day of booking. They should be encouraged to use the nets.
2. Public enlightenment on the disadvantages of farming close to residential areas, keeping stagnant water around residential areas and throwing of refuse in gutters.
3. Public should be encouraged to spray insecticides in their residence, to kill mosquitoes.
4. malaria test screening should be incorporated in to the routine antenatal screening on their first day of booking.
5. Provision of free treatment for all pregnant women that are tested positive for Malaria.
6. Organize public health education classes/ campaigns on the risk factors of malaria infection among pregnant women in Jalingo and Takum metropolis.

Recommendation for further research

1. It is recommended that details of these infections be investigated so that appropriate control strategies be instituted.
2. The findings also recommend that the exercise of public enlightenment, administration of childhood immunization and screening of pregnant women should be adopted to interrupt transmission of the parasites in the communities.

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