PREVALENCE OF MALARIA: KNOWLEDGE, ATTITUDE AND CULTURAL PRACTICES OF PREGNANT WOMEN IN KATSINA METROPOLIS, NIGERIA

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Abstract
A study on Malaria in Pregnancy was carried out in Katsina Metropolis. A total of four hundred and eight (408) pregnant women were interviewed and administered questionnaires. Blood samples from each of the interviewed subjects were collected to make thin and thick smears. A total of 149 samples of the blood were found to be infected with Plasmodium corresponding to prevalence 36.5%. Only one type of specie, Plasmodium falciparum was encountered during the study. Distribution of infection in the trimester was highest in the 1st trimester (43.5%) and among those with non-formal education (75.0%), but age group of 19 years has 45.7% and health workers with 100%. A high percentage of the respondents (93.4%) attributed malaria infection to mosquito bites. Knowledge on mode of transmission of malaria varies considerably among age groups, different educational level and social status. A low percentage (3.7%) of the subject respondents was asymptomatic while a higher percentage (75.2%) showed fever as a major symptom of malaria. This varies gradually among different age, gravids and trimester groups. About 2.0% mostly full house wives (3.1%) do not take any preventive measure of malaria, while a high percentage of 79.2% mostly teachers with 100% sleep under mosquito net as their preventive measure (P > 0.05). Among the respondents (20.8%) who did not sleep under mosquito nets, 8.6% of them have insufficient/no mosquito net, 2.4% restrict the infection to weather fluctuation and 0.5% attributed malaria to rainy season.
Keywords: Prevalence, malaria, *Plasmodium*, cultural practices and pregnant women

**Introduction**

Malaria of the genus *Plasmodium*, is the most common Protozoan parasitic disease in the tropical and subtropical regions of the world (Davidson, 2000). It was once thought that the disease came from fetid marshes and hence the name malaria (Olumese *et al.*, 1999). It has also been found out in 1880 by Charles Laveron a French Army surgeon that the disease is caused by four (4) different species; *P. falciparum*, *P. ovale*, *P. vivax*, and *P. malariae* (Nonstrand, 1978), of these four different species pathogenic to man, *P. falciparum* infection is the commonest and the most deadly (Miller and Marley, 1999). Severe *P. falciparum* infection is the commonest cause of death among children in endemic areas and it often complicates itself into cerebral malaria (Angyo *et al.*, 1996). Malaria is endemic in about 103 countries with more than half the world population at risk, (Smyth, 1996).

In all the endemic areas, the frequency of malaria is higher in pregnant women than the same women before pregnancy (Ebrahim, 1996). Malaria in pregnancy is a major public health problem with serious consequences to the women and the foetus. It causes severe maternal anemia, spontaneous abortion, stillbirth, premature delivery (gestation of less than 37 weeks), intrauterine growth retardation and low birth weight increasing rise of infant death, (Isma’il *et al.*, 2000; Verboeff *et al.*, 2001). Low birth weight is a well documented risk factor; along with poor neuro-sensory, cognitive and behavioral performance and achievement (Mc-Cormick *et al.*, 1992). The interaction between HIV and malaria during pregnancy are complex studies. In Kenya and Malawi it was shown that the prevalence and density of malaria parasites are also found in HIV positive victims (Parise *et al.*, 1998). The risk of infants dying during the post neonatal period has also been identified to rise higher in children born with HIV positive mothers and with placental malaria than in those born to HIV positive mothers without placental malaria (Bloland *et al.*, 1995 and Nosten *et al.*, 2007).

Malaria is an internationally devastating disease and the burden of this disease fall heaviest among children below the age of 5 years in Sub-Saharan Africa and 30% of annual mortality in population attributed to Malaria (AHRQ, 2004).

Malaria increases susceptibility to other infections and retard growth and development in children. It is associated with considerable economic burden including direct loss to government productive work or education. Malaria killed Northern Nigerian children every 30 seconds, hence, pregnant
women and their unborn children are also vulnerable to malaria which serves as major cause of maternal anemia and parental death (Davidson, 2000).

There are lot of activities and momentum to combat malaria in Katsina State and Nigeria at large, but deadly gaps still exist. More need to be done to prevent pregnant women and their children from being infected and ensure access to qualitative malaria treatment. We need to empower families and communities to participate and improve their knowledge and practices on how to recognize and treat malaria through nongovernmental organizations like UNICEF and WHO (Lokomba, 2012).

The present study was carried out to determine the prevalence of the common *Plasmodium* parasites and assess the attitudes and practices of pregnant women on the infections caused by the parasite.

**Materials methods**

**Description of the study area**

Katsina State, covering an area 23,938 sq. km., is located between latitudes 11°08'N and 13°22'N and longitudes 6°52'E and 9°20'E. The State is bounded by Niger Republic to the North, by Jigawa and Kano States to the East, by Kaduna State to the South and by Zamfara State to the West. As of 2007, Katsina's estimated population was 459,022 with total annual rainfall ranging from 600 to 700mm and 1000mm to over 800 in the eastern part of the State’s Metropolis.

The city is the centre of an agricultural region producing groundnuts, cotton, hides, millet and guinea corn, and also has mills for producing peanut oil and steel (Wikipedia, 2004).

Some of the major rivers which originate in or transverse the state contain water in their channels only during the rainy season and have little or no water in the dry season.

A cool dry (harmattan) season from December to February; a hot dry season from March to May; a warm wet season from June to September and a less marked season after rains during the months of October to November, characterized by decreasing rainfall and a gradual lowering of temperature. The southern half of the state belongs to the Northern Guinean Savannah Zone, while the north belongs to the Sudan Savannah Zone (Wikipedia, 2010).

**Sample collection**

Samples collection was carried out between the months of May to October, 2011. Blood collection and analysis was made using a technique of disinfection as described by Cheesbrough (1998). Blood was collected from four hundred and eight (408) pregnant women at the Antenatal clinics in the districts and General Hospital in Katsina. The lobe of the finger was first
disinfected with alcohol, blood lancet were used to prick the finger which were then squeeze to drop small quantity of blood of about 15x15mm at the right and another drop at the centre of the slide. The right drop was spread immediately using the edge of a slide to make the thin smear, while the central drop was spread to make the thick smear which was covered about 15x15mm at the left side of the slide.

**Administering questionnaires**

In all the four hundred and eight (408), sixty eight (68) questionnaires were administered to each group of the respondents (pregnant women) from whom the samples were collected. The questionnaires contain data about: age group, educational level, and occupation, modes of transmission and control measures of the mosquitoes/malaria. The slides were then labeled in accordance with the number of questionnaires.

**Fixing and staining**

The blood film collected was allowed to air-dry with the slide in the horizontal position. Absolute methanol was used to fix the thin blood film and allow fixing for 1 to 2 minutes. All the thick and thin blood films were stained using Giemsa 3% stain for 40 minutes. The stain was then washed using tap water and the slides were placed in draining rack and allowed air-dry. The blood films were placed in a box and carried to the Biology laboratory of Isa Kaita College of Education Dutsin-Ma for microscopic examination using 40 x and 100 x oil immersion objective. The results and the species of the malarial parasites were reported on the top of the questionnaires.

**Statistical analysis**

Data collected were analyzed using descriptive statistics and Chi square (X²) test. However, tables were drawn to show the differences and similarities between parameters.

**Results**

It was established in this research that, out of four hundred and eight (408) blood samples collected and examined under the microscope in the laboratory, a total of one hundred and forty nine (149) were found to be infected with *Plasmodium falciparum* representing an incidence of 36.5%. It is only this type species which was encountered during the study, (table 1).

Specific incidence base on gravid status indicate that the primigravids (45.2%) have a higher incidence than the multigravids (34.6%) with p > 0.05 (table 2).
The trimester distribution of the infection indicates that women in their first (1st) trimester have the highest prevalence (43.5%), followed by those who are in the third (3rd) trimester (38.3%) and the second (2nd) trimester (32.5%), \( p > 0.05 \) (table 3).

Base on educational level the incidence was found to be higher in pregnant women with non-formal education (75.0%) and varies from pregnant women who attended post secondary school (45.5%), secondary school (44.8%) illiterates (43.2%), Primary School (38.4%) to those who attend Qur’anic schools (33.1%) where \( p > 0.05 \) (table 4).

The incidence of infection was age dependent showing a highest prevalence at the 10 to 19 years age group (45.7%) and 40 to 50 age group (37.5%) while 20 to 29 age group (34.2%) and 30 to 39 age group (34.1%) in years having the least incidence with slight variation, \( p > 0.05 \) (table5).

Base on social status (occupation) the infection reveals an increased incidence rate from craft women (34%), full house wives (34.4%), traders (39.1%), physical working class (39.5%), teachers (42.9%) and students (60%) to a peak amongst health workers with 100%, \( p > 0.05 \) as in table 6.

**Table 1:** Prevalence and frequency of malaria parasite with respect to species

<table>
<thead>
<tr>
<th>Parasite Species</th>
<th>Frequency</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. ovale</td>
<td>149</td>
<td>36.5</td>
</tr>
<tr>
<td>P. vivax</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P. malariae</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P. falciparum</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>149</td>
<td>36.5</td>
</tr>
</tbody>
</table>

\( X^2 \) test \( (p < 0.005) \)

**Table 2:** Prevalence of malaria parasite based on gravid status

<table>
<thead>
<tr>
<th>Gravid Status</th>
<th>No. Examined</th>
<th>No. Positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primigravid</td>
<td>73</td>
<td>33</td>
<td>45.2</td>
</tr>
<tr>
<td>Multigravid</td>
<td>335</td>
<td>116</td>
<td>34.6</td>
</tr>
<tr>
<td>Total</td>
<td>408</td>
<td>149</td>
<td>36.5</td>
</tr>
</tbody>
</table>

\( X^2 \) test \( (p < 0.005) \)

**Table 3:** Prevalence of malaria parasite by duration of the pregnancy

<table>
<thead>
<tr>
<th>Duration of pregnancy</th>
<th>No. Examined</th>
<th>No. Positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Trimester</td>
<td>46</td>
<td>20</td>
<td>43.5</td>
</tr>
<tr>
<td>2nd Trimester</td>
<td>166</td>
<td>54</td>
<td>32.5</td>
</tr>
<tr>
<td>3rd Trimester</td>
<td>196</td>
<td>75</td>
<td>38.3</td>
</tr>
<tr>
<td>Total</td>
<td>408</td>
<td>149</td>
<td>36.5</td>
</tr>
</tbody>
</table>

\( X^2 \) test \( (p < 0.005) \)

**Table 4:** Prevalence of malaria parasite by educational level

<table>
<thead>
<tr>
<th>Education level</th>
<th>No. Examined</th>
<th>No. Positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>37</td>
<td>16</td>
<td>43.2</td>
</tr>
<tr>
<td>Primary school</td>
<td>73</td>
<td>28</td>
<td>38.4</td>
</tr>
<tr>
<td>Secondary school</td>
<td>29</td>
<td>13</td>
<td>44.8</td>
</tr>
<tr>
<td>Post secondary school</td>
<td>11</td>
<td>05</td>
<td>45.5</td>
</tr>
<tr>
<td>Qur’anic school</td>
<td>254</td>
<td>84</td>
<td>33.1</td>
</tr>
</tbody>
</table>
Table 5: Prevalence malaria parasite by age group

<table>
<thead>
<tr>
<th>Age group</th>
<th>No. examined</th>
<th>No. positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 to 19</td>
<td>79</td>
<td>36</td>
<td>45.7</td>
</tr>
<tr>
<td>20 to 29</td>
<td>222</td>
<td>76</td>
<td>34.2</td>
</tr>
<tr>
<td>30 to 39</td>
<td>91</td>
<td>31</td>
<td>34.1</td>
</tr>
<tr>
<td>40 to 50</td>
<td>16</td>
<td>06</td>
<td>37.5</td>
</tr>
<tr>
<td>Total</td>
<td>408</td>
<td>149</td>
<td>36.5</td>
</tr>
</tbody>
</table>

X² test (p < 0.005)

Table 6: Prevalence of malaria parasite by Social status (occupation)

<table>
<thead>
<tr>
<th>No. examined</th>
<th>No. positive</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical working class</td>
<td>38</td>
<td>15</td>
</tr>
<tr>
<td>Craft women</td>
<td>50</td>
<td>17</td>
</tr>
<tr>
<td>Full house wife</td>
<td>224</td>
<td>77</td>
</tr>
<tr>
<td>Trader</td>
<td>82</td>
<td>32</td>
</tr>
<tr>
<td>Health worker</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>Teacher</td>
<td>07</td>
<td>03</td>
</tr>
<tr>
<td>Student</td>
<td>05</td>
<td>03</td>
</tr>
<tr>
<td>Total</td>
<td>408</td>
<td>149</td>
</tr>
</tbody>
</table>

X² test (p < 0.005)

A high percentage of respondents 93.4% attributed malaria infection to mosquito bites. This knowledge is higher among the health workers, teachers, students (100%) and decreases from Craft women (98.0%), Traders (95.1%), and full house wives (91.9%) to physical working class (89.5%) as seen in appendix I. This knowledge also varies according to the educational level from the interviewed subjects without formal/with non-formal education (100%), those who attended post secondary school (100%), primary school (93.3%). Qur’anic School (91.7%) and Illiterates (91.9%) as indicated in appendix II.

The aged group knowledge of malaria transmission showed that 83.5% of those between 10 to 19 years of age attributed malaria to mosquito bites. The awareness increase to 94.6%, among women aged 20 to 29 and 97.8% to those aged 30 to 39 and 100% among those aged 40 to 50 as shown in appendix III.

Other modes of malaria transmission notified by the respondents include mother to child (3.9%), sexual intercourse (1.2%), and intake of contaminated food (1.7%), contact with house fly (0.5%), house fly bite (0.5%), higher temperature (0.2%), exposure to sun (0.2%), smelling of bad water (0.2%), and contact with blood (0.2%), and those respondents that do not know (Lay men) how malaria is transmitted with 3.7% as indicated in appendix III.
A low percentage of 3.7% of the pregnant women are asymptomatic 
while a relatively higher percentage (75.2%) show fever as a major symptom 
of malaria. This varies gradually from the age group 10 to 19 years (55.7%) to 
age group 40 to 50 years (87.5%) as shown in appendix IV. Hence, from 
the pregnant women who are in their first trimester (65.2%) to those who are 
in the third trimester 77.1% (appendix V), while approximately the same 
percentage of primigravidas (75.3%) and multigravidas (75.2%) have shown 
fever as a common symptom (appendix VI).

About 2.0% of the studied population mostly housewives (3.1%) do 
not take any preventive measures against malaria infection, while a higher 
percentage of the respondents (79.2%) sleep under mosquito net to prevent 
malaria. This varies gradually from Teachers (100%), Traders (85.4%), 
Students (80.0%), Full housewives (76.8%), Physical working class (63.1%) 
and Health workers (50.0%). However, other preventive measures used by 
the pregnant women include hygiene (52.5%), use of drugs/mass 
chemotherapy (60.0%), use of insecticides (29.2%), drainage of water 
(31.1%), devegetation (1.5%), burning of herbs/shrubs and grasses (2.2%), 
seeking protection from God (3.7%), shooting mosquitoes normally (2.5%), 
pouring oil on stagnant water (0.5%), covering of pots (0.5%), covering 
one’s self during sleep (0.7%) and closing bed room (1.0%) as shown in 
appendix VII.

Out of 20.8% of the respondents who did not sleep under mosquito 
net 8.6% asserted that it is because they lack mosquito nets, 1.0% have no 
reason, 3.2% stated that it is because there are no more mosquitoes, 2.4% 
opined that the weather is hot, 0.7% sleep outside bed rooms, 0.2% because 
they sleep inside the room, 0.7% judged enough the alternative measures 
they use. Similarly, 0.2% because of travelling, 1.5% incapable due to 
laziness, 0.2% use to forget and 0.5% stated till raining season while 1.0% 
are of the view that they do not know the importance of the net (appendix 
VIII).

**Discussion**

It has been reported from this research, that the high prevalence of 
malaria among women in the study area may be attributed to the high level 
of illiteracy, traditional beliefs, lack of personal engagement of the 
population to fight malaria, the failure of government policy, the climate 
which influence the development of the mosquito as well as the endemicity 
of the area, the human behavior and the presence of *Anopheles gambiae* and 
*A. funestus* which are strongly anthropophagical and consequently are said 
by CDC (2008) to be the most efficient malaria vector in the world. All these 
factors promote the spread of the parasite infection.
Moreover, the presence of *Plasmodium falciparum* in the metropolis of Katsina being sub-saharan to some extent is vulnerable among the study populations; because CDC (2004) reported that most *Plasmodium falciparum* infection occur in sub Saharan Africa and the *P. falciparum* has been shown to be more common in pregnant than non pregnant women.

The higher prevalence of malaria infection established in the study area is in line with the work of Ebrahim (1996) who stated that in all malaria endemic areas the frequency of malaria is higher in the pregnant women than the same women before pregnancy, non pregnant women and men.

The higher prevalence rate of the infection among the primigravids compared with multigravids in the study area may be attributed to the fact that women at their first pregnancy (primigravids) are highly stressed compared to those with higher gravids who have experienced the physiological changes caused by the pregnancy. This condition lower the condition of the primigravids immunity which is proportionate to the stress and may also contribute to one self.

The pregnant women who are in the first trimester showed a higher prevalence than those who are in their second and third trimester. This controversy is due to the fact that, pregnant women who attended the antenatal care center of the study area start receiving intermittent preventive treatment (IPT) at their second and third trimester which reduces the prevalence of the parasite. This disagrees with the statement made by Desai *at al.* (2007) who says that the second trimester carries the highest risk of infection.

The absence of any significant difference between the prevalence of the infection among the educated and illiterate women suggests that the prevalence of the malaria parasite in the area is not affected by education. This is because, those who attended primary, secondary or post secondary schools are not health educated. Meaning that, the syllabus that was used in the schools did not contain areas on health management.

It was revealed in the research, that occupation might influence the prevalence of infection in the study area based on the results obtained which have shown that the health workers recorded the peak of the infection followed by the students. The reason might be due to the fact that the former are more exposed to mosquitoes because, they spend most of their night time to read in an open or closed space without protective measures just as the health workers.

This correlates with the work of Aiyelabegan (2002) on the prevalence of malaria parasites in pregnant women in Sokoto metropolis who discovered that students have the highest rate of infection.

The higher prevalence of infection seen in women aged 10-19 compared to other age groups could be due to the fact that youngest pregnant
women have experienced less contact with mosquitoes than the other aged groups and therefore their immunity is not well developed/active as others.

The results revealed that the knowledge on malaria transmission is very poor and reflect ideas rooted in the custom and tradition of the people who believed that sexual intercourse, ingestion of contaminated food, contact with house fly or its bite, high temperature exposure to sun and smelling of bad water predispose someone to malaria infection. This supports the work of Malar (2005) who conducted a research on epidemiological and biological features of malaria among children in Niamey, Niger Republic and noticed that traditional believes are still deeply rooted in families and they interfere with the care seeking pattern. Only few women knew that malaria can be transmitted from mother to fetus, while some asserted that they do not know any mode of malaria transmission. Older pregnant women 40 to 50 years, those with post secondary education, health workers and students recorded more correct knowledge on malaria transmission. From this, it could be deduced that, the level of education and the life time experience is very important in understanding the modes of malaria transmission. Oparacha (2007) pointed out that the mother’s perception and management of childhood malaria in Umuahia South Local Government Area, Abia State Nigeria, that the older mothers with tertiary education and health workers recorded more correct knowledge on the etiology of malaria.

The socio-cultural and behavioral practices to prevent malaria indicate that most of the pregnant women prefer to sleep under mosquito net to prevent malaria. This shows that pregnant women of this area are aware of the efficiency in using mosquito net to control malaria in pregnancy which will contribute to roll back malaria and to reduce the maternal and neonatal death. This disagrees with the findings of Idowu and Mafrana (2007) on malaria in pregnancy in Abeokuta, Nigeria who reported that only 0.2% of the Abeokuta’s women used Insecticide Treated Nets. It was also reported that a high parentage of the respondents use Intermittent Preventive Treatment (IPT). This might be due to the fact that the pregnant women who attended public antenatal care centers in their second and third trimester were been given free drugs. WHO (2003) in their report recommended that all pregnant women should receive at least two (2) doses of IPT during routinely antenatal clinic visits. More so, the result revealed that some of the respondents do not take any preventive measures. This shows that up to now some pregnant women of the area are not worried about infants/fetus health status. This may have great impact on the morbidity and mortality. Out of the pregnant women who do not use mosquito net, some asserted that it is because they do not have the nets. This shows that poverty may have played some role in the choice of malaria preventive measures. Other stated reasons by the respondents on not sleeping under mosquito net include: sleeping
outside and hot weather. This agrees with the CDC report (2004) which highlighted that the climate may determine human behaviors that may increase contact with *Anopheles* mosquitoes. Hot weather may also encourage people to sleep outdoors or discourage them from using mosquito nets. The results indicated that some of the interviewed subjects do not sleep under mosquito nets because, according to them there are no more mosquito. But traditional folk believe that malaria is “a raining season disease” that still exists in the area. This study also document on the most common symptoms and signs found among the population studied. Therefore most of the pregnant women experienced fever during malaria illness. This correlates with the view of Hagmann *et al.* (2007), who stated that congenital malaria tends to present and rise with fever and Erik (1999) said that malaria is very important cause of fever.

However, a low percentage of the subjects are asymptomatic. This disagrees with the work of Nonsten *et al.* (2007) who reported that majority of women with malaria during pregnancy remained asymptomatic. Other symptoms and signs shown by the pregnant women in this research include headache, tiredness, joint pain, pimples/rashes on the mouth, lean bodies, diarrhea and loss of appetite. This approves the report of Erik (1999) who reported that the signs and symptoms of malaria are non specific and mimic those many other infections.

**Conclusion**

The research undertaken indicates that there is a high prevalence of *Plasmodium* and *falciparum* is the only species in which malarial parasites are found. Recognition of malaria-like illness was also based on peoples beliefs and the behavioral practices and their attitudes may become key determinants to successfully rollback malaria throughout the study area, Nigeria and Africa at large.

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Table of appendices

Appendix I: Knowledge on the modes of malaria transmission by women occupation

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Mosquito Bite</th>
<th>Sexual Intercourse</th>
<th>Ingestion of contaminated food</th>
<th>Mother to child</th>
<th>Don’t know</th>
<th>Contact with house fly</th>
<th>House fly bite</th>
<th>High temperature</th>
<th>Exposure to sun</th>
<th>Smelling of bad water</th>
<th>Contact with blood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical working class</td>
<td>34 (89.5)</td>
<td>02 (5.3)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>01 (0.6)</td>
<td>01 (0.6)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Craft women</td>
<td>49 (98.0)</td>
<td>0 (0.0)</td>
<td>01 (2.0)</td>
<td>03 (6.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Full house wife</td>
<td>206 (91.9)</td>
<td>02 (0.9)</td>
<td>06 (2.7)</td>
<td>04 (1.8)</td>
<td>12 (5.4)</td>
<td>02 (0.9)</td>
<td>01 (0.4)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Trader</td>
<td>78 (95.1)</td>
<td>01 (1.2)</td>
<td>0 (0.0)</td>
<td>07 (8.5)</td>
<td>03 (3.7)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>01 (1.2)</td>
<td>01 (1.2)</td>
</tr>
<tr>
<td>Health worker</td>
<td>02 (100.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>01 (50.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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</tr>
<tr>
<td>Teacher</td>
<td>07 (100.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>381 (93.4)</td>
<td>05 (1.2)</td>
<td>07 (1.7)</td>
<td>16 (3.9)</td>
<td>15 (3.7)</td>
<td>02 (0.5)</td>
<td>02 (0.5)</td>
<td>01 (0.2)</td>
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## Appendix II: Knowledge on the modes of malaria transmission by educational level

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Mosquito Bite</th>
<th>Sexual Intercourse</th>
<th>Ingestion of contaminated food</th>
<th>Mother to child</th>
<th>Don’t know</th>
<th>Contact with house fly</th>
<th>House fly bite</th>
<th>High temperature</th>
<th>Exposure to sun</th>
<th>Smelling of bad water</th>
<th>Contact with blood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>34 (91.9)</td>
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<td>02 (5.4)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Primary School</td>
<td>71 (93.3)</td>
<td>0 (0.0)</td>
<td>02 (2.7)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Secondary School</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<td>0 (0.0)</td>
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<td>Qur’anic School</td>
<td>233 (91.7)</td>
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<td>05 (2.0)</td>
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<td>09 (3.5)</td>
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<td>02 (0.8)</td>
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<td>01 (0.4)</td>
<td>01 (0.4)</td>
<td>01 (0.4)</td>
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<td>Non formal Education</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>381 (93.4)</td>
<td>05 (1.2)</td>
<td>07 (1.7)</td>
<td>16 (3.9)</td>
<td>15 (3.7)</td>
<td>02 (0.5)</td>
<td>02 (0.5)</td>
<td>01 (0.2)</td>
<td>01 (0.2)</td>
<td>01 (0.2)</td>
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### Appendix III: Knowledge on the modes of malaria transmission by age group

<table>
<thead>
<tr>
<th>Age group</th>
<th>Mosquito Bite</th>
<th>Sexual Intercourse</th>
<th>Ingestion of contaminated food</th>
<th>Mother to child</th>
<th>Don’t know</th>
<th>Contact with house fly</th>
<th>House fly bite</th>
<th>High temperature</th>
<th>Exposure to sun</th>
<th>Smelling of bad water</th>
<th>Contact with blood</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-19</td>
<td>66 (83.5)</td>
<td>01 (1.3)</td>
<td>03 (3.8)</td>
<td>01 (1.3)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>20-29</td>
<td>210 (94.6)</td>
<td>04 (1.8)</td>
<td>03 (1.4)</td>
<td>09 (4.1)</td>
<td>10 (4.5)</td>
<td>01 (0.5)</td>
<td>01 (0.5)</td>
<td>01 (0.5)</td>
<td>01 (0.5)</td>
<td>01 (0.5)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>30-39</td>
<td>89 (97.8)</td>
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<td>01 (1.1)</td>
<td>05 (5.5)</td>
<td>01 (1.1)</td>
<td>01 (1.1)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>01 (1.1)</td>
<td>01 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>40-50</td>
<td>16 (100.0)</td>
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<td>0 (0.0)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>381 (93.4)</td>
<td>05 (1.2)</td>
<td>07 (1.7)</td>
<td>16 (3.9)</td>
<td>15 (3.7)</td>
<td>02 (0.5)</td>
<td>02 (0.5)</td>
<td>01 (0.2)</td>
<td>01 (0.2)</td>
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## Appendix IV: Common malaria symptoms and signs among the respondents by age groups

<table>
<thead>
<tr>
<th>Age group</th>
<th>Fever</th>
<th>Headache</th>
<th>Tiredness</th>
<th>Joint pain</th>
<th>Pimple on the mouth</th>
<th>Vomiting</th>
<th>Chill</th>
<th>Stomach</th>
<th>Dizziness</th>
<th>Muscle pain</th>
<th>Loss of appetite</th>
<th>Thinness</th>
<th>Diarrhoea</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-19</td>
<td>44 (55.7)</td>
<td>19 (24.1)</td>
<td>25 (31.6)</td>
<td>04 (5.1)</td>
<td>01 (1.3)</td>
<td>01 (1.3)</td>
<td>03 (3.8)</td>
<td>01 (1.3)</td>
<td>01 (1.3)</td>
<td>02 (2.5)</td>
<td>02 (2.5)</td>
<td>02 (2.5)</td>
<td>01 (1.3)</td>
<td>07 (8.8)</td>
</tr>
<tr>
<td>20-29</td>
<td>174 (78.4)</td>
<td>77 (34.7)</td>
<td>85 (38.3)</td>
<td>30 (13.5)</td>
<td>05 (2.3)</td>
<td>24 (10.8)</td>
<td>32 (14.4)</td>
<td>03 (1.4)</td>
<td>08 (3.6)</td>
<td>20 (9.0)</td>
<td>05 (2.3)</td>
<td>04 (1.8)</td>
<td>01 (0.5)</td>
<td>05 (2.3)</td>
</tr>
<tr>
<td>30-39</td>
<td>75 (82.4)</td>
<td>36 (39.6)</td>
<td>34 (37.4)</td>
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<td>02 (2.2)</td>
<td>08 (8.8)</td>
<td>22 (24.2)</td>
<td>01 (1.1)</td>
<td>02 (2.2)</td>
<td>04 (4.4)</td>
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<td>01 (1.1)</td>
<td>01 (1.1)</td>
<td>03 (3.3)</td>
</tr>
<tr>
<td>40-50</td>
<td>14 (87.5)</td>
<td>07 (43.8)</td>
<td>06 (37.5)</td>
<td>01 (6.25)</td>
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<td>04 (25.0)</td>
<td>05 (31.3)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>01 (6.25)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>307 (75.2)</td>
<td>139 (34.1)</td>
<td>150 (36.7)</td>
<td>42 (10.3)</td>
<td>08 (1.9)</td>
<td>37 (9.1)</td>
<td>62 (15.2)</td>
<td>05 (1.2)</td>
<td>11 (2.7)</td>
<td>26 (6.4)</td>
<td>09 (2.2)</td>
<td>07 (1.7)</td>
<td>03 (0.7)</td>
<td>15 (3.7)</td>
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## Appendix V: Common malaria symptoms and signs among respondents by duration of pregnancy

<table>
<thead>
<tr>
<th>Duration of pregnancy</th>
<th>Fever</th>
<th>Headache</th>
<th>Tiredness</th>
<th>Joint pain</th>
<th>Pimple on the mouth</th>
<th>Vomiting</th>
<th>Chill</th>
<th>Stomach</th>
<th>Dizziness</th>
<th>Muscle pain</th>
<th>Loss of appetite</th>
<th>Thinness</th>
<th>Diarrhea</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st trimester</td>
<td>30 (65.2)</td>
<td>19 (41.3)</td>
<td>14 (30.4)</td>
<td>12 (26.1)</td>
<td>01 (2.2)</td>
<td>03 (6.5)</td>
<td>05 (10.9)</td>
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<td>01 (2.2)</td>
<td>03 (6.5)</td>
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<td>0 (0.0)</td>
<td>0.04 (8.7)</td>
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<tr>
<td>2nd trimester</td>
<td>126 (75.9)</td>
<td>57 (34.3)</td>
<td>58 (34.9)</td>
<td>12 (7.2)</td>
<td>03 (1.8)</td>
<td>18 (10.8)</td>
<td>27 (16.3)</td>
<td>04 (2.4)</td>
<td>08 (4.8)</td>
<td>06 (3.6)</td>
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<td>0.08 (4.8)</td>
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<tr>
<td>3rd trimester</td>
<td>151 (77.1)</td>
<td>63 (32.1)</td>
<td>78 (39.8)</td>
<td>18 (9.2)</td>
<td>04 (2.1)</td>
<td>16 (8.2)</td>
<td>30 (15.3)</td>
<td>01 (0.5)</td>
<td>02 (1.0)</td>
<td>17 (8.7)</td>
<td>03 (1.5)</td>
<td>02 (1.0)</td>
<td>03 (1.5)</td>
<td>0.03 (1.5)</td>
</tr>
<tr>
<td>Total</td>
<td>307 (75.2)</td>
<td>139 (34.1)</td>
<td>150 (36.7)</td>
<td>42 (10.3)</td>
<td>08 (1.9)</td>
<td>37 (9.1)</td>
<td>62 (15.2)</td>
<td>05 (1.2)</td>
<td>11 (2.7)</td>
<td>26 (6.4)</td>
<td>09 (2.2)</td>
<td>07 (1.7)</td>
<td>0.03 (0.7)</td>
<td>0.15 (3.7)</td>
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</table>
**Appendix VI:** Common malaria symptoms and signs among the respondents by gravid status

<table>
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<tr>
<th>Gravid status</th>
<th>Fever</th>
<th>Headache</th>
<th>Tiredness</th>
<th>Joint pain</th>
<th>Pimple on the mouth</th>
<th>Vomiting</th>
<th>Chill</th>
<th>Stomach</th>
<th>Dizziness</th>
<th>Muscle pain</th>
<th>Loss of appetite</th>
<th>Thinness</th>
<th>Diarrhea</th>
<th>Asymptomatic</th>
</tr>
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<tbody>
<tr>
<td>Primigravid</td>
<td>55 (75.3)</td>
<td>28 (38.4)</td>
<td>24 (32.9)</td>
<td>07 (9.6)</td>
<td>01 (1.4)</td>
<td>09 (12.3)</td>
<td>02 (2.7)</td>
<td>02 (2.7)</td>
<td>01 (1.4)</td>
<td>07 (9.6)</td>
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<td>02 (2.7)</td>
<td>01 (1.4)</td>
<td>05 (6.8)</td>
</tr>
<tr>
<td>Multigravid</td>
<td>252 (75.2)</td>
<td>111 (33.1)</td>
<td>126 (37.6)</td>
<td>35 (10.4)</td>
<td>07 (2.1)</td>
<td>28 (8.4)</td>
<td>60 (17.9)</td>
<td>03 (0.9)</td>
<td>10 (2.9)</td>
<td>19 (5.7)</td>
<td>07 (2.1)</td>
<td>05 (1.5)</td>
<td>02 (0.6)</td>
<td>10 (2.9)</td>
</tr>
<tr>
<td>Total</td>
<td>307 (75.2)</td>
<td>139 (34.1)</td>
<td>150 (36.7)</td>
<td>42 (10.3)</td>
<td>08 (1.9)</td>
<td>37 (9.1)</td>
<td>62 (15.2)</td>
<td>05 (1.2)</td>
<td>11 (2.7)</td>
<td>26 (6.4)</td>
<td>09 (2.2)</td>
<td>07 (1.7)</td>
<td>03 (0.7)</td>
<td>15 (3.7)</td>
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### Appendix VII Respondents socio-cultural and behavioral preventive practices in malaria by occupation

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Sleeping under net</th>
<th>Hygiene</th>
<th>Pour oil on stagnant water</th>
<th>Shoot mosquito manually</th>
<th>Drugs</th>
<th>Protection from God</th>
<th>Cover pots</th>
<th>Use of insecticides</th>
<th>Draining of water</th>
<th>Devegetation</th>
<th>Burning herbs</th>
<th>Close room with fan</th>
<th>Do not take any measure</th>
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</thead>
<tbody>
<tr>
<td>Physical working class</td>
<td>24 (63.1)</td>
<td>13 (34.2)</td>
<td>0 (0.0)</td>
<td>03 (7.9)</td>
<td>18 (47.4)</td>
<td>04 (10.5)</td>
<td>0 (0.0)</td>
<td>10 (26.3)</td>
<td>06 (15.8)</td>
<td>01 (2.6)</td>
<td>01 (2.6)</td>
<td>01 (2.6)</td>
<td>01 (2.6)</td>
</tr>
<tr>
<td>Craft women</td>
<td>45 (90.0)</td>
<td>36 (72.0)</td>
<td>02 (4.0)</td>
<td>03 (6.0)</td>
<td>34 (68.0)</td>
<td>01 (2.0)</td>
<td>01 (2.0)</td>
<td>17 (34.0)</td>
<td>19 (38.0)</td>
<td>01 (2.0)</td>
<td>01 (2.0)</td>
<td>01 (2.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Full house wife</td>
<td>172 (76.8)</td>
<td>111 (49.6)</td>
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<td>128 (57.1)</td>
<td>06 (2.7)</td>
<td>0 (0.0)</td>
<td>61 (27.2)</td>
<td>68 (30.4)</td>
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<td>03 (1.3)</td>
<td>02 (0.9)</td>
<td>07 (3.1)</td>
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<tr>
<td>Trader</td>
<td>70 (85.4)</td>
<td>49 (59.8)</td>
<td>01 (1.2)</td>
<td>01 (1.2)</td>
<td>53 (64.6)</td>
<td>04 (4.9)</td>
<td>01 (1.2)</td>
<td>21 (25.6)</td>
<td>30 (36.6)</td>
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<td>02 (2.4)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Health worker</td>
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<td>01 (50.0)</td>
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<td>02 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>02 (0.0)</td>
<td>01 (50.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
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<td>0 (0.0)</td>
<td>04 (80.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>03 (60.0)</td>
<td>01 (20.0)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Teacher</td>
<td>07 (100.0)</td>
<td>04 (57.1)</td>
<td>0 (0.0)</td>
<td>01 (14.3)</td>
<td>06 (85.7)</td>
<td>0 (0.0)</td>
<td>05 (71.4)</td>
<td>02 (28.6)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>323 (79.2)</td>
<td>214 (52.5)</td>
<td>02 (2.5)</td>
<td>10 (2.5)</td>
<td>245 (60.0)</td>
<td>15 (3.7)</td>
<td>02 (0.5)</td>
<td>119 (29.2)</td>
<td>127 (31.1)</td>
<td>06 (1.5)</td>
<td>09 (2.2)</td>
<td>04 (1.0)</td>
<td>08 (2.0)</td>
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</table>
### Appendix VIII: Attitude of the respondents with to refusal use of mosquito net by occupation

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Don’t have mosquito net</th>
<th>No reason</th>
<th>No more mosquito</th>
<th>Hot weather</th>
<th>Sleep outside</th>
<th>Don’t know the importance</th>
<th>Laziness</th>
<th>Till rainy season</th>
<th>Forgetfulness</th>
<th>Stiffing</th>
<th>Alternative measures are enough</th>
<th>Traveling</th>
<th>Sleep in the room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical working class</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Craft women</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Full house wife</td>
<td>24</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>0</td>
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