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Impact of Insecticide Treated Nets and Intermittent Preventive Treatment in Reducing Malaria Morbidity among Pregnant Women in Gombe, Nigeria

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ABSTRACT: Malaria in pregnancy is a major public health problem affecting women fetuses and new borns.. Many studies highlight the critical importance of continuing the use of Insecticide Treated Nets (ITN) and Intermittent Preventive Treatment In Pregnancy (IPTp) among pregnant women to reduce the adverse consequences of malaria in pregnancy. This study was conducted in order to determine malaria prevalence in relation to the use of ITN and IPTp among the pregnant women in the study area. Five (5) ml of blood was obtained from each participant by the use of a sterile syringe and placed in a sterile EDTA container for laboratory analysis. The malaria parasite was detected by microscopic examination of Giemsa-stained thick blood films. Information on the use of ITN and IPTP was collected using administered questionnaire. A high prevalence of 78.4% was observed among the studied population. Although 74.4% of those that use ITN were positive for malaria parasite as against the 83.6% of those that reported not using the ITN, the difference was statistically not significant ($p<0.05$). 70.0% of those reported using IPTp were positive however, higher percentage was observed for those reported not using IPTp (83.7.0%). The difference was statistically significant in this case. This study has shown the influence of malaria prevention method during pregnancy on malaria infection and the need for targeted preventive starategies when designing and implementing policies aimed at improving uptake of these measures during pregnancy in Gombe.

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Malaria is a life threatening parasitic disease caused by the protozoa of the genus *Plasmodium*. Five species are known to inflict humans namely; *P. falciparum, P. malariae, P. ovale, P. vivax and P. knowlesi.* The disease is transmitted by the bite of infected female Anopheles mosquitoes. Malaria in pregnancy is caused mainly by the specie *P. falciparum*, which is the most common species in Africa (Riley et al., 1994). Malaria control efforts in Nigeria have been ongoing since the colonial days. However, effective coordination began only with the creation of the Division of Malaria and Vector Control in the early 1960s. This evolution culminated in the establishment of a National Malaria Control Committee, which produced a five year plan (1975–1980) with the key objective to reduce the malaria burden by 25% by 1980 (WHO, 2012). In the last decade, the Nigeria National Malaria Control Programme (NMCP) has received strong partnership support resulting in massive scale up of interventions including insecticide-treated mosquito nets (ITNs), rapid diagnostic tests (RDTs), and artemisinin-based combination therapies (ACTs). Between 2007 and 2010, over 50 million ITNs have been made available to the population and 70 million RDTs have been distributed to health facilities across the country (WHO, 2012). Use of insecticide-treated nets (ITNs) is one of the key components of malaria prevention and control as recommended by the World Health Organization (WHO, 2007). The nets reduce human contact with mosquitoes, thus leading to a significant reduction in the incidence of malaria, associated morbidity, and mortality; as well as in the adverse effects during pregnancy in areas of intense malaria transmission (Ter-Kuile *et al*., 2003). Another key intervention for controlling malaria and its effects during pregnancy is the administration of intermittent preventive treatment (IPT). This consists of a full therapeutic course of antimalarial medicine given to pregnant women at routine prenatal visits, regardless of whether they are infected with malaria or not. Intermittent preventive treatment reduces incidences

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of maternal malaria episodes, maternal and foetal anaemia, placental parasitaemia, low birth weight and neonatal mortality. Therefore, the WHO recommends IPT with sulfadoxine-pyrimethamine in areas with moderate to high malaria transmission in Africa (WHO, 2004). In 2010, 42% of households possessed either one or more ITN. In states receiving support, (Akwa Ibom, Anambra, Bauchi, Gombe, Jigawa, Kano and Rivers) that proportion reached 75%. The impact of these interventions has not been quantified yet, because Nigeria's scale-up of interventions has been too recent to result in impact but it will likely be noticeable soon (WHO,2012). Malaria during pregnancy remains a serious public health problem with substantial risk for the mother, her fetus and the new born. Since pregnant women form part of the most vulnerable group to malaria and other infection, knowledge of their malaria status will provide an insight into areas where control measures should be prioritized.

MATERIALS AND METHODS

Study Area: The research was conducted in six randomly selected wards out of 11 wards in Gombe Local Government Area, Gombe State Capital. Gombe Local Government Area is situated between latitude 12^0 8' and 10^0 24'N Longitude $11^0$22' and $11^0$24' E with an altitude of 500 M above sea level. The Local Government Area has a total population figure of 250,000 (National Population Census, 2006)

Study Population: Sample size was determined using the formula proposed by Araoye (2004). Three hundred and eighty four (384) pregnant women who registered for antenatal care in five randomly selected health care facilities (which included Tudun Wada Primary Health Care, Idi Health Clinic, Madaki Health Clinic, Pantami Primary Health Care And Gombe Town Maternity) residing within Gombe local government constituted the study population. Selected pregnant women were informed on the research and its purpose, and their consent was obtained for participation in the study before sample collection.

Blood Sample Collection: Five (5) ml of the maternal peripheral blood was obtained from each participant by use of a sterile syringe and placed in a sterile Ethylene Diamine Tetraacetic Acid (EDTA) container for laboratory analysis as described (Cheesbrough, 2009). The blood sample was collected with the help of a qualified and certified laboratory scientist recruited for the study.

Parasitological and Haematological Tests: *Malaria Parasite Screening:* The malaria parasite was detected by microscopic examination of Giemsa stained thick blood films. The parasitaemia was expressed as number of malaria parasite per microlitre of blood.

Thick Blood Film Preparation: A thick blood smear was prepared by spreading a drop of blood placed on the centre of a clean grease free slide. This was allowed to air-dry for ten minutes. It was then rinsed under tap water, air-dried and a drop of immersion oil placed on it for examination with x100 objectives (Cheesbrough, 2009).

Parasite identification: Positive slides were identified and interpreted on the basis of microscopy by using standard method described (Cheesbrough, 2009).

*Use of ITN and IPTP-SP***:** Information on the use of ITN and IPTP-SP was collected using administered questionnaire.

Ethical Clearance: Prior to sample collection, introductory letter was received, upon request, from the Department of Zoology, Modibbo Adama University of Technology, Yola. Approval to conduct the research was granted by the office of the Coordinator Gombe Local Government Primary Health Care after submitting the introductory letter. Verbal informed consent of the study participants was kindly sought after explaining the purpose of the research and prior to data collection.

Data Analysis: Data obtained during the study were entered into SPSS version twenty (20) for descriptive statistic and chi-square test ($p<0.05$) was used to determine if there is any relationship between prevalence of malaria and parameters in the objective of the study.

RESULTS AND DISCUSSION

The number of pregnant women, 219 (57%) utilizing ITN differed from those that do not (165 individuals equivalent to 43%). Net usage as disclosed in Table 1 indicated that difference in malaria prevalence between usage and non-usage by the pregnant women was found to be statistically similar ($p>0.05$). Although those pregnant women using ITN recorded lower malaria prevalence (74.4%) as against those that do not use ITN (83.6%) ($p>0.05$).

Table (1) shows that the pregnant women that have used anti malaria drug are lower 150 (39.1%) as compared to those that have not taken anti malaria

drug, 234 (60.9%). Analysis revealed significant difference ($p<0.05$) in malaria prevalence between those using anti malaria drug and those that do not, where those that do not use anti malaria drug have higher malaria prevalence (83.7.0%) as compared to those that use anti malaria drug (70.0%). The 78.4% malaria prevalence determined among the pregnant women in the study area is higher than the 52.7% malaria prevalence reported (Amadi and Nwankwo, 2012) in Abia. The difference could be attributed to the poor attitude of the pregnant women towards seeking ante natal care. The malaria prevalence is lower than 99% prevalence reported in Enugu (Gunn *et al.*, 2015). It is also lower than the 89 % affected in Ibadan (Falade *et al*., 2008) but similar to 78.9% reported (Oladeinde *et al.*, 2012) in Benin and 72% documented (Adefiole *et al.*, 2007) in south west. However the malaria prevalence obtained in this study could be considered high knowing that malaria prevalence is higher in the southern part of the country than their northern counterparts (FMoH, 2010) and all the prevalences used in the comparison above are from the southern region. The high malaria prevalence could be attributed to the environmental conditions (especially during the rainy season which corresponded to the period the study was carried out) inherent in the study area creating conducive atmosphere for the breeding of Mosquitoe vector.

It is expected that ITN usage will significantly affect malaria infection, nevertheless it is surprising that in this study net usage by pregnant women failed to influence malaria infection as the malaria prevalence among pregnant women using net was found to be statistically similar to those that do not use net. It is likely that there is default in usage due to poor installation of the nets. This finding corroborate with that of a study in Cote d' Ivoire where no difference was found between user and non-user group of mosquito net with regard to parasitaemia (Henry *et al*., 1999). The finding is also in accord with the result of a study carried out in East Africa where net usage did not appear to reduce malaria prevalence (Friedman et al., 2003). Generally, there is no marked variation in malaria prevalence in a highly endemic area during the season of high prevalence rate (Koudou *et al*., 2010).This finding contrast sharply with that of Tanzania (Mbonyera *et al.,* 2000) where effective utilization of ITN was accompanied by 100% reduction in malaria cases, Gambia where ITN utilization was common among houses with low malaria incidence (Clarke *et al.*, 2003), Rwanda where increase in ITN distribution brought down malaria sharply in the affected community (Sievers *et al*., 2008). Effective prevention against malaria reduces intensity of malaria infection (Ter Kuile *et al*., 2003). In this study, participants who have taken antimalarial drug have low malaria prevalence (70.0%) as against those that do not moreover, the lower p value obtained (0.02) suggested that antimalaria drug have significant effect on malaria infection as seen on table 1. Effective antimalaria therapy is known to reduce the mortality and morbidity due to malaria infection usually by interfering with the growth and reproduction of *Plasmodium spp.*

Table 1. Prevalence of Malaria Infection and parasitaemia in relation to the use of Insecticide Treated Net (ITN) and IPTp

		Number examined	Number (%) positive	Mild (%)	Moderate (%)	Severe (%)
[*a]Insecticide treated nets usage	YES	219	163 (74.4)	153 (69.8)	8 (3.7)	2 (0.9)
	NO	165	138 (83.6)	119 (72.1)	17 (10.3)	2 (1.2)
[*b]Antimalaria drug usage	YES	150	105 (70.0)	98 (65.3)	6 (4.0)	1 (0.7)
	NO	234	2196 (83.7)	174 (74.3)	19 (8.1)	3 (1.3)
TOTAL		384	301 (78.4)	272 (70.8)	25 (6.5)	4 (1.0)

*[*a] MALARIA (X^2Cal=6.06, X^2tab=3.841, df = 1, p=0.19) Not significant PARASITAEMIA (X^2Cal=9.20, X^2tab=7.815,df = 3, p>0.27) Not significant; [*b] MALARIA (X^2Cal=11.48, X^2tab=3.841= 1, p=0.001) significant. PARASITAEMIA (X^2Cal=11.66, X^2tab=7.815,df = 3, p=0.009) significant*

Conclusion: Malaria prevalence was found to be higher in pregnant women who do not have/use any form of malaria prevention tools. There was no statistically significant association between ITN usage and malaria infection. While significant association between use of antimalaria drug and malaria infection was established. Proper net utilization campaigns should be intensified considering the massive ITN distribution in the study area as recent as 2015 however with little impact on malaria infection with respect to the study participants as shown by the finding.

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