Malaria and Associated Risk Factors in Awka Awka South Local Government Area, Anambra State, Nigeria

Abstract

Malaria is still a major contributor to high rate of the global infectious disease–related mortality and morbidity due to its marked effects and alteration on the haematological parameters of infected individuals. This study was conducted to determine the following: prevalence and intensity of malaria, the associated risk factors of in Awka metropolis from January to June 2021. A total of 1060 subjects were enrolled int the study. Prevalence of malaria parasites was determined using thick and thin films. A total 925 indivduals were infected with malara parasite giving a prevalence of 87.3%. Of the 925 individuals infected, 743(80.3%) had mild infection, 150 (16.2%) moderate infection. The study showed that more males (94.2%) were infected with the malaria parasite than females (80.6%). Infection rate increased with increase in age. The highest prevalence of malaria (94.3%) occurred among those less than ten years old while the least prevalence (72.2%) was recorded among those more than sixty years old. The prevalence of malaria in relation to age was statistically significant ($p<0.05$). In relation to occupation, farmers recorded the highest prevalence of malaria (94.7%) while civil servants had the least prevalence (65.4%). Based on literacy level, the highest prevalence of malaria was recorded among those with primary education (96.8%) while those with tertiary education had the least prevalence (84.3%). On marital status, married ones had the highest prevalence of malaria (91.9%) while the singles had the least prevalence (80.1%). The high prevalence of malaria in Awka calls for intensive education and free supply of insecticide treated nets.

INTRODUCTION

Malaria caused by protozoan parasites of the genus *Plasmodium*, remains the most infectious parasitic disease of humans that infects and kills higher percentage of people than any other single infectious disease (Sherman, 1998). In 2012, malaria caused an estimated 207 million clinical episodes, and 627,000 deaths; an estimate of 91% deaths in 2010 were in the African region, while 86% were children under 5yrs of age (CDC, 2016). In Nigeria, malaria is holoendemic and it is one of the reasons of the high mortality rate especially in children (Ukpai and Ajoku, 2001; Bruce-Chwatt 1993). It is estimated that 50% of the population has at least one episode of malaria each year while children under five years of age have on the average of 2.4 attacks in a year (Lambo, 2005).

Five species of *Plasmodium* known to cause malaria are *Plasmodium falciparum, P.vivax, P. ovale, P. knowlesi* and *P.malariae* (Abdoon and Alshahrani, 2003; Duchemin *et al*., 2001; Bruce- Chwatt, 1986a). These parasites contribute to majority of human sufferings in malaria endemic regions of the world (Mohan and Ramaswamy, 2007; Oparaocha, 2003). Among these malaria parasites, *P. falciparum* is the most predominant species accounting for about 98% of malaria cases in Nigeria (Lambo, 2005). *Plasmodium malariae* often occurs as a mixed infection with *P. falciparum* (Lambo, 2005). *Plasmodium falciparum* malaria is often characterized by fever which may be acute, often times intermittent or continuous; the fever is sometimes followed by shivering and sweating (Lambo, 2005).

Some risk factors of the malaria disease may include age, caregivers education, occupation and economic status amongst others (Abuaku *et al.*, 2012 and Douglas *et al.*, 2012). In high transmission areas, partial immunity to the disease is acquired during childhood (Mbanugo and Ejim, 2000). In such settings, the majority of malaria disease, and particularly severe disease with rapid progression to death, occurs in young children without acquired immunity. Severe anaemia, hypoglycemia and cerebral malaria are features of severe malaria more commonly seen in children than in adults (WHO, 2015).

In most parts of Nigeria, farming activities which occur mostly during the rainy season period of the year favour the breeding of mosquitoes, thus making the effects of malaria apparently noticeable in rural areas due to their proximity to the farmlands (Aribodor *et al*., 2003; WHO, 2000).

Awka metropolis is one of the areas in the rain forest belt of Eastern Nigerian where malaria is endemic. Literature is replete with information on malaria prevalence in Awka (Mbanugo and Ejims, 2000; Aribodor *et al.*, 2003; Onyido *et al*., 2012), but there is apparent dearth of information on malaria transmission currently.

The aim of this study was to determine the prevalence and morbidity of malaria in Awka Metropolis.

Fig 1: Map of Anambra State Showing Awka South Local Government Area

Source: GIS and Cartography Lab, Department of Geography and Meteorology, NAU, Awka. 15/2/2020

3.2 Study Design

The study was a hospital- based survey of individuals in selected health facilities in Awka within a period of 6 months from January to June, 2020. The samples collected were later taken to the laboratory for examination.

3.3Ethical Consideration

The study was approved by the ethical committee of Anambra State Ministry of Health. Advocacy visit to the State Ministry of Health with a letter of introduction from Head, Department of Parasitology and Entomology, Nnamdi Azikiwe University, Awka, Anambra State was made. Advocacy visits with a copy of the approval letter from the Ministry of Health to the Medical Directors of the Health facilities used for the study, was used to get the support and co-operation of the institutions and their staff.

Selection of the Health Facilities

Three health facilities were chosen from Awka metropolis based on their location and attendance by the people. The selected Health facilities were (1) Chukwuemeka Odimegwu Ojukwu University Teachuing Hospital Awka, (2) Reginal Caeli Hospital (RCH) Awka, and St Charles Diagnostic Hospital Awka.

3.4Collection of Blood Samples

The blood collection was done by trained nurses in the health facilities. A total of 1060 samples were collected in this study. Each individual's left hand was tied with a tourniquet, the site of collection of the blood sample was wiped clean with a cotton swab soaked in methylated spirit to clean and sterilize the area. A 2ml syringe with scalp vein needle was used to collect 1ml of venous blood of each participant. The blood was transferred into an EDTA bottle to prevent agglutination. Dry cotton was placed at the point of entrance of the needle into the vein and the needle was gently removed, covered with its cap and disposed into a waste-bin provided for the purpose.

3.5 Diagnosis of Malaria

Microscopic examination of thick and thin blood films was adopted in this study, for the diagnosis of malaria parasites (Cheesbrough 2005).

3.5.1Preparation of Thick Blood Films

Two drops of the participant's blood were placed on a well-labeled grease-free microscopic slide. The blood was homogenously spread out in a circular motion using an edge of a spreader slide to make an even smear. The smear was allowed to air-dry on a slide rack to avoid washing off during staining. It was later placed in a slide box to protect them from flies, dust and heat.

3.5.2Preparation of Thin Blood Films

Thin blood films were prepared on separate slides. A small drop of the participant's blood was placed at the centre of a well-labeled grease-free microscopic slide. A smooth edge of one end of the spreader slide was placed just in front of the drop of blood at an angle of about 45^0 to the horizontal slide containing the drop of blood. The drop of blood was allowed to run along the

edge of the spreader slide. The spreader was gently pushed forward along the horizontal slide to make a sharp thin smear of the blood. Care was taken to ensure even contact of the spreader and the surface of the horizontal slide. Each thin blood film was fixed by dipping in absolute methanol for two seconds so as to minimize cell damage and the production of artifacts. The film was allowed to air-dry on a slide rack and later placed in a slide box away from flies, dust and heat.

3.5.3 Staining of the Blood Films

Both the thick and thin blood films were stained with Leishman's stain. Each blood film was placed on the staining rack with the blood film facing upward. It was then flooded with 10% dilution of Leishman's stain using a pipette, allowed staying for 10 minutes before it was dipped into water for 5 seconds to wash off the stain. The back of each slide was wiped clean with cotton wool and placed in an upright position on a draining rack for the films to air dry.

3.5.4 Microscopic Examination of the Blood Films

A drop of immersion oil was placed on each slide and examined under the microscope using x100 objective lens. The presence of malaria parasites in the blood film was indicated by a positive sign (+) while the absence of malaria parasite was indicated by a negative sign (-).

3.5.5Determination of Intensity of Malaria

The intensity of malaria parasites in the blood films was indicated with one or more positive signs as follows:

(a) Mild infection (+) for 1-10 parasites per 100 high power fields,

(b) Moderate infection (++) for 11-100 parasites per 100 high power fields,

(c) Heavy infection (+++) for 1-10 parasites per high power fields.

(Cheesbrough, 2005)

3.6 Data analysis

The data collected were fed into Microsoft Excel 2010 software and then copied into Statistical Programme for Social Sciences (SPSS) software version 22.0 for analysis. Chi-square test was performed to access the presence of any significant differences in the variables. Questionnaire results were also coded into SPSS and variables created.

RESULTS

4.1 Prevalence and intensity of malaria among the studied subjects

The result of 1090 blood samples collected for malaria diagnosis from 3 different health facilities in the study area were presented in Table 1. Of the 1060 samples, 411(38.8%) was from COOUTH, Awka, 380(35.8%) from RFH, Awka, 269(25.4%) from Rock Foundation Hospital,

Awka. In all, 520(49.1%) were males while 540(50.9%) were females. Seventy-five (70) (6.6%) were in the age group of <10 years, 80(7.5%) fell in the age group 11-20 years, 230(21.7%) were in the age group 20-30 years, 190(17.9%) were in the age group 31-40 years, 200 (18.9%) were in the age group 41-50 years, 182(17.2) were in the age group 51-60 years and 108(10.2%) were in the age group 60 years and above (Table 1).

Table 1: Prevalence and intensity of malaria in relation to health facility.

Health facility	No. Examined	No. Inf. (%)	Mild Inf. (+) (%)	Moderate Inf. (++) (%)	Heavy Inf. (+++) (%)
COOUTH	411(38.8)	370(90.0)	286(77.3)	66(17.8)	18(4.9)
Regina Caeli Hospital	380(35.8)	335(88.2)	279(83.3)	46(13.7)	10(3.0)
Rock Foundation	269(25.4)	220(81.8)	178(80.9)	38(17.3)	4(1.8)
Total p-value=0.000	**1060**	**925(87.3)**	**743(80.3)**	**150(16.2)**	**32(3.5)**

Of the 1060 individuals tested for malaria from the 3 different health facilities in the study area, 925(87.3%) were positive for the parasite among whom 370(90.0%) were from COOUTH, Awka, 335(88.2%) from Regina Caeli Hospital, Awka, 220(81.8%) from Rock Foundation Hospital. There was a significant difference in malaria prevalence among to the health facilities (P<0.05) P-value =; P-value=0.000 (Appendix).

Of all the 925(87.3%) individuals infected with malaria, 843(80.3%) had mild malaria infection 150(16.2%) had moderate infection, and 32(3.5%) had heavy infection (Table 1). In COOUTH, 286(77.3%) had mild infection, 66(17.8%) had moderate infection while 18(4.9%) had heavy infection. At RCH, Awka, 279(83.3%) had mild infection with malaria parasites, 46(13.7%) had moderate and 10(3.0%) had heavy infections. At Rock Foundation Hospital 178(80.9%) had mild malaria infection, 38(17.3%) had moderate infection and 4(1.8%) had heavy infection of malaria parasites.

Prevalence and Intensity of Malaria in relation to gender

Of the 925(87.3%) malaria positive individuals, 520(49.1%) were males while 540(50.9%) were females (Table 2). Of 490 infected males, 390(79.6%) had mild infection, 0(16.3%) had moderate infection while 20(4.1%) had heavy infection. Of 435 infected females, 353(81.1%) had mild infection, 70(16.1%) had moderate infection while 12(2.8%) had heavy infection. There was a significant difference (P<0.05) in the prevalence of malaria in relation to gender. (Chi-square=18.642; P-value=0.000).

Table 2: Prevalence and intensity of malaria in relation to gender:

Gender	No. Examined	No. Infected (%)	Mild Inf. (+) (%)	Moderate Inf. (++) (%)	Heavy Inf. (+++) (%)
Male	520(49.1)	490(94.2)	390(79.6)	80(16.3)	20(4.1)
Female	540(50.9)	435(80.6)	353(81.1)	70(16.1)	12(2.8)
Total	**1060**	**925(87.3)**	**743(80.3)**	**150(16.2)**	**32(3.5)**

Chi-square=18.642; P-value=0.000

The highest prevalence of malaria (94.3%) in relation to age occurred among subjects less than 10 years old while the least prevalence (72.2%) occurred among those that were 61 years old and above. Prevalence in other age groups was as follows: 65(81.3%) in 11–20 years, 212(92.2%) in 21–30 years, 170(89.5%) in 31–40 years old, 179(89.5%) in 41-50 years old and 155(85.2%) in 51-60 years old.

Of the 66(94.3%) in the age group <10 years old that had malaria, 42(63.6%) had mild malaria infection, 18(27.3%) had moderate infection and 6(9.1%) had heavy infection. In the age group 11-20 years, 36(55.4%) had mild infection, 26(40.0%) had moderate infection and 3(4.6%) had heavy infection of malaria parasites. In the age group 21-30 years old, 190(89.6%) had mild infection, 15(7.1%) had moderate infection, 7(3.3%) had heavy infection. In the age group 31-40 years, 141(82.9%) had mild infection, 23(13.5%) moderate and 6(3.5%) had heavy infection. In the age group 41-50 years 155(86.6%) had mild infection, 19(10.6%) had moderate and 5(2.8%) had heavy infection of malaria parasites. In the age group 51-60 years, 123(79.3%) had mild infection, 28(18.1%) moderate infection and 4(2.6%) had heavy infection. Finally, in the age group 61 years and above, 56(71.8%) had mild infection, 21(26.9%) moderate and 1(1.3%) had heavy infections. There was a significant difference in the prevalence and intensity of malaria infection in relation to age. (P<0.05) (P<0.000).

Table 3: Prevalence and intensity of malaria in relation to age.

Age (years)	No. Examined	No. Infected (%)	Mild Inf. (+) (%)	Moderate Inf. (++) (%)	Heavy Inf. (+++) (%)
<10	70(6.6)	66(94.3)	42(63.6)	18(27.3)	6(9.1)
11-20	80(7.5)	65(81.3)	36(55.4)	26(40.0)	3(4.6)
21-30	230(21.7)	212(92.2)	190(89.6)	15(7.1)	7(3.3)
31-40	190(17.9)	170(89.5)	141(82.9)	23(13.5)	6(3.5)
41-50	200(18.9)	179(89.5)	155(86.6)	19(10.6)	5(2.8)
51-60	182(17.2)	155(85.2)	123(79.3)	28(18.1)	4(2.6)
61 +	108(10.2)	78(72.2)	56(71.8)	21(26.9)	1(1.3)
Total	**1060(100.0)**	**925(87.3)**	**743(80.3)**	**150(16.2)**	**32(3.5)**

(P<0.05 P<0.000)

4.2 Prevalence and intensity of *Plasmodium* infection among the studied individuals by associated risk factors.

From the prevalence and intensity of malaria infection by risk factors based on occupation, farmers had the highest prevalence 360(94.7%), while civil servants had the least 157(65.4%). Traders had a prevalence of 339(92.9%) and students/pupils had a prevalence of 69(92.1%) (Table 4). However, traders had the highest prevalence of mild infection 299(88.2%) followed by farmers 308(85.6%). The least prevalence was observed among the civil servants (59.2%). For moderate infection, the highest prevalence was recorded among the civil servants 62(39.5%) followed by students/pupils 20(29.0%). The least prevalence was recorded among traders 30(8.8%). For heavy infection, the highest prevalence was observed among the students/pupils (8.7%). The least prevalence was recorded among the civil servants 1(1.3%). There was a significant difference in the prevalence and intensity of malaria infection by risk factors in relation to occupation ($P<0.05$) (P-value=0.000).

The prevalence and intensity of malaria infection by risk factors is shown in Table . Based on literacy level, the highest malaria prevalence 155(96.8%) was recorded among those who had primary education and the least prevalence 455(84.3%) was recorded among those who had tertiary education. Those who had secondary education had a prevalence of 315(87.5%). There was a significant difference in the prevalence of malaria infection in relation to education ($P<0.05$) (P-value=0.0).

On the intensity of malaria, those who had tertiary education had the highest prevalence of mild malaria 142(91.6%) followed by those who had secondary education 257(81.6%). Surprisingly, the least prevalence of mild infection (75.6%) was observed among those with tertiary education. The highest prevalence of moderate and heavy infections was observed among those with tertiary education and those with secondary education with a total prevalence of 23.5% and 6.3% respectively. The least prevalence of heavy infection was obtained from those with tertiary education (0.9%).

On marital status**,** those who are married had the highest prevalence 561(91.9%) while those who are single had the least 34(81.6%). Divorced had a prevalence of 82.1% while the widowed had a prevalence of 80.1%. Based on intensity, the highest prevalence of mild infection was recorded among the married 513(91.4%) followed by widowed 168(81.6%). The least was recorded among the divorced 28(35.9%). For moderate infection, the highest prevalence (56.4%) was recorded among the divorced, followed by single (45.0%) and the least prevalence among the married (7.1%). For heavy infection, the highest infection rate was recorded among the single 10(12.5%) followed by divorced (7.7%) while the least was among the married (1.4%). There was a significant difference in the prevalence of malaria infection in relation to marital status ($P<0.05$) ($P<0.1$).

Table 4: Prevalence and intensity of malaria in relation to associated risk factors.

Occupation	**No. Examined**	**No. Infected (%)**	**Mild Inf. (+) (%)**	**Moderate Inf. (++) (%)**	**Heavy Inf. (+++) (%)**
Pupils/Students	75(7.1)	69(92.0)	43(62.3)	20(29.0)	6(8.7)
Traders	365(34.4)	339(92.9)	299(88.2)	30(8.8)	10(2.9)
Farmers	380(32.1)	360(94.7)	308(85.6)	38(10.6)	14(3.9)
Civil Servants	240(22.6)	157(65.4)	93(59.2)	62(39.5)	2(1.3)
Total	**1060(100.0)**	**925(87.3)**	**743(80.3)**	**150(16.2)**	**32(3.5)**

Level of literacy					
Primary /FSLC	160(15.1)	155(96.8)	142(91.6)	5(3.2)	8(5.2)
Secondary/WASSCE	360(34.0)	315(87.5)	257(81.6)	38(12.1)	20(6.3)
Degree/Tertiary	540(50.9)	455(84.3)	344(75.6)	107(23.5)	4(0.9)
Total	**1060(100.0)**	**925(87.3)**	**743(80.3)**	**150(16.2)**	**32(3.5)**
Marital status					
Single	98(9.2)	80(81.6)	34(42.0)	36(45.0)	10(12.5)
Married	610(57.5)	561(91.9)	513(91.4)	40(7.1)	8(1.4)
Divorced	95(8.9)	78(82.1)	28(35.9)	44(56.4)	6(7.7)
Widowed	257(24.2)	206(80.1)	168(81.6)	30(14.6)	8(3.9)
Total	**1060(100.0)**	**925(87.3)**	**743(80.3)**	**150(16.2)**	**32(3.5)**

DISCUSSION

Of the 1060 individuals tested for malaria from the three different health facilities in the study area, 925(87.3%) were positive for the parasite. The prevalence of malaria parasite in this study population is far higher than that of the following: 58.2% prevalence in Ogbunike, Anambra State (Onyido *et al.* 2011a), 38.9% prevalence in Awka, Anambra State (Onyido *et al.*, 2012). It is also higher than 58.0% reported by Mbanugo and Ejims (2000) in Awka, Anambra State, 46% prevalence in Nnewi, Anambra State (Umeanaeto *et al*., 2006), 27.29% prevalence in Sokoto, Sokoto State (Abdullahi *et al*., 2006), 58.2% prevalence in Awka, Anambra State (Nwaorgu and Orajaka, 2011), 59.8% prevalence in Udi, Enugu State (Eneanya, 1998), 53.90% prevalence in Abagana, Anambra State (Ugha *et al*., 2012), 76% in Azia, Anambra State (Aribodor *et al*., 2003), 74.9% prevalence in Yola, Adamawa State (Chessed *et al*., 2012), 76.8% prevalence in Okada, Edo State (Otajevwo, 2012), 77.4% prevalence in Owerri, Imo State (Mbanugo and Emenalo, 2004), 80.5% prevalence in Ota, Ogun State (Olasehinde *et al*., 2008), 62.0% prevalence in Umudioka, Anambra State (Onyido *et al*., 2010), 85.50% prevalence in Okigwe and 75% prevalence in Owerri, Imo State (Ukpai and Ajoku, 2001), 73% prevalence in Ikwuano, Abia State (Oparaocha, 2003) 70.8% prevalence in Uli, Anambra State (Onyido *et al*., 2012) 79.3% and prevalence in Warri, Delta State (Otajevwo, 2012).

However the results were lower than those of Kalu *et al.* (2012) who reported 93.3% in Aba and 90.39% prevalence in Umuahia in Abia State, and that of Ilozumba and Uzoezie (2009) who reported 83.4% in Odoakpu in Onitsha South Local Government Area, Anambra State. The high prevalence of malaria in Awka (92.1%) revealed that malaria infection is holoendemic (population remain asymptomatic even with considerably high levels of malaria parasitaemia) in

the study area i.e. there is active transmission of malaria in the study area. Epidemiology of malaria is however determined by many factors including parasite virulence, host immunity and environmental factors including geographical locations (Eneanya, 1998). The high prevalence of malaria parasites in Awka could also be due to some factors such as amount of rainfall, relative humidity, temperature, extent in urbanization, availability of breeding places for malaria vectors (mosquito species), rapid development of the parasites, poverty, inadequately planned socio-economic projects, over-crowded human populations and the poor behavioural attitude of the inhabitants of the area. Awka which is the capital territory in Anambra State, Nigeria has undergone serious environmental modifications over the years owing to rapid growth in human population and urbanization. Such modifications could have led to ecological changes that might have affected human malaria vector population structure in the city which might have impacted on the efficiency in transmitting malaria in the area. This finding agrees with reports that there has been a marked increase in the number and size of towns and cities in many developing countries without corresponding increase in such services that inhibit the breeding of vectors of malaria resulting in the increase of urban malaria (Iwueze *et al*., 2014; Fonterille and Simard, 2004),

Mild malaria infection was observed in (80.3%) of all the 925 individuals infected, while moderate and heavy infections were 150(16.2%) and 32(3.5%) respectively. Rahim (2008) noted that innate immunity is an inherent property of the host that makes it susceptible to malaria infection or detrimental to the growth and proliferation of the parasite. It is possible that because of the constant exposure to mosquito bites and malaria transmission, they appeared apparently healthy without obvious signs and symptoms of infections as a result of acquired immunity from repeated infections (Thomas *et al*., 2004). This also agrees with the findings of Ilozumba and Uzoezie (2009) who stated that Onitsha South Local Government Area of Anambra State is in a malaria endemic region of Nigeria and noted that these individuals might be in various stages of immune development in their lives due to repeated infections with malaria parasites in this study. This may also have accounted for the high number of mild infections when compared to heavy infections. This high intensity underscores the fact that malaria is still a heavy burden on the continent, despite all that have been done. Age and nutritional status of the host might represent natural or acquired resistance and can play a role in the severity of the disease produced (Lambo, 2005).

The outcome of this study showed that males were more infected when compared to their female counterparts (95.7% and 88.7%, respectively), which is contrary to the findings of Mintaka and Opoku-Okrah (2013), who reported that females were more infected than males. The result obtained in this study is, however, similar to studies conducted by Yadav *et al*. (2014) which reported higher malaria parasitaemia in males (64.1%) than females (34.9%) and also by Adedapo *et al*. (2007), who reported both adult males and females to be at the same risk of infection except for pregnant women who were stated to be at a higher risk. This disparity with other findings could be due to differences in geographical location, climate, population group, and size. The gender variations with regard to the outcome of the present study could also be due to the health-seeking behaviour of males compared to their female counterpart whereby the latter are more inclined to get their malaria medication over the counter as opposed to the former who report to the hospital whenever they feel unwell.

In this study, the prevalence of malaria decreased with increase in age. The highest prevalence of malaria parasite (94.3%) was observed among individuals less than 10 years old. This contrasts

with the findings of Nwaorgu and Orajiaka (2011) and Mbanugo and Ejim (2000), who reported that 0 -1 year olds had low prevalence for *Plasmodium* infection. This has further demonstrated the vulnerability of the children in this age group to malaria infection (Brown, 1980). This might also suggest that malaria infection occurs more in children less than 5 years old in moderate infection than mild and severe form or the disease. Although it has been established that residual immunity derived from mothers could be very effective in younger children but environmental condition and inability of children of this age in the study area to ward-off environmental induced mosquito attack predispose them to malaria attack (Nwaorgu and Orajiaka, 2011). The markedly increased level of parasitaemia in individuals less than 10 years old according to Mbanugo and Ejim (2000) could be attributed to the gradual loss of these maternally derived antibodies. Individuals in the area where the present study was carried out are less protected and are more prone to mosquito bites.

The prevalence and intensity of malaria infection by level of education showed that the highest prevalence (96.8%) was observed among those who had only primary education while the least prevalence (84.3%) was observed among those with had tertiary education. This agrees with the findings of Onyido *et al*. (2014) where the primary education group had the highest malaria prevalence (21.2%) and no malaria parasite was observed among the children of caregivers or mothers with tertiary education. The tertiary education group had the least prevalence of (17.6%). Onyido *et al*. (2014) observed that it could be that those with tertiary education have proper knowledge about the mode of infection of malaria and also the ways to prevent and control the disease as a result of their educational exposure. They take care of themselves properly. This further proved the earlier suggestion that those with tertiary education have proper knowledge about the mode of malaria disease and also the ways to prevent and control the disease. As a result of their educational exposure, they take care of themselves properly (Onyido*et al*., 2014). It could also be that they resort to early diagnosis and treatment before the condition would develop into anaemia.

By occupation, farmers and children of farmers had the highest prevalence (94.7%) while civil servants had the least prevalence of (65.4%).This agrees with Irikannu and Chukwuekezie (2015) who also observed least prevalence among civil servants but contrasts with their findings where they observed highest prevalence in traders. Least malaria prevalence in civil servants has also been reported in Abagana (Ugha *et al*., 2013). Tshikuka *et al*. (1996) reported a similar relationship between occupation and malaria infection and observed a significantly higher prevalence of the *Plasmodium* parasite in low paid, unskilled workers and the unemployed than the civil servants.

By marital status, married individuals and their children had the highest prevalence of (91.9%) while those of widowed had the least (80.1%). The variation here may be by chance as the malaria diseases can affect anyone, irrespective of the marital status.

Of all the 925(87.3%) individuals, 843(80.3%) had mild malaria infection, 150(16.2%) had moderate infection and 32(3.5%) had heavy infection with malaria parasites. In this study, the highest occurrence of heavy infection of malaria parasite (9.1%) was in the age group less than 10 years. This has further demonstrated the vulnerability of the children in this age group to malaria infection (Onyido *et al*., 2014). This might also suggest that malaria infection occur more in children less than 10 years old.

RECOMMENDATION

From the findings of the present study, it is recommended that there should be regular Public health education campaigns and more intervention programmes for individuals by the State Government. Health caregivers should create awareness campaigns that may lead to the reduction of vectors of malaria disease – mosquitoes so as to prevent and control of the disease especially in younger children. Free or subsidized long lasting insecticide treated bed nets (LLITNs) should be made available to mothers and other care givers. There should be sensitization of family members especially children on the need to sleep inside the nets to prevent bites of mosquitoes. Early diagnosis and treatment of children in hospitals should be advocated to prevent anaemia due to malaria.

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