

**PREVALENCE OF MALARIA PARASITAEMIA IN THREE SELECTED
LOCAL GOVERNMENT AREAS OF NIGER STATE, NORTH CENTRAL,
NIGERIA**

Abstract

Introduction

Malaria- a parasitic protozoan infection, caused by Plasmodium species- is a major public health challenge in Africa. Aside hundreds of thousands of annual deaths attributable to malaria, lots of valuable manhours- that could otherwise be put to some productive endeavours- are wasted in hospital visits and waiting time in clinics. An estimated 81% of all annual global malaria cases, as well as 91% of all global deaths that are due to malaria, occur in Africa. Therefore, the monitoring of prevalence of malaria parasitaemia is an integral part of any preventive and control measure put in place to curb the spread of malaria.

Materials and Method

This study was designed to determine the prevalence of malaria parasitaemia in three selected local government areas (LGA) of Niger State, north central, Nigeria. A total of 930 subjects were sampled from Borgu, Mashegu and Magama LGAs of Niger State. Out of these, 504(54.2%) were males, while 426(45.8%) were females. Twenty-two percent, 27.1%, 22%, 5.3%, 4.7%, 6.3%, 4.5% 3.7% and 4.4% were within the 1-5 years, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40 and >40years age-groups respectively. The subjects were requested to complete questionnaires (self-administered for literate ones but interviewer-administered for those who could read and write and 0.5mL of capillaries blood samples were collected from each of them. Thick and thin blood films of the samples were stained with Giemsa and the stained slides were microscopically examined for the presence or absence of the asexual stages of Plasmodium spp.

Results

28 The study recorded an overall prevalence of 51.9%. The females had a higher prevalence
29 (53.3%) than the males (50.8%). Among the various age-groups, 74.6%, 48.4%, 46.8%,
30 46.9%, 45.5%, 44.8%, 45.2%, 41.2% and 24.4% prevalences respectively were recorded
31 within the 1-5years, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40 and >40years age-
32 groups. No statistically significant ($p>0.05$) differences in prevalence were found among the
33 various occupational groups of the subjects; students (47.9), farmers (57.7%), fishermen
34 (64.9%), cattle-rearers (57.3%) and dependants/ full-time house-wives (60%). However, a
35 statistically significant difference in prevalence ($p<0.05$) was discovered between subjects
36 who lived in thatched-roof houses and those who lived in houses with corrugated iron roofing
37 sheets. Prevalence was also significantly higher ($p<0.05$) among subjects who had no formal
38 education. From the findings of the study, one out of every two subjects had malaria
39 parasitaemia. If this is extrapolated to the entire communities of Borgu, Mashegu and
40 Magama LGAs, it means greater than half (51.9%) of the general populace are infected with
41 malaria.

42 Conclusion and Suggestions

43 It is therefore recommended that the government of Niger State and the chairmen of these
44 three LGAs should immediately put measures in place to curb and curtail the spread of
45 malaria in these rural communities.

46 Keywords: malaria, parasitaemia, Niger State, prevalence, Nigeria

47 Introduction

48 Malaria is a major public health challenge in Africa, where it causes millions of
49 death annually (Olawumi *et al.*, 2014). Pregnant women, infants, children under
50 five years and visitors to malaria-prone areas are particularly vulnerable to
51 malaria, among whom morbidity and mortality are most severe and highest (Ter
52 *et al.*, 2003; WHO, 2004; Isah *et al.*, 2011; Patrick *et al.*, 2006; Ashley *et al.*,
53 2006; Sarr, *et al.*, 2006). In the tropics, up to 80% of childhood fever could be
54 due to malaria and an approximate 30-35% of hospital visits results from
55 malaria or malaria-related issues (Daboer *et al.*, 2010).

56 The long-term consequences of malaria in endemic areas like sub-Sahara Africa
57 among children under five years is equally disturbing, as these could manifest
58 as cognitive impairment or stunted growth(Patrick *et al.*, 2006; Custodia *et al.*,
59 2009; Ikeh *et al.*, 2008; Yartey *et al.*,2006; Ashley *et al.*, 2006; Sarr *et al.*,
60 2006). It takes heavy tolls on pregnant women, in form of pre-term birth, intra
61 uterine foetal death, miscarriages, maternal hypoglycaemia, cerebral oedema
62 and maternal death (WHO, 2007; Onah *et al.*, 2006; Falade *et al*, 2008; FMoH,
63 2000; Gajida *et al.*, 2010). Prevalence of direct or indirect maternal death
64 traceable to malaria in Nigeria has been reported as 10% in Calabar, Enugu 8%,
65 7.8% in Lagos and 8.2% in Kano (Gajida *et al.*, 2010; Schanta-Dunn and Nour,
66 2009)

67 Certain estimates claim that between 80-90% of global cases of malaria occur in
68 sub-Sahara Africa (Isah *et al.*, 2011; WHO, 2007; Guyatt and Snow, 2001) Out
69 of a total number of 216 million cases estimated to have to occurred in 2010,
70 81% were in Africa, 13% in southeast Asia and 5% in Eastern Mediterranean
71 region. Same year, 2010, 655, 000 deaths were estimated to be due to or related
72 to malaria and out of these, 91% were in Africa, 6% in Southeast Asia and 3%
73 in Eastern Mediterranean region (WHO, 2011).

74 Malaria- a protozoan infection- is caused essentially in Africa by *Plasmodium*
75 *falciparum*. *Plasmodium species* are transmitted to humans by the bites of adult
76 haematophagous anthropophilic female Anopheles mosquitoes (Kalu *et al.*,
77 2012). In Asia, *Plasmodium vivax* accounts for about 70% of malaria infections,
78 while in other parts of the world, *Plasmodium falciparum* accounts for about
79 33% of all malaria infections (Ukpai and Ajoku, 2001; Kalu *et al.*, 2012). In
80 Nigeria, the Federal Government has initiated different prevention and control
81 programmes, such as Roll Back Malaria. The effectiveness of this and other
82 measures depends to a large on extent on studies like this, which will help guide
83 government as where and how interventions programmes are needed and should
84 be implemented. This study aimed at determining the prevalence of malaria

85 parasitaemia in three selected local government areas of Niger State, North
86 central, Nigeria. It equally aimed at evaluating the prevalence with regards to
87 the age, gender and local government areas of the subjects.

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89

90 **MATERIALS AND METHOD**

91 Study Sites and Study Design

92 This descriptive cross sectional study was conducted in three local Government
93 Areas of Niger State, North-Central region of Nigeria. The state is located in the
94 North Central geopolitical zone and Middle Belt of Nigeria and covers a land
95 mass of 76,363 square kilometres. It lies between Latitude 8°.00-11°.30'N and
96 Longitude 4°.00-8°.00'E; it shares international boundary with the Republic of
97 Benin to the west and 6 interstate boundaries in Nigeria namely; Kebbi and
98 Zamfara States to the north, Kwara and Kogi States to the South and Kaduna
99 and Federal Capital Territory to the East (NSMST, 2016.) (Fig 1)

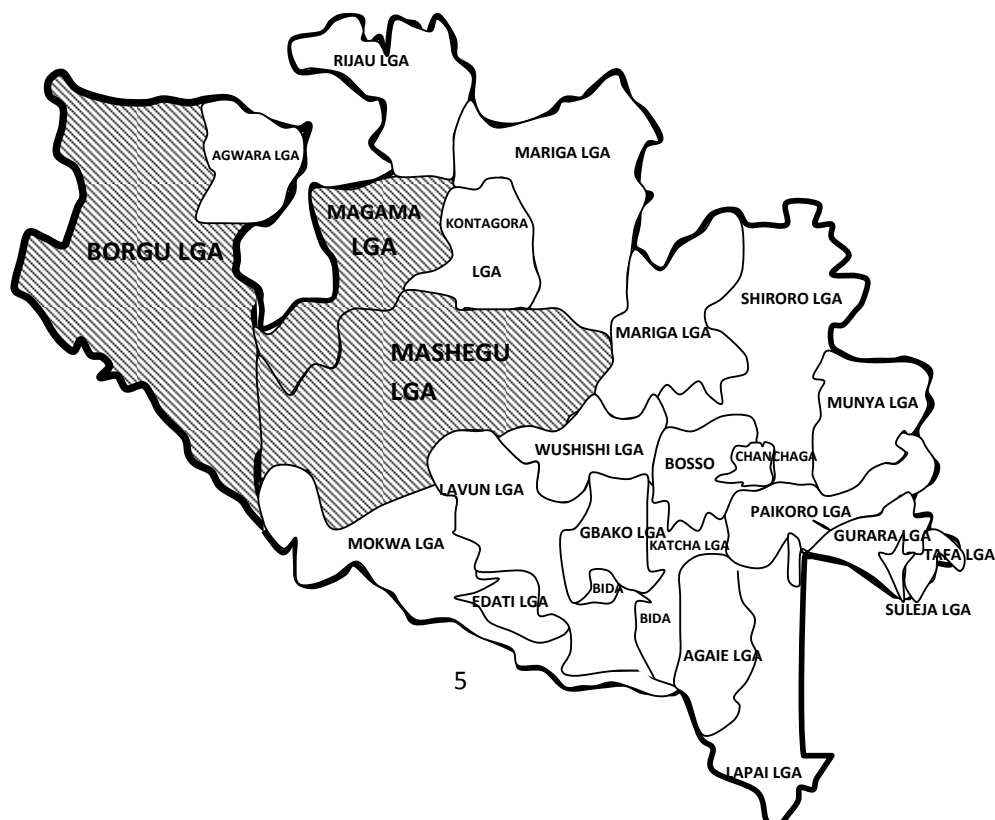
100 The climate of Niger State is that of tropical continental region which is
101 characterized by relatively wide annual temperature range and a restricted
102 rainfall. It is also marked by two distinct seasons, namely, rainy and dry. The
103 rainy season starts in April and lasts till October, with June and August as the
104 months of peak rainfall. The dry season, extending from November to March is
105 completely devoid of rains and characterized by harmattan with dust-laden cold
106 winds swept-in by the Northeast Trade wind. The departure of harmattan for the

rains is ushered-in by the arrival of moist tropical maritime air mass of the southwest trade wind. This point is usually marked by hot sunny days with temperature range of 34-40°C, the highest of which occur in March (Ikusemoran, 2009).

The vegetation of the North central Nigeria reflects that of Guinea Savanna zone, characterized by predominance of tall grasses interspersed with few trees. (Jimbrin and Jaiyeoba, 2013).

Ethical Consideration

Ethical clearance was sought and obtained from University of Ilorin ethical review committee and Niger state ministry of health



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128 Fig 1: Sketch Map of Niger State showing the 25 Local Government Areas. The
129 shaded areas are the three Local Government Areas where the study took
130 place.

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132 Sample Collection

133 Blood samples were collected aseptically by finger prick to make thick and thin
134 blood smears on clean grease-free microscope slides. The slides were properly
135 labelled and allowed to air dry before they were packed into slide boxes.

136 Microscopic Examination

137 Giemsa stain was prepared and diluted (3%) in buffered distilled water (pH 7.2).
138 Thin films were first fixed with methanol and allowed to air dry after which
139 both thick and thin smears were stained with filtered and diluted Giemsa stain
140 for 30 minutes and then examined under compound microscope for the presence
141 of asexual stage of *P. falciparum* as earlier described by Cheesbrough (2009).
142 Parasite density was recorded as number of parasite/ul of blood, assuming an
143 average leucocyte count of 8,000/ul of blood.

144

145 RESULTS

The study recorded an overall malaria parasitaemia prevalence of 51.9%. The subjects comprised of 504 males (54.2%) and 426 females (45.8%). Two hundred and five (22%) of the subjects fell within the 1-5 years age-group, while 252 (27.1%), 205(22%), 49 (5.3%), 44(4.7%), 58(6.3 %), 42(4.5%), 34(3.7 %) and 41(4.4%) fell within the following age-groups respectively; 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40 and >40(Table 1)

Table 1: Subjects' Distribution by Gender and Age-groups

Age-groups	Male	Female	Total
1-5	114	91	205
6-10	144	108	252
11-15	113	92	205
16-20	22	27	49
21-25	28	16	44
26-30	21	37	58
31-35	20	22	42
36-40	18	16	34
>40	24	17	41
Total	504	426	930

The male subjects had a prevalence of 51.9% while females had 48.1% prevalence (Table 2)

Table 2: Prevalence among the genders

Gender	Positive	Negative	Total
Male	256	248	504

Female	227	199	426
Total	483	447	930

158

159 Malaria parasitaemia prevalence among the various age-groups were found to
 160 be 74.6%, 48.4%, 46.8%, 46.9%, 45.5%, 44.8%, 45.2%, 41.2% and 24.4%
 161 respectively among the 1-5 years, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-
 162 40 and >40 age-groups (Table 3)

163 Table 3: Distribution of prevalence rates among the age-groups

Age-groups	Positive	Negative	Total
1-5	153	52	205
6-10	122	130	252
11-15	96	109	205
16-20	23	26	49
21-25	20	24	44
26-30	26	32	58
31-35	19	23	42
36-40	14	20	34
>40	10	31	41
Total	483	447	930

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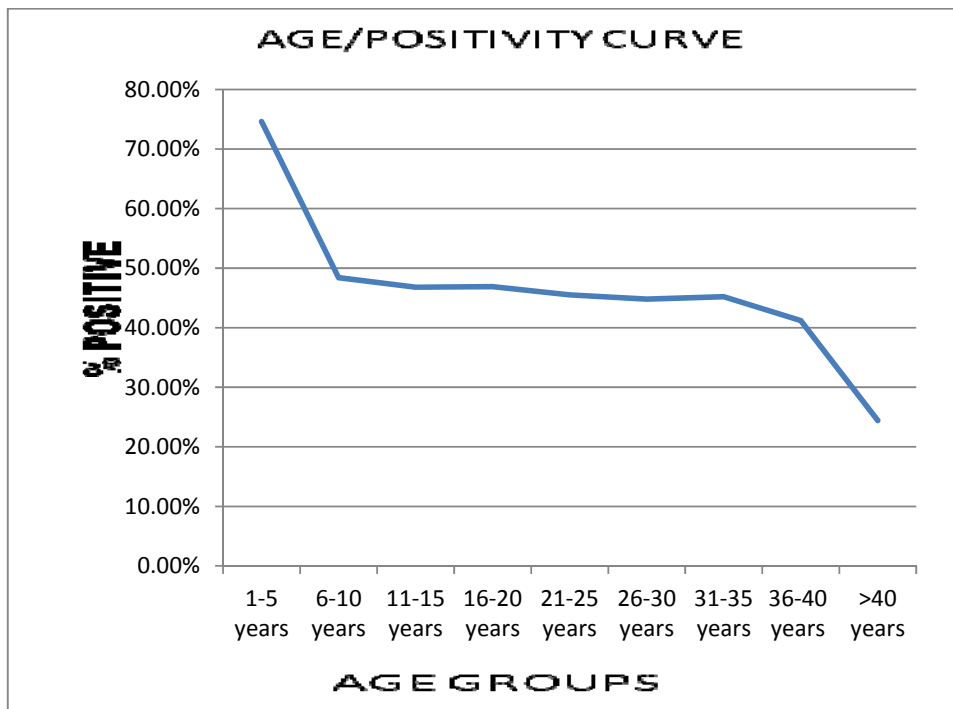


Figure2: Age/Positivity Curve

Figure 2 shows that prevalence decreases as age increases and this further reinforces the fact that infants and children under five years are somewhat vulnerable to malaria infection.

Occupationally, prevalence among the subjects were found to be; fishermen 64.9%; dependants 60%; cattle-rearers 57.3%; farmers 51.7% and students 47.9%. the difference were not statistically significant ($p > 0.05$, *chi-square*) (Table 4)

Table 4: Distribution of prevalence according to subjects' occupations

Occupations	Positive	Negative	Total
Students	227	247	474
Farming	121	113	234
Fishing	50	27	77
Cattle-	43	32	75

rearing			
Dependants/ Full time housewives	42	28	70

Housing-wise, the subjects essentially lived in three types of housing structures; mud houses with thatched roof; mud houses with corrugated iron roofing sheets and concrete houses with corrugated iron roofing sheets. The study found that subjects living in thatched-roof houses were statistically significantly more infected than those living in houses with corrugated iron roofing sheets ($p < 0.05$) (Table 5)

Table 5: Distribution of prevalence according to housing types

Housing type	Positive	Negative	Total
A	338	228	566
B	72	124	196
C	73	95	168
Total	483	447	930

Legend: A: thatched-roof mud houses; B: mud houses with corrugated iron roofing sheets; C: concrete houses with corrugated iron roofing sheets

Furthermore, prevalence was discovered to be significantly higher among subjects with non-formal education (64.1%) ($p < 0.05$ *chi-square*), followed by those with primary education (52.4%) and quaranic education (50%). Those with post-secondary education had the least prevalence (27%) (Table 6)

Table 6: Distribution of prevalence according to level of education

Level of education	Positive	Negative	Total
Pre-primary	227	247	474(51%)
Non-formal	177	99	276%)
Quaranic	30	30	60(6.5%)
Primary	22	20	42(4.4%)
Secondary	17	24	41(4.4%)
Post-secondary	10	27	37(4%)

Four hundred and sixty-nine (50.4%) of the subjects were from Borgu LGA(local government area), while 220 (23.7%) and 241(25.9%) were from Mashegu and Magama LGAs respectively. Of the three LGAs, Borgu had the highest prevalence (59.9%), while Mashegu and Magama LGAs had 43.2% and 44.4% respectively

DISCUSSION

Prevalence of malaria parasitaemia is usually high in rural areas where mosquito-breeding and transmission are intense. The overall prevalence of 51.9% obtained in this study shows that malaria remains an important public health problem despite several control measures in Niger State and Nigeria as a whole. The observed prevalence in this study is higher than 27.7%, 29.5% and 37.7% reported by Ikeh *et al.*, (2008) in Plateau State; Elechi *et al.*, (2015) in Borno State and Millicent and Gabriel, (2015) in Kaduna State respectively but consistent with the findings of Okoli and Solomon, (2014), James *et al.*, (2013) and NMSI, (2010) in Plateau State.

208 Disparity in prevalence of malaria parasitaemia between this study and those
209 afore mentioned studies may be due to multiple factors such as geographical
210 location, sampling and processing protocols, targeted population, seasonal
211 variation, environmental condition as well as rate of use of malaria intervention
212 tools (Yewhalaw *et al.*, 2013). The high prevalence (51.9%) obtained in this
213 study is attributable to socio economic status of the study population such as the
214 housing structure, deplorable level of education, ignorance, poverty, neglect and
215 socio cultural life style of the subjects.

216 Prevalence of malaria parasitaemia in relation to age showed a decreasing trend
217 towards an increasing age. This may be attributed to the gradual acquisition of
218 immunity to malaria which comes with cumulative exposure and is directly
219 related to age in an endemic area (Griffin *et al.*, 2015). The highest prevalence
220 of infection within the age range 1-5 years strongly suggests that the residual
221 maternal immunity acquired by the children had waned off and their immune
222 systems are not yet fully developed. Consequently, they were not able to
223 develop effective resistance to infections. Malnutrition is another reason that
224 may be adduced to the high prevalence of malaria parasitaemia among this age
225 group. Observations showed that many of these children are severely
226 malnourished and this has been found to induce down-regulation of the overall
227 anti-falciparum IgG antibody response (Elechi *et al.*, 2015). Previous studies
228 from various African regions have also reported highest prevalence in younger
229 age groups (Jean-Bosco *et al.*, 2011; Favour and Oguntade 2010; Okafor and
230 Oko-Ose 2012 and Mba and Aboh 2012).

231 Similarity in the overall prevalence of malaria between male and female
232 observed in this study is largely due to uniformity in the degree of exposure of
233 both sexes to mosquito bites. The higher prevalence (62.2%) seen among
234 females than males (35.7%) in the age group 21-25years may be due to
235 pregnancy which is associated with immune-suppression specifically among

236 primigravidae and secundigravidae. This finding is consistent with previous
237 studies which reported higher prevalence among females in the same age group
238 (Jenkins *et al.*, 2015; Kiggudu *et al.*, 2013 and Adedotun *et al.*, 2013).
239 However, a predominance of malaria infection in males has also been
240 documented (Udeze *et al.*, 2013).

241 Several studies have linked socio-economic status with malaria parasitaemia
242 (Bawa *et al.*, 2014; Jombo *et al.*, 2011; Danielle, 2015; Maris and Humphrey,
243 2015 and Merit *et al.*, 2014). In agreement with previous studies, this current
244 study illustrated that housing structures and level of education have significant
245 impact on the prevalence of malaria parasitaemia. Houses made of thatched roof
246 have an increased risk of mosquito bites indoors because such houses create
247 cooler and darker environment which favours resting mosquitoes. Moreover,
248 mud walls and thatched roofs often have crevices through which infected
249 mosquitoes can gain access to the inside of the house thereby leading to
250 increased mosquito population and resulting in higher risk of malaria
251 transmission.

252 On the other hand, education holds the key to a sustainable response to malaria
253 prevention and awareness of malaria services while low level of education is
254 associated with ignorance and increased vulnerability to malaria (RBM, 2015)

255 However, this study did show positive association between occupation and
256 malaria parasitaemia. The study revealed that malaria prevalence was higher in
257 Borgu local government area than Mashegu and Magama local government
258 areas. This may be largely due to lack of access to health care facilities and
259 social amenities in Borgu local government area. Also, Borgu shares
260 international boundary with republic of Benin (which is also endemic for
261 malaria) and the possibility of cross border movement may be responsible for
262 the observed higher parasitaemia (Gatton *et al.*, 2015). The drainage of river

Niger and its tributaries and presence of Yankari game reserve may be contributory factors.

Conclusion and recommendation

From the findings of this study it can be concluded that greater than half (51.9%) of the entire communities of Borgu, Mashegu and Magama LGAs of Niger State are infected with malaria. The attendant effects of this high rate plasmodiasis in an agrarian rural community are enormous. This could either suggest a high level of ignorance among the locals on how to prevent malaria infection or absence of basic health facilities. It is therefore recommended that the government of Niger State and the chairmen of these three LGAs should immediately put measures in place to curb and curtail the spread of malaria in these rural communities.

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