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Assessment of Malaria Parasitaemia among the Residents of Abuja Municipal Area Council (AMAC), FCT, Abuja, Nigeria

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ABSTRACT: Malaria intensity in both Urban and Rural areas of Nigeria is of Public Health importance. This study was conducted to assess the malaria parasitaemia among the residence of Abuja Municipal Area Council, FCT, in order to provide epidemiological data on malaria in the council for effective management program. A total of 200 residence within the range of 2-50 years were sampled for malaria parasitaemia using thick and thin film smears. A capillary blood sample was collected from each of the residence using finger prick technique, thick and thin blood films were prepared, stained, dried and examined for malaria parasites. The data was analyzed using simple percentages and chi-square analytical methods. The result from the study revealed an overall prevalence of 54.0% while the proportion of the residence infected were highest within the 2-10 years age-group (76.9%, P = 0.003, X^2 = 8.42) followed by those in 11-20 years (65.0%) and 21-30 years (50.0%). Those in 31-40 years and 41-50 years (29-7% and 21.4%) had lowest. The highest density recorded was >10,000 parasites/ul across the positives as 2-10 years (P = 0.003, X^2 = 2.22) has the highest. Malaria parasitaemia was highest among the vulnerable group 2-10 years (P = 0.003, X^2 = 2.22) in the council and remain endemic. There is an urgent need to identify innovative and integrated control measures to reduce the scurge among them. Public Health education campaign against malaria infection and its agent (mosquito) should be intensified in the Council.

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Malaria is one of the World's most deadly and life threatening parasitic disease (Abah and Temple, 2015) and *Dougnon et al;* 2015 described as one of the World's deadliest diseases affecting people, particularly in tropical and subtropical regions of the World. Malaria parasitaemia is the presence of malaria parasite in the red blood cells causing feverish condition, anaemia and in many cases especially in children resulting to death. It is typically caused by single-celled obligate protozoan parasite of the genus Plasmodium (*Udoh et al.,* 2016) and the species are: falciparum, malariae, oval , vivax and those mostly found in Sub-Saharan African are falciparum and malariae species (*Idowu et al.,* 2009, *Okonko et al.*, 2010, *Tela et al.,* 2015, *Unata et al.,* 2015, *Pamela et al.,* 2015). Nevertheless, *Idowu et al*., 2010, *Pamela et al.,* 2015 reported that the majority of malaria infections in Sub-Saharan Africa are caused by Plasmodium falciparum, more so, the main causes of morbidity and mortality affecting people of all age groups especially children in endemic areas such as Nigeria (*Olasehinde et al.,* 2014). In areas where it is endemic such as Nigeria, it poses a major problem to both human capital and economic development among other factors (*Nwanosike et al.,* 2015). Moreover, it has been estimated to cause death of two million children globally per annum (Okafor and Oke-Oso, 2012). Globally, nearly 50% of the world's 3.28% to 3.40% billion people live in areas at risk of malaria infections (*Tyndall et al.,* 2012, *Orok et al*.,2016), which are distributed in 106 nations (Nigeria Fact Sheet, 2011). *Okonko et al.,* 2010, reported that 300 to 500 million clinical cases occur globally leading to over 1 million deaths. The world Health Organization estimated that 216 million of malaria cases occurred in 2010, of which 81% occurred in Africa (Nigeria Malaria Fact Sheet, 2011), in the African region, 30 nations accounted for 90% of global malaria deaths and are found in Sub-Saharan Africa. Typically, Nigeria, Democratic Republic of Cong, Tanzania, Uganda, Mozambique and Cote d'ivore account for approximately 103 million malaria cases and 47% of the world total per annum *(Orok et al*.,2016). In a country like Nigeria where malaria is endemic, malaria is common to children, young, even the elderly and represents a substantial public health challenge (*Okoroiwu et al.,* 2018). *Nwanosike et al*., 2015, reported that malaria accounts for about 60% of

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out- patient hospital visits and 30% of hospitalizations among children less than five years of age. Still in Nigeria, several studies on the assessment, prevalence, pattern and distribution of malaria parasitaemia have been variously reported. For instance, *Abbas et al*., 2015 revealed a 6.4% prevalence of malaria in Lagos and 43.3% in Borno; while *George et al.,* (2015) reported 38.8% in North Central Nigeria. *Dougnon et al.*,(2015) had 22.0% prevalence in Nigeria, with males (63.33%) being more infected than their female (36.36%) counterparts, while *Okoroiwu et al*.,(2018) got 40.4% prevalence in Lagos . Elsewhere, in Northeastern Nigeria, *Houben et al*.,(2013) made a discovery of 24.5%, , moreso, *Sam et al.,(*2014) revealed a prevalence of 71.1% in their study of epidemiological factors in prevalenc of malaria parasites in Primary Health Facilities Attendees in Ogun state, Nigeria, nevertheless, Awoyemi,(2003) reported 43.0% in his study of malaria morbidity amongst hospital workers in Ilorin.

The most critical factors incriminated in the spread or eradication of malarial disease include human behaviours (shifting population centers; changing farming methods); living standards and poverty as the predisposing factors associated with the disease (*Worrall et al*.,2003). The availability of numerous breeding places for malaria parasite vectors (Mosquitoes), the incessant rainfall, unsanitary environmental conditions, ignorance, poor behavioral attitudes and inadequately planned socio-economic projects have made the Nigerian environment a fertile ground for the escalation of the malaria infection (*Anthonio-Nkonjio et al*.,2006; *Okoroiwu et al*.,2018). Likewise, it has been observed that there is high level of malaria infection in Abuja, the capital City of Nigeria (Okoroiwu, 2019). The reason is due to the tropical nature of Abuja coupled with lifestyles and behaviours, micro-climate, topography, population density and cultural practices among others.

These factors encourage the breeding of mosquitoes and thus increase human vector (mosquitoes) contact which promotes the continuous transmission of infection (*Okoroiwu et al*., 2018). Nevertheless, Abuja Municipal Area Council has been making efforts at combating the malaria scourge even before the malaria eradication programme. It is evident that many publications have done great works on prevalence of malaria in Africa, Nigeria and Abuja. However, none has studied the assessment of malaria parasitaemia to know its involvement in frequent cases of illnesses encountered in the Municipal and this is the rationale for this investigation. The purpose was to determine the prevalence of malaria parasitaemia among the residents of Abuja Municipal Area Council, FCT, Abuja, Nigeria

MATERIALS AND METHODS

Study Design: This is a cross-sectional descriptive study of the assessment of malaria parasitaemia among the residents of Abuja Municipal Area Council (AMAC), FCT.

Study Area: The AMAC was created on October, 1984. It is located on the eastern wing of the Federal Capital Territory and comprises of Twelve Wards namely, City centre; Garki; Gwagwa; Gwarimpa; Jiwa; Karshi; Kabusa; Karo; Nyanya; Orozo and Wuse. Each of these is represented by an elected Councilor. It has a population of about 776,298 according to 2006 population census. The bulk of Federal institutions, ministries, departments and agencies are located within the Council. It has 152 secondary schools and 320 primary schools. The Municipal is divided into‘’Phases’’by its planners, with the City’s development taking a concentric form with Phase 1, which consists of the City’s inner districts-Central area , Maitama, Asokoro, Wuse, Wuse 11, Garki , Garki 11, Guzape and Guzape 11- at its core spreading out from the foot of Aso Rock, while Phase 5, consists of the newly created Kyami District covering the vicinity of the Nnamdi Azikiwe International Airport and the permanent campus of the University of Abuja, over 40 kilometers west of Aso Rock. Each Phase is separated from the other by an expressway, for example , Phase 1 and 2 are separated from each other by the Nnamdi Azikiwe expressway, while the main city (Phases 1-5) are enclosed by the Murtala Muhammed expressway as well as the Federal A2 highway which traverses the Federal Capital Territory on its way to Kaduna and Lokoja. Thus there is an integration of the City’s road network with the Federal highway network, providing access to the immediate outlying countryside and the surrounding states of the country that is Niger state to the west, Kaduna state to the north, Nasarawa state to the east and Kogi state to the south.

Study Population: This study was carried out among the Residents of Abuja Municipal Area Council, FCT, Abuja. The population comprised of males and females of the ages ranging from 2-50 years. The adults are majorly civil servants, few of the indigenes are mainly farmers, public servants, students, scholars and pupils.

Sample Size Determination: A suitable sample size of 200 residents of AMAC of ages ranging from 2-50 years where randomly selected for this study. Sample size was calculated using $n = N^2P(1-P)/d^2$ according to Naing et al., 2006. A prevalence rate of 15.4% was chosen, margin of sampling error or precision was set at 5% with 95% confidence interval.

15.4% (0.154); d = marginal error = 5% (0.05)

Using $n = N^2P(1-P)/d^2 = n = (1.96)^2 \times 0.154(1-0.154) / (0.0025) = 3.8416 \times 0.154 (0.846) /0.0025 = 200$

Sampling Techniques: The blood samples of the 200 residents of AMAC were collected using random sampling Techniques. The samples were sent to the laboratory for processing to determine the presence of malaria parasites in the samples.

Sample Collection, Processing and Analysis: A capillary blood sample was collected from each of the residents using finger prick techniques. This was done holding the ring finger of the patient, swabbed the tip with 70% alcohol and then punctured with sterile safety lancet. The first drop of the blood was wiped off with dry cotton wool, a micro-pipette was used to collect the drops of blood onto prepared clean, grease free glass slide, thick and thin smears were made on the same slide with an interval of 2mm from each other, labeled and allowed to dry. Having dried, the end of the slide containing thin film is fixed by dipping into 70% alcohol to avoid lyses, allowed to dry, stained and examined for malaria parasite under the oil immersion objectives. The presence of malaria parasite in either of the films is regarded as positive either with one plus (+), two pluses (++) or three pluses (+++).

Methods of Data Analysis: The data collected were analyzed using simple percentages, frequency and chi-square methods to establish the relationship between ages, sex and malaria parasitaemia in the Council.

Ethical consideration and Approval: Permission to carry out the assessment was obtained from the quality control and research committee of defense headquarters, medical center through the director and Head of department of Health, Abuja Municipal Area Council. While informed consent was obtained from the individual participants and the parents of the individual under-aged after explaining what they will gain from participating.

Inclusion and Exclusion Criteria: Inclusion criteria were children, men and women between the ages of 2-50 years living in the area council. Individuals below 2 years and those above 50 years, as well as those not resident in the council were excluded.

RESULT AND DISCUSSION

200 blood samples were randomly collected from AMAC residents for malaria parasitaemia. Out of this number, 108 (54.0%) of them were positive for malaria parasitaemia and 92(46.0%) were negative. More so, out of 155 males that were involved, 77(49.0%) had malaria parasitaemia while 31(68.9%) of 45 of the female counterparts in the study were positive (table 1). Table 2 is the related prevalence of malaria parasitaemia among the residents of AMAC. ≤ 1000 parasites/ul of blood which is mild infection were found in 20.0%, 1000-10,000 parasites/ul of blood harbored moderate parasitaemia representing 17.0% while, >10,000parasites/ul of blood which is severe infection were found in 17.0% of them. Table 2 showed the total and sex-related prevalence of malaria parasitaemia among the AMAC Residence. Total prevalence of malaria parasitaemia is 54.0%, Males has 49.7% of the infection while the female counterparts had 68.9%. Table 2 is the level of malaria parasitaemia density across the residence of AMAC Table 3 is the age-related prevalence of malaria parasitaemia among the age groups of AMAC Residence. 2-10 years age group had the highest (76.9%) , followed by 11-20 (65.0%), while ages 21-30, 31-40 and 41-50 cohorts had 50.0%. 29.7% and 21.4% respectively. Table 4 is the malaria parasitaemia density distribution across the ages. Malaria density is highest (25.0%) among 2-10 age groups.

Table 1: Sex-related prevalence of malaria parasitaemia among the residents of AMAC, FCT

Sex (gender)	No examined	No positive (%)	No negative (%)
Male	155	77 (49.7)	78 (50.3)
Female	45	31 (68.9)	14 (31.1)
Total	200	108 (54.0)	92 (46.0)

Table 2: Malaria density distribution across the positives

Malaria density	Test subjects
≤ 1000 parasite/ul of blood (mild infection)	40(20.0%)
1000-10,000/ul of blood (moderate infection)	34(17.0%)
>10000 parasite/ul of blood (severe infection)	34(17.0%)
Total	108(54.0%)

$X^2 = 6.0$; P = 0.004

Table 3: Age-related Prevalence of Malaria parasitaemia among the residents of AMAC, FCT

Age groups (Years)	No examined	No positive (%)	No negative (%)
2-10	65	50(76.9)	15(23.1)
11-20	40	26(65.0)	14(35)
21-30	30	15(50.0)	15(50)
31-40	37	11(29.7)	26(70.3)
41-50	28	6(21.4)	22(78.6)
Total	200	108(54.0)	92(46.0)

$X^2 = 8.42$; P = 0.003

Malaria worldwide is a major health challenge to humans living in endemic regions, as such it could cause obstruction and/or delay in daily activities thereby leading to low productivity among the labor force due to absenteeism (*Ughasoro et al*., 2013) and great loss of lives, the cost of treatment of patients and

the negative impact of the disease it also a highly social and economic burden (Ukpai and Ajoku, 2001). In this cross-sectional descriptive assessment of malaria parasitaemia among the residents of Abuja Municipal Area Council (AMAC), FCT, and the overall prevalence of 54.0% (table 1) constitute a major public health threat to the inhabitants of AMAC and showed that malaria is endemic in the area council. This may be attributed to a number factors such as lifestyle of the residents, topography and population density (Umaru and Uyaiabias, 2015) as well as the effect of climatic factors such as temperature, humidity and rainfall which regulates the biology of development of both mosquitoes and parasites (Martin and Lebvre, 1995). The prevalence of 54.0% obtained in this investigation is low when compared with the works of *Kalu et al.,* 2012; *Idris et al.,* 2017 and *Sam et al.,*2014 who variously reported 73.4%; 72.2% and 71.1% respectively. The relatively low prevalence in this study may be as a result of the development of high levels of the acquired anti-malaria immunity among them, but could be attributed to increased malaria awareness among the residents in the area council and the intensified efforts of various health authorities in Federal Capital Territory, Abuja in the control and prevention of malaria among the population of FCT, Abuja.

However, the outcome of this assessment is high, when compared with those of *George et al*., 2015; *Abbas et al*., 2015; *Dougnon et al.,* 2015; *Okoroiwu et al*., 2018; *Houben et al*., 2013 and Awoyemi, 2003 who in their various surveys revealed 38.8% in North central Nigeria; 6.4% and 43.3% both in Lagos and Borno; 22.0% in Nigeria; 40.4%; 24.5% in Northeastern Nigeria and 43.0% in Ilorin respectively. Recent malaria risk map estimated that malaria prevalence in Nigeria varied from less than 20.0% in certain areas to over 70.0% in others. This variation could be as a result of different climatic conditions, less rainfall and surface water that serve as mosquito breeding sites as well as study area, socio-economic condition and educational background of the study population.

Table 4: Age distribution of malaria parasitaemia count across positives

Age groups (Years)	Positive cases	≤ 1000/ul	1000-10000/ul	>10000	Frequency (%)
2-10	50	18	18	14	50(25.0)
11-20	26	7	5	14	26(15.0)
21-30	15	7	6	2	15(7.5)
31-40	11	5	2	4	11(5.5)
41-50	6	3	3	0	6(3.0)
Total	108	40	34	34	108(54.0)

$X^2 = 2.22$; $P = 0.034$

The sex-related result shown in table 1 indicated that more female (68.9%) were infected than their male (49.0%) counterparts. The same observation had been documented in a similar study in 2003 (Awoyemi) and 2018 (*Okoroiwu et al*., 2018), but was not in conformity with the revelations of *Kalu et al*.,2012 and *Dougnon et al.,*2015 who reported males (63.1%), females (36.4%) and males (73.8%) , females (72.9%) respectively. This revelation in the differences in sex-related prevalence may be as a result of the female counterparts being more involved in farming activities and trading as a result were at high risk of malaria infection due to exposure, inherited and cultural determinants (Salwa, 2010). Other possible reasons for the disparity could be differences in lifestyles of both sexes in their different environments as well as the personnel involved in the studies. The relationship between the age of the study population and the prevalence of malaria parasitaemia is shown in table 3. There was a high burden of malaria parasitaemia especially among the most vulnerable groups such as children 2-10 years (76.9%, P = 0.003, $X^2 = 8.42$), while 11-20 years age cohort recorded an infection rate of 65.0% with those in age bracket of 21-30, 31-40 and 41-50 years recorded 50.0%, 29.7% and 24.1% respectively, but the mean prevalence rate of 40.5% is very high indeed. However, this observation does not corroborate the findings of Kalu *et al.,* 2012 who reported 85.4% among the age group of 11-20 years in their study termed' 'Prevalence of malaria parsitaemia in Umuchieze and Uturu communities of Abia state Nigeria''. The prevalence and density proportional decreased with age. This could be as attributed to the fact that the individuals of these ages have developed immunity against malaria parasites and the low densities of parasitaemia seen in them could be as a result of immunity derived from persistent attacks due to malaria. The results of this study constitute an eloquent testimony that malaria infection is endemic in Abuja Municipal Area Council (AMAC) and mostly affect the vulnerable groups such as children especially those in 2-10 years old. This is a great public health problem in the area and with this baseline information, there is need for awareness, early diagnosis and treatment. In conclusion, malaria parasitaemia is a common and serious public health problem in our environment, and the prevalence of 54.0%, with 2-10 years mostly affected calls for an urgent action in the area, hence, there is need for a comprehensive strategy including intermittent preventive treatment of malaria in the area council. Public health education campaign for mothers and health care-givers be given to create more awareness that may lead to reduction of vectors of malaria and control of disease especially in young children.

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