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## Burden of malaria parasitaemia among pregnant women in Irrua specialist teaching hospital, Irrua, Edo State, Nigeria

Okogun G. R.A, Ugwuoke Hilary and Chidi Ibhafidon Esther

Department of Medical Laboratory Sciences, Ambrose Alli University Ekpoma Edo state Nigeria

### ABSTRACT

Malaria disease has been a major public health concern in Nigeria especially in pregnant women and children. In this study, peripheral blood samples of 330 volunteers attending anti-natal clinic at Irrua Specialist Teaching Hospital (ISTH), Irrua, Edo State, Nigeria were collected and examined to determine the prevalence of malaria parasitaemia among pregnant women according to trimesters and to determine the relationship between malaria parasitaemia and anaemia in pregnancy according to trimesters. Thick and thin film of the blood samples were made, stained with Leishman (thin film) and Geimsa (thick film) and examined microscopically. Rapid diagnostic tests were also done to check for the presence of malaria antigen using commercially available malaria test strips. The blood level was estimated by the haematocrit method. Forty five(45) (16.1%) of the pregnant subjects were infected with malaria parasite hence an overall prevalence of 16.1%, , primigravidae infection accounts for 8.2% of total infection whereas multigravidae accounts for 7.9%. A total of 6.1% of the infected women were in their first trimester. 4.3% of the women also were in their second trimester while 5.7% were in their third trimester. The haematocrit of the pregnant women showed that. 35% of the primigravidae had severe anaemia, 57% had mild anaemia while 7.8% had normal haematocrit values. Among the multigravidae, 7.8% had severe anaemia, 79% had mild anaemia and 13.2% had normal haematocrit values The study showed a low prevalence of parasitaemia among pregnant women in ISTH, Irrua, Edo State. Primigravidae women had a higher prevalence of parasitaemia than multigravidae women. We therefore recommend that more prophylactic measures should be taken to ensure the reduction to a minimal level. Public enlightenment should also be carried out on the dangers of malaria to the health of pregnant women and their unborn babies.

**Keywords:** Prevalence, parasitaemia, multigravidae, primigravidae pregnancy.

### INTRODUCTION

Each year, approximately 50 million women living in malaria endemic countries throughout the world become pregnant. An estimated 10,000 of these women and 20,000 of their infant die as a result of malaria during pregnancy and severe malaria anaemia contribute to more than half of these deaths [75]. Pregnant women and children are the most sufferer of malaria as these two groups are highly susceptible to malaria infection [65]. For instances, malaria during pregnancy in sub-Saharan Africa was estimated to account for 400,000 cases of severe anaemia in pregnant women, approximately 35% of preventable low birth weight, approximately 5% of infant mortality and 75,000 – 200,000 infants deaths annually [13].

Again, women with partial immunity who live in region where the disease is endemic are at increased risk for more frequent and severe episodes of malaria during pregnancy [62]. Thus, malaria is widely recognized as an infection which jeopardizes the outcome of pregnancy. Where the disease is endemic or have low endemicity, women of all parties are seen equally affected [44] and symptomatic malaria is seen in all ages. Thus malaria infection during pregnancy is a major public health problem in tropical and subtropical region throughout the world. In area of epidemic or low (unstable) malaria transmission, adult women will not acquire any significant level of immunity and

usually become ill when infected with malaria. For pregnant women in these areas, the risk of developing severe malaria is 2-3 times higher than that for non-pregnant women living in the same area [75]. Maternal death may result from either directly from severe malaria or indirectly from malaria-related severe anaemia. Most studies come from sub-Saharan Africa, where approximately 25,000,000 pregnant women are at risk of malaria infection every year, and one in four women have evidence of placental infection at the time of delivery [33]

Most malaria infections and the most severe morbidity and mortality are caused by *Plasmodium falciparum*. Most *Plasmodium falciparum* infection occur in sub-Sahara Africa. The *Plasmodium falciparum* parasites have been shown to be more common in pregnant than in non-pregnant women and to have a substantial effect on pregnancy outcome causing both pre-maturity (gestation of less than 37 weeks) and intrauterine growth retardation [10]

In high transmission areas, malaria is associated with maternal anaemia, potentially responsible for maternal death with severe and low birth weight (LBW) due to both pre-maturity and intrauterine growth retardation [70]

LBW is a high risk factor for pre-natal death and it is also correlated with morbidity and mortality during infancy. A recent study estimated that malaria may contribute to 3-5% of maternal anaemia, 8-14% of LBW and 3-5% of infant mortality [70].

Pregnancy-associated malaria (PAM) or placental malaria is a presentation of the common illness that is particularly life-threatening to both mother and developing fetus. PAM is caused primarily by infection with *Plasmodium falciparum*, [68], the most dangerous of the four species of malaria-causing parasites that infect humans. During her first pregnancy, a woman faces a much higher risk of contracting malaria and of associated complications [60]. Prevention and treatment of malaria are essential components of pre-natal care in areas where the parasite is endemic [77].

While the average adult citizen of an endemic region possesses some immunity to the parasite, pregnancy causes complications that leave the woman and fetus extremely vulnerable [68] The parasite interferes with transmission of vital substances through the fetal placenta, [42] often resulting in stillbirth, spontaneous abortion, or dangerously low birth [68]. The tragedy of malaria in developing countries receives abundant attention from the international health community, but until recently, PAM and its unique complications were not adequately addressed [77]

Globally, an estimated 125 million or more pregnant women per year risk contracting malaria. PAM causes around 100,000 infant deaths each year, due in large part to low birth weight [19]

## MATERIALS AND METHODS

A total of 330 blood samples from apparently healthy pregnant (280) attending ante natal clinic at ISTH and non pregnant (50) volunteer subjects (control) working in the hospital were used for this study.

Irrua, Edo State, Nigeria lies in latitude  $6^{\circ}45^1$  to  $01^{\circ}N$ , and longitude  $6^{\circ}15^1$  to  $48^{\circ}E$  having a population range of under 10,000. The peoples major occupations are farming, trading and civil service jobs and students.

**Note:** Age range of the population not taken into consideration.

### Sample Collection:

Blood samples were collected from the volunteers after informed and written consent was obtained from them, following the explanation on the purpose of the investigation and the need for participation. Ethical permission was also obtained from the ethical committee of Irrua Specialist teaching Hospital. 3ml of peripheral blood sample were collected into EDTA container mixed thoroughly but gently and taken to the diagnostic laboratory for examination.

### Parasitological Examination:

Standard laboratory techniques using thick and thin blood films stained with Giemsa and Leishman stains respectively were used for the detection of malaria parasites [77].

**% of parasite load** = Total No. of parasitized red blood cell/ total No of red blood cell x 100%

An estimate of less than 1% of parasitized red blood cell has no clinical predictive value. Only values of 2-3% or above are of clinical concern [39].

**Malaria Parasite Antigen Test:**

Malaria parasite antigen tests was done using the rapid diagnostic strip for the quantitative detection of malaria antigen in blood. This was performed according to the manufacturer's instruction (SD Bioline RDT).

**Estimation of Packed Cell Volume (PCV):**

A non-heparinized capillary tube was filled to 2/3<sup>rd</sup> its length by capillary action. The tube was sealed using a burner flame and spun at 12,000rpm using haemocrit centrifuge for 5 minutes. The reading was taken using the microhaematocrit reader.

**Statistical Analysis:**

Data were subjected to statistical analysis (chi-square) using SPSS v 16.0 statistical package. All indicators were determined using 5% confidence interval (C1).

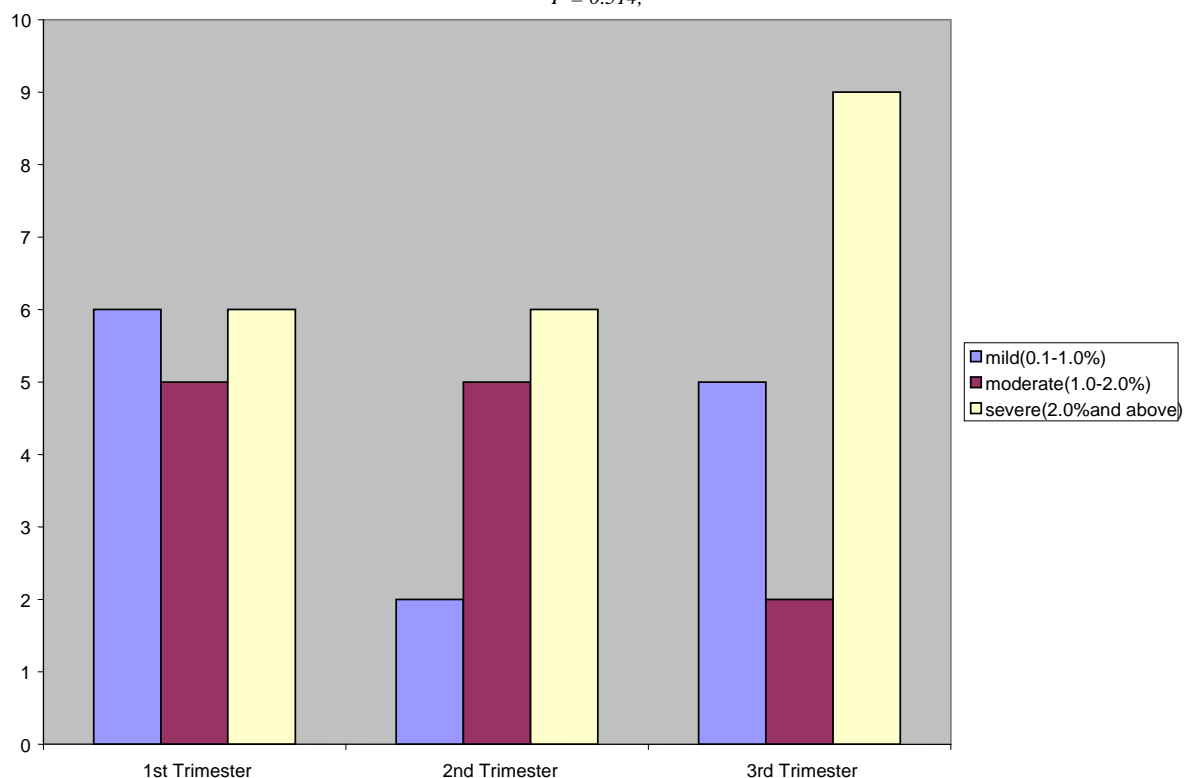
**RESULTS**

A total of 330 volunteers made up of 280 apparently healthy pregnant women and 50 control subjects (non-pregnant) were studied. Of the 280 pregnant women, 128 (45.7%) were primigravidae while 152 (54.3%) were multigravidae. 23 (18%) primigravidae were infected with malaria parasite while 105 (87%) were negative for malaria parasite. The overall prevalence rate of infection was 16.1%. There was however no significant correlation between malaria parasite infection and primigravidae or multigravidae ( $p > 0.05$ ).

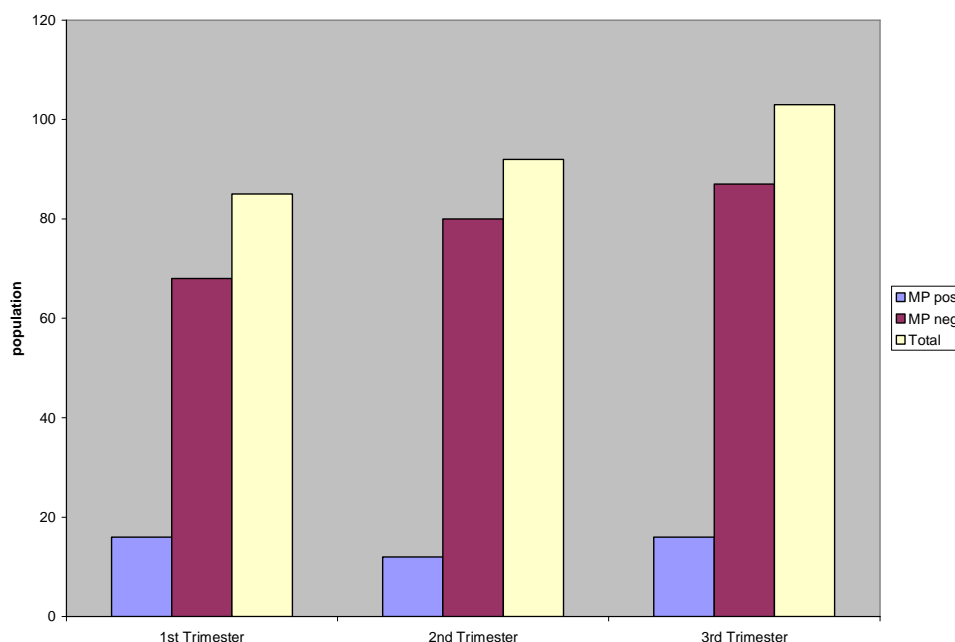
**Table I: Prevalence of malaria parasitaemia among pregnant women according to parity in the study**

Parity	Number sampled n(%)	Number infected n(%)	Number negative n(%)	Prevalence rate (%)
Primigravidae	128 (45.7)	23 (18.0)	105 (82)	8.2
Multigravidae	152 (54.3)	22 (14.5)	130 (85.5)	7.9
Total	280	45 (16.1)	235 (83.9)	16.1

$P = 0.514$ ,



**Figure 1: Malaria parasite density in the various trimesters under study. Women with parasitaemia ranging from 0.1-1.0% were considered to be having mild infection with no clinical predictive value, while women with parasitaemia from 2.0% and above are said to be severely infected with clinical predictive value. Hence 6 (7.1%) women in their first trimester were said to have mild infection while 6 (10.5%) were severely infected**



**Figure II: Malaria parasite infection according to Trimesters**

A total of 17 (20%) women in their first trimester were infected with malaria parasite, whereas 16 (15.5%) of the women in their 3<sup>rd</sup> trimester of pregnancy were infected with malaria parasite. Only 12 (13.0%) women in their 2<sup>nd</sup> trimester were infected with malaria parasite.

**Table II: Haematocrit values of primigravidae and multigravidae in the study**

PCV Range (%)	Primigravidae n(%)	Multigravidae n(%)	Non pregnant control	Total
Severe (15-24)	45 (35.1)	12 (7.8)	1	58
Mild (25-34)	73 (57)	20 (79)	2	95
Normal (35-45)	10 (7.8)	20 (13.2)	47	77
Total	128 (100)	152 (100)	50	330

$P = 0.3757(\text{ANOVA})$

**Table III: Haematocrit values of pregnant women and non-pregnant control subject**

PCV Range	Pregnant women n(%)	Non-Pregnant women n(%)	Total
15-24	57 (20.3)	0	57
25-34	193 (68.9)	2 (4)	195
35-45	30 (10.7)	47 (96)	78
Total	280 (100)	50 (100)	330

$P = 0.00,$

The ranges of Haematocrit values of Primigravidae and multigravidae were compared. 45 (35.1%) primigravidae and 12 (7.8%) multigravidae women had severe anaemia while 73 (57%) primigravidae and 120 (79%) multigravidae had mild anaemia and 10 (7.8%) primigravidae and 10 (13.1%) multigravidae had normal haematocrit value. The differences in haematocrit between primigravidae and multigravidae was statistically not significant,  $P > 0.05$ . Also the difference in haematocrit between the patients and the control subject were tested statistically and was found to be significant ( $P < 0.05$ )

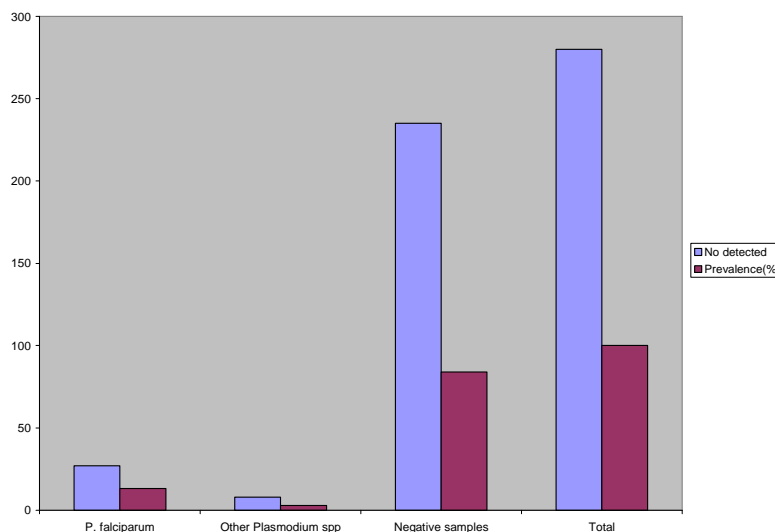
**Table IV: Haematocrit values of pregnant women in the various trimesters studied**

PCV Range (%)	First Trimester n(%)	Second Trimester n(%)	Third Trimester n(%)	Total (N)
Severe (15-24)	0	12 (13.0)	23 (22.3)	35
Mild (25-34)	78 (91.8)	71 (77.1)	80 (77.6)	229
Normal (35-45)	7 (8.2)	9 (9.7)	0 (0)	16
Total	85 (100)	92 (100)	103 (100)	280

$P = 0.98,$

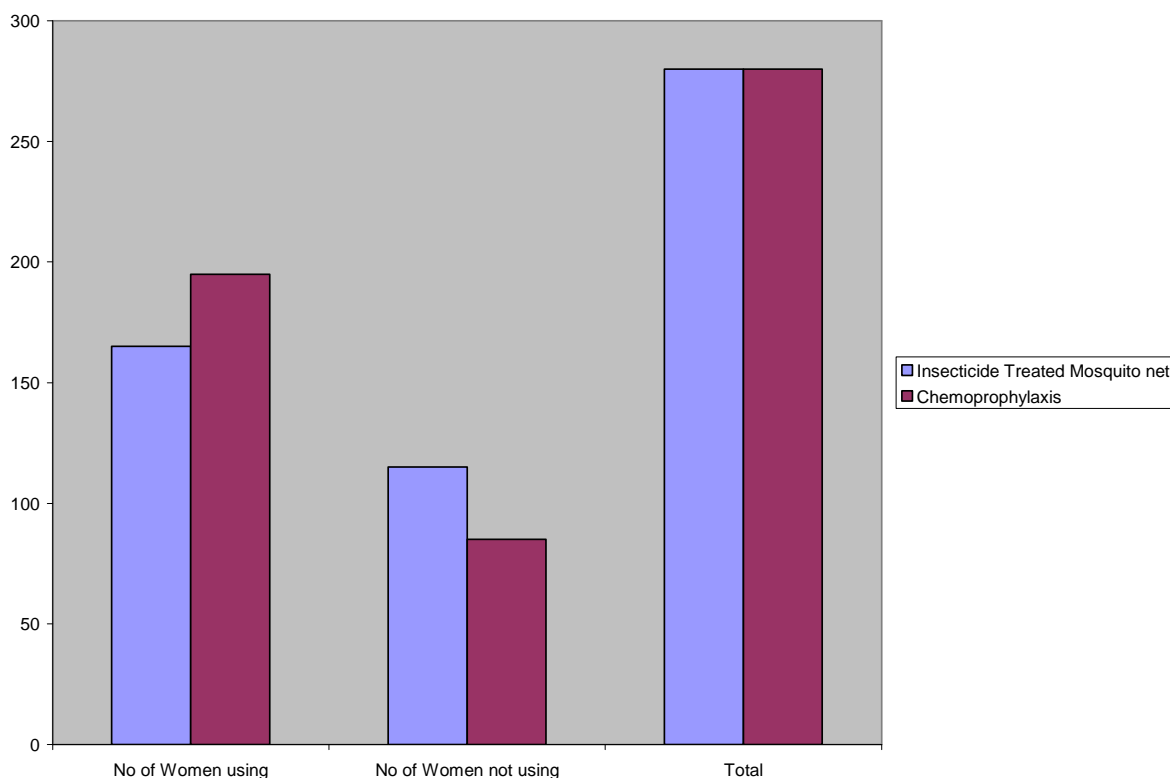
The ranges of haematocrit values of the women in the three trimesters were compared. Only 12 (13.0%) women in their second trimester and 23 (22.3%) women in their third trimesters had severe anaemia. 78 (91.8%) women in their first trimester, 71 (77.1%) of women in their second trimester and 80 (77.6%) in their third trimester had mild

anaemia. Also 7 (8.2%) women in first trimester and 9 (97%) women in their second trimester had normal haematocrit value. No woman in the third trimester had normal haematocrit value. The haematocrit value of women in the various trimester was compared statistically and it was not significant,  $P = 0.98$ .



**Figure III: Prevalence of Plasmodium spp among pregnant women by Antigen detection Technique**

Using the rapid diagnostic test strip for antigen detection of *Plasmodium falciparum* and other *Plasmodium* species, 37 (13.2%) of the total 280 sample strip detected antigen of *Plasmodium falciparum*, while 8 (2.9%) strip detected other *Plasmodium* species, A total of 235 strips were negative for malaria parasite antigen.



**Fig IV: Preventive measures used by pregnant women in the study**

Of all the 280 pregnant women enrolled in this study, 115 (41.8%) admitted using insecticide treated mosquito net and 195 (69.6%) were already in chemoprophylaxis using weekly pyrimethamine.

## DISCUSSION

Malaria infection in pregnancy adversely affects the development and survival of the fetus through low birth weight, maternal anaemia and possibly abortion and stillbirth. These malaria induced medical problems constitute major clinical public health and research concern [48].

About 45 (16.1%) out of 280 pregnant women were positive. 128 primigravidae and 152 multigravidae women were involved in this study. A total of 165 (58.9%) women involved in this study admitted to using insecticide treated mosquito net, while 195 (69.6%) women were already on chemoprophylaxis as at the time of recruitment, using weekly perimethamine. A prevalence of 16.1% obtained from this study is still low compared to previous work done in other areas; 57% Libreville, Gabon [8], 63.5% in Awka, Nigeria in 2003 [15], 59.9% in Ebonyi, Nigeria [55] and 58.4% in Enugu, Nigeria [54]

There is a wide variation in reported prevalence even within the same region. Many reasons could be advanced for the very wide difference in the reported prevalence of malaria parasite among pregnant women. Chiefly among them being the group of pregnant women that are studied (All pregnant women attending a clinic or only healthy pregnant women who had no complaints). In this study, asymptomatic pregnant women were used. The high percentage of the number of patients using insecticide treated mosquito net and the use of chemoprophylaxis also contributed to the low prevalence. However, it was observed that the prevalence of malaria parasitaemia was higher in Primigravidae compared to Multigravidae but this was not significant when statistically tested. This is consistent with report of previous studies [9]; [44]; [47]. However, this has been attributed to the facts that anti-adhesion antibodies are usually developed against chondroitin sulphate A-binding parasite over successive pregnancies and may account for susceptibility of Primigravidae to infection [21] Also it was observed that women in their first trimester had higher prevalence of malaria parasitaemia than those in second and third trimester but when tested statistically, it was not significant.

Rates of infection considered as having clinical concern ranges from 1.5-3.9% while ranges from 0.0-0.4% were considered as not having clinical predictive value and hence referred to as mild infection and were not considered as values of concern. This is in support of the report Kakilaya which states that "an estimate of <1% of parasitized red cells does not need to be defined since no clinical predictive value is gained; it is values from 2-3% or above that are of clinical concern[39].

Furthermore, 85 (178%) were pregnant women in their first trimester out of which 17 (20%) were infected, 92 (32.8%) were women in their second trimester out of which 12 (13%) were infected with malaria parasite and 103 (36.8%) were women in their third trimester with 16 (15.5%) having malaria parasitaemia. This shows that pregnant women in their first trimester has the highest prevalence rate of 20.0% followed by those in their third trimester with 15.5% and the least being those in their second trimester with 13.0% prevalence rate however, this finding was not statistically significant.

The relationships between the haematocrit fraction volumes in both parties were compared. 75 (26.7%) Primigravidae and 98 (35%) Multigravidae were found to have haematocrit fraction volume within the range of 15-29% regarded as being below the lower limit of the normal reference range while 28 (10%) Primigravidae and 47 (30.9%) Multigravidae was found within the range of 30-39% considered as being within the normal reference range in this study. Since a high percentage (61.7%) of the women under study fell below the lower limit of the normal reference range, it therefore confirms physiological anaemia in pregnancy. When the difference in haematocrit fraction volume in relation to both varieties was compared, it was statistically significant.

Rapid diagnostic test was done for all samples to detect the presence of antigen of *Plasmodium falciparum* and other plasmodium species. Figure III shows that of the 280 strips used in this study, 37 stripes detected the presence of *Plasmodium falciparum*, 8 detected other *Plasmodium* species while 235 strips were negative for malaria parasite antigen. This implies that *Plasmodium falciparum* is common in this area of study. This is in support of the view that *Plasmodium falciparum* has been shown to be more common in pregnant women than other *Plasmodium* species and has substantial adverse effect on pregnancy outcome. Of all the 280 pregnant women enrolled in this study, 115 (41.8%) admitted using insecticide treated mosquito net and 195 (69.6%) were already in chemoprophylaxis using weekly pyrimethamine. The number of women using preventive measures was statistically significant.  $P = 0.008$  (fig 4) [32].



## CONCLUSION

From this study, it was shown that Primigravidae women had a higher incidence of malaria parasitaemia and they suffer a higher number of clinical pregnancy outcomes than Multigravidae women. This is due to immunity related factor, knowledge, attitudes and maturity related practices in both parties. Malaria during pregnancy also increases maternal and infant mortality. Therefore, pregnant women should go for regular check-up for the presence of malaria parasite so that appropriate measures can be taken to prevent the complication of malaria in pregnancy.

*Recommendation:*

Pregnant women should be given first hand information on dangers that malaria pose to them and their babies, and the steps they can take to help protect them. These messages should address the importance of practices such as continuing ante-natal care, receiving the next scheduled dose of Intermittent Preventive Treatment (IPT), sleeping under Insecticide Treated Net (ITN) and covering hands and legs in the evening. Then family members can help protect the woman from malaria by filling in areas in the ground near their homes where water collects, then clearing bushes away from the house, disposing trash regularly and keeping food containers covered. Finally, cases of iron, folic acid and/vitamin B deficiency should be properly accessed as it could lead to anaemia in pregnancy.

Limitation: This study did not take into cognizance the age of the subjects.

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