

Original Research Article

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

Abstract

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. 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 capillary 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. The study recorded an overall prevalence of 51.9%. The females had a higher prevalence (53.3%) than the males (50.8%). Among the various age-groups, 74.6%, 48.4%, 46.8%, 46.9%, 45.5%, 44.8%, 45.2%, 41.2% and 24.4% prevalences respectively were recorded within the 1-5years, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40 and >40years age-groups. No statistically significant ($p>0.05$) differences in prevalence were found among the various occupational groups of the subjects; students (47.9%), farmers (57.7%), fishermen (64.9%), cattle-rearers (57.3%) and dependants/ full-time house-wives (60%). However, a statistically significant difference in prevalence ($p<0.05$) was discovered between subjects who lived in thatched-roof houses and those who lived in

houses with corrugated iron roofing sheets. Prevalence was also significantly higher ($p<0.05$) among subjects who had no formal education. From the findings of the study, one out of every two subjects had malaria parasitaemia. If this is extrapolated to the entire communities of Borgu, Mashegu and Magama LGAs, it means greater than half (51.9%) of the general populace are infected with malaria. 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.

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

Introduction

Malaria is a major public health challenge in Africa, where it causes millions of death annually (Olawumi *et al.*, 2014). Pregnant women, infants, under-5 children and visitors to malaria-prone areas are particularly vulnerable to malaria, among whom morbidity and mortality are most severe and highest (Ter *et al.*, 2003; WHO, 2004; Isah *et al.*, 2011; Patrick *et al.*, 2006; Ashley *et al.*, 2006; Sarr, *et al.*, 2006). In the tropics, up to 80% of childhood fever could be due to malaria and an approximate 30-35% of hospital visits results from malaria or malaria-related issues (Daboer *et al.*, 2010).

The long-term consequences of malaria in endemic areas like sub-Sahara Africa among under-5 children is equally disturbing, as these could manifest as cognitive impairment or stunted growth (Patrick *et al.*, 2006; Custodia *et al.*, 2009; Ikeh *et al.*, 2008; Yartey *et al.*, 2006; Ashley *et al.*, 2006; Sarr *et al.*, 2006). It takes heavy tolls on pregnant women, in form of pre-term birth, intra uterine foetal death, miscarriages, maternal hypoglycaemia, cerebral oedema and maternal death (WHO, 2007; Onah *et al.*, 2006; Falade *et al.*, 2008; FMoH, 2000; Gajida *et al.*, 2010). Prevalence of direct or indirect maternal death traceable to malaria in Nigeria has been reported as 10% in Calabar, Enugu 8%, 7.8% Lagos and 8.2% Kano (Gajida *et al.*, 2010; Schanta-Dunn and Nour, 2009)

60 Certain estimates claim that between 80-90% of global cases of malaria occur in
61 sub-Sahara Africa (Isah *et al.*, 2011; WHO, 2007; Guyatt and Snow, 2001) Out
62 of a total number of 216 million cases estimated to have occurred in 2010,
63 81% were in Africa, 13% in southeast Asia and 5% in Eastern Mediterranean
64 region. Same year, 2010, 655, 000 deaths were estimated to be due to or related
65 to malaria and out of these, 91% were in Africa, 6% in Southeast Asia and 3%
66 in Eastern Mediterranean region (WHO, 2011).

67 Malaria- a protozoan infection- is caused essentially in Africa by *Plasmodium*
68 *falciparum* *Plasmodium species* are transmitted to humans by the bites of adult
69 haematophagous anthropophilic female Anopheles mosquitoes (Kalu *et al.*,
70 2012). In Asia, *Plasmodium vivax* accounts for about 70% of malaria infections,
71 while in other parts of the world, *Plasmodium falciparum* accounts for about
72 33% of all malaria infections (Ukpai and Ajoku, 2001; Kalu *et al.*, 2012). This
73 study aimed at determining the prevalence of malaria parasitaemia in three
74 selected local government areas of Niger State, North central, Nigeria. It equally
75 aimed at evaluating the prevalence with regards to the age, gender and local
76 government areas of the subjects.

77

78

79 MATERIALS AND METHOD

80 Study Sites and Study Design

81 This descriptive cross sectional study was conducted in three local Government
82 Areas of Niger State, North-Central region of Nigeria. The state is located in the
83 North Central geopolitical zone and Middle Belt of Nigeria and covers a land
84 mass of 76,363 square kilometres. It lies between Latitude 8°.00-11°.30'N and
85 Longitude 4°.00-8°.00'E; it shares international boundary with the Republic of

86 Benin to the west and 6 interstate boundaries in Nigeria namely; Kebbi and
87 Zamfara States to the north, Kwara and Kogi States to the South and Kaduna
88 and Federal Capital Territory to the East (NSMST, 2016.) (Fig 1)

89 The climate of Niger State is that of tropical continental region which is
90 characterized by relatively wide annual temperature range and a restricted
91 rainfall. It is also marked by two distinct seasons, i.e. rainy and dry. The rainy
92 season starts in April and lasts till October, with June and August as the months
93 of peak rainfall. The dry season, extending from November to March is
94 completely devoid of rains and characterized by harmattan with dust-laden cold
95 winds informed by the Northeast Trade wind. The departure of harmattan for
96 the rains is informed by the arrival of moist tropical maritime air mass of the
97 southwest trade wind. This point is usually marked by hot sunny days with
98 temperature range of 34-40°C, the highest of which occur in March
99 (Ikusemoran, 2009).

100 The vegetation of the North central Nigeria reflects that of Guinea Savanna
101 zone, characterized by predominance of tall grasses interspersed with tall dense
102 species (Jimbrin and Jaiyeoba, 2013).

103 Ethical Consideration

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

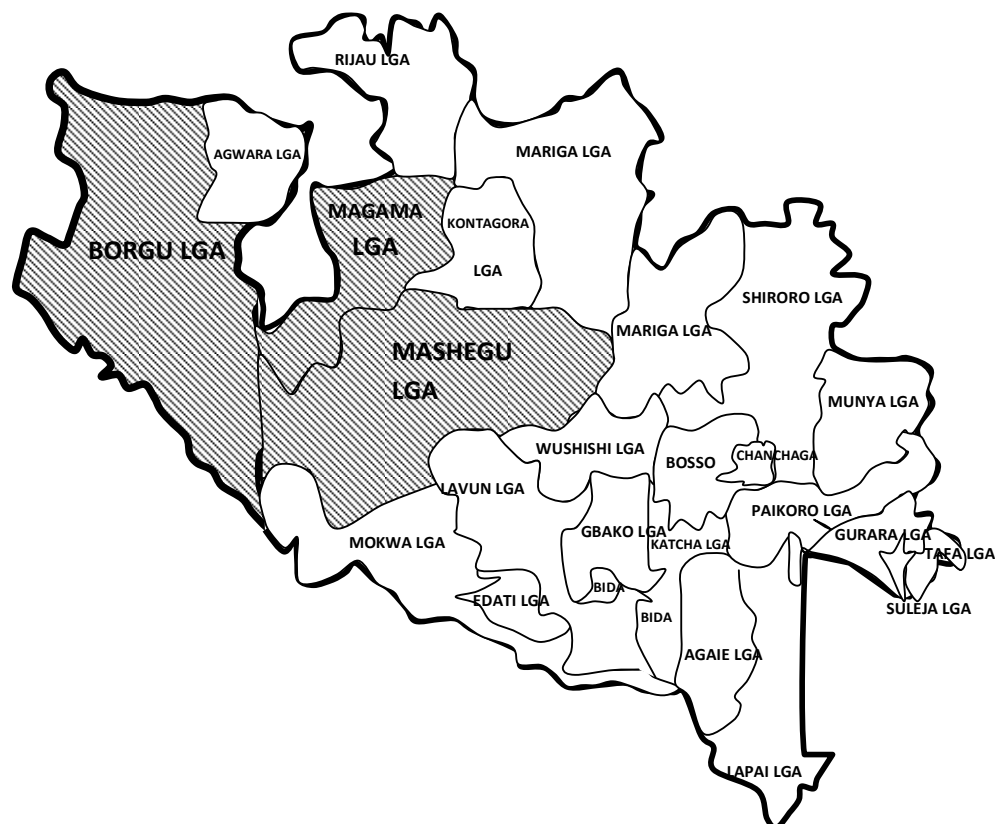


Fig 1: Sketch Map of Niger State showing the 25 Local Government Areas. The shaded areas are the three Local Government Areas where the study took place.

Sample Collection

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

125 Microscopic Examination

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

133

134 RESULTS

135 The study recorded an overall malaria parasitaemia prevalence of 51.9%. The
 136 subjects comprised of 504 males (54.2%) and 426 females (45.8%). Two
 137 hundred and five (22%) of the subjects fell within the 1-5 years age-group,
 138 while 252 (27.1%), 205(22%), 49 (5.3%), 44(4.7%), 58(6.3 %), 42(4.5%),
 139 34(3.7 %) and 41(4.4%) fell within the following age-groups respectively; 6-10,
 140 11-15, 16-20, 21-25, 26-30, 31-35, 36-40 and >40(Table 1)

141

142 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

143

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

146 Table 2: Prevalence among the genders

Gender	Positive	Negative	Total
Male	256		504
Female	227		426
Total	483		930

147

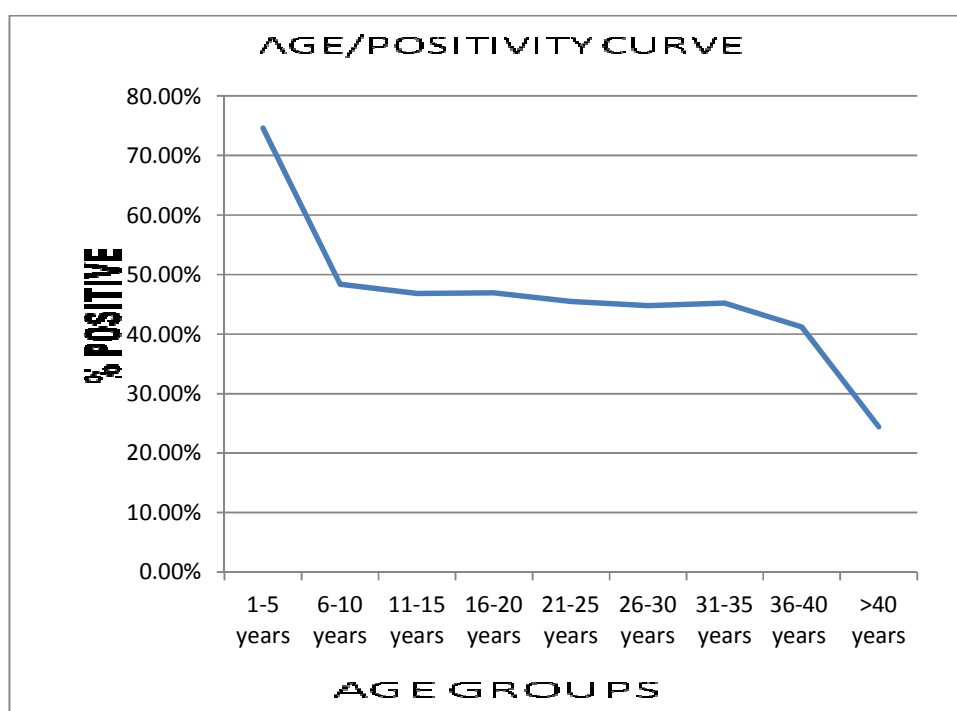
148 Malaria parasitaemia prevalence among the various age-groups were found to
149 be 74.6%, 48.4%, 46.8%, 46.9%, 45.5%, 44.8%, 45.2%, 41.2% and 24.4%
150 respectively among the 1-5 years, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-
151 40 and >40 age-groups (Table 3)

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

Age-groups	Positive	Negative	Total
1-5	153		205
6-10	122		252
11-15	96		205
16-20	23		49
21-25	20		44
26-30	26		58

31-35	19		42
36-40	14		34
>40	10		41
Total			

153



154

155 Figure2: Age/Positivity Curve

156

157 Occupationally, prevalence among the subjects were found to be; fishermen
 158 64.9%; dependants 60%; cattle-rearers 57.3%; farmers 51.7% and students
 159 47.9%. the difference were not statistically significant ($p>0.05$) (Table 4)

160 Table 4: Distribution of prevalence according to subjects' occupations

Occupations	Positive	Negative	Total
Students	227(47.9%)		474
Farming	121(51.7%)		234

Fishing	50(64.9%)		77
Cattle-rearing	43(57.3%)		75
Dependants/ Full time housewives	42(60%)		70

161

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

168

169 Table 5: Distribution of prevalence according to housing types

Housing type	Positive	Negative	Total
A	338(59.7%)		566
B	72(36.7%)		196
C	73(43.5%)		168
Total	483(51.9%)		930

170 Legend: A: thatched-roof mud houses; B: mud houses with corrugated

171 iron roofing sheets; C: concrete houses with corrugated iron roofing

172 sheets

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

177 Table 6: Distribution of prevalence according to level of education

Level of education	Positive	Negative	Total
Pre-primary	227 (47.9%)		474(51%)
Non-formal	177(64.1%)		276%)
Quaranic	30(50%)		60(6.5%)
Primary	22(52.4%)		42(4.4%)
Secondary	17(41.5%)		41(4.4%)
Post-secondary	10(27%)		37(4%)

178

179 Four hundred and sixty-nine (50.4%) of the subjects were from Borgu
 180 LGA(local government area), while 220 (23.7%) and 241(25.9%) were from
 181 Mashegu and Magama LGAs respectively. Of the three LGAs, Borgu had the
 182 highest prevalence (59.9%), while Mashegu and Magama LGAs had 43.2% and
 183 44.4% respectively

184 DISCUSSION

185 Prevalence of malaria parasitaemia is usually high in rural areas where
 186 mosquito-breeding and transmission are intense. The overall prevalence of
 187 51.9% obtained in this study shows that malaria remains an important public
 188 health problem despite several control measures in Niger State and Nigeria as a
 189 whole. The observed prevalence in this study is higher than 27.7%, 29.5% and
 190 37.7% reported by Ikeh *et al.*, (2008) in Plateau State; Elechi *et al.*, (2015) in
 191 Borno State and Millicent and Gabriel, (2015) in Kaduna State respectively but
 192 consistent with the findings of Okoli and Solomon, (2014), James *et al.*, (2013)
 193 and NMSI, (2010) in Plateau State.

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

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

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

222 primigravidae and secondgravidae. This finding is consistent with previous
223 studies which reported higher prevalence among females in the same age group
224 (Jenkins *et al.*, 2015; Kiggudu *et al.*, 2013 and Adedotun *et al.*, 2013).
225 However, a predominance of malaria infection in males has also been
226 documented (Udeze *et al.*, 2013).

227 Several studies have linked socio-economic status with malaria parasitaemia
228 (Bawa *et al.*, 2014; Jombo *et al.*, 2011; Danielle, 2015; Maris and Humphrey,
229 2015 and Merit *et al.*, 2014). In agreement with previous studies, this current
230 study illustrated that housing structures and level of education have significant
231 impact on the prevalence of malaria parasitaemia. Houses made of thatched roof
232 have an increased risk of mosquito bites indoors because such houses create
233 cooler and darker conditions which are favourable to resting mosquitoes.
234 Moreover, mud walls and thatched roofs often have crevices through which
235 infected mosquitoes can gain access to the inside of the house thereby leading to
236 increased mosquito abundance and resulting in higher risk of malaria
237 transmission.

238 On the other hand, education holds the key to a sustainable response to malaria
239 prevention and uptake of malaria services while low level of education is
240 associated with ignorance and increased vulnerability to malaria (RBM, 2015)

241 However, this study did show positive association between occupation and
242 malaria parasitaemia. The study revealed that malaria prevalence was higher in
243 Borgu local government area than Mashegu and Magama local government
244 areas. This may be largely due to lack of access to health care facilities and
245 social amenities in Borgu local government area. Also, Borgu shares
246 international boundary with republic of Benin (which is also endemic for
247 malaria) and possibility of cross border movement may be responsible for the
248 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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