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Malaria in Pregnancy: A Demographic and Clinical Surveillance at Mother and Child Hospital Ondo, South Western, Nigeria

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Abstract

This study is designed to screen the patients' blood for *Plasmodium falciparum* and to relate some socio-cultural factors like age, trimester stage of pregnancy, use of drugs, use of insecticides, use of mosquito nets and use of herbs for malaria parasite infections.

Blood samples were collected through venous collection process from 54 pregnant women who visited Mother and Child Specialist Hospital, Ondo, Ondo State, Nigeria for antenatal. Rapid test kit and microscopic test analysis was used in the detection of the presence of *Plasmodium falciparum* in the obtained blood samples.

Out of the 54 pregnant women whose blood samples were taken, 3.7% were below 20 years, 72.2% (21-30 years); 22.2% (31-40 years) and 1.9% (above 40 years). Nine (23.1%) of age group, 21-30, showing prevalence rate with high susceptibility to malaria parasitemia infections. Of the 3 (5.6%) that were in the first trimester stage, no malaria parasitemia was seen in their blood sample and of the 27 (50%) that were in the second trimester stage, 6 (46.2%) were mp positive while 21 (51.2%) were mp negative, Of 24 (44.4%) that were in the third trimester stage, 7 (53.8%) show mp positive, while 17 (41.5%) were mp negative.

Of 27 (50.0%) non-mosquito nets users 6 (46.2%) were mp positive while 21 (51.2%) were mp negative while 27 (50.0%) mosquito nets users 7 (53.8%) were mp positive while 20 (48.8%) were mp negative. 41 (75.9%) denied usage of herbs for treatment for malaria while 13 (24.1%) confirmed the use of herbs as treatment for malaria. Of 24 (44.4%) malarial drug users, 6 (46.2%) mp, positive and 18 (43.9%) negative. Of 24 (48.1) insecticide users, 8 (61.5%) were of mp positive while 18 (43.9%) negative. Of 26 (48.1%) pregnant women living in a clean and tidy environment, 4 (30.8%) were mp positive while 22 (53.7%) mp negative.

To reduce maternal mortality during pregnancy, development of adequate information on *P. falciparum* infection risks is highly needed in the study area. Novel technologies to prevent, monitor, diagnose and efficient treatment of malaria mostly among pregnant women must be adopted through Local and National Malaria Control Programme.

Keywords: Checklist; Critical care; Catheter-related infection

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Introduction

Malaria in pregnancy is one of the dreaded causes of fetal mortality and morbidity. High grades of fever, hypoglycemia, anemia and other complications can all adversely affect the fetus. Falciparum malaria can cause problems for the fetus with mortality up to 15-70% [1]. Spontaneous abortion, still birth, placental insufficiency and IUGR (temporary/chronic), low birth weight, fetal distress are the different problems observed in the growing fetus. Transplacental spread of malarial parasites results

in congenital malaria [2]. In endemic areas, high prevalence of neonatal parasitemia has been reported, with majority of the parasitemic newborns being asymptomatic, however, the mortality was found to be higher in the parasitemic newborns compared with the aparasitemic and in the symptomatic compared with the asymptomatic [3]. Congenital malaria due to transplacental or perinatal infection of the fetus is being increasingly reported. It has been reported in 8-33% of pregnancies from both malaria-endemic and non-endemic areas [4]. It has been reported following maternal infections with all four species of human plasmodium, though most cases are reported following *P. falciparum P. vivax*. In non-endemic countries, *P. malariae* may cause a disproportionately higher number of congenital malaria cases due to its longer persistence in the host. In endemic areas symptomatic malaria in the neonate is rare despite a high incidence of maternal parasitemia and placental malaria as maternally derived IgG and the high proportion of fetal hemoglobin inhibit parasite development [5]. The symptoms of malaria during pregnancy differ with the intensity of malaria transmission and with the level of immunity acquired by the pregnant women [6].

This research work was designed to investigate the prevalence of malaria parasite among pregnant women who visit antenatal clinic at Mother and Child Specialist Hospital, Ondo, Nigeria. Their level of awareness, personal hygiene, use of various treatment such as anti-malaria drugs, herbs, use of insecticides and mosquito nets in preventing the transmission of the malaria parasites was assessed.

Materials and Methods

Study area and population

The study population consisted of 54 patients among pregnant women who came for antenatal at Mother and Child Specialist Hospital, Ondo, Ondo State, Nigeria between September and October, 2015. They were selected randomly without prior knowledge of their clinical and family history.

Sample collection

Blood samples were obtained from selected pregnant women using venous blood collection process. The collection was done by experts in the medical field. The blood samples were collected in EDTA bottles. The patients were swabbed with 70% alcohol and care was taken while using syringes Excessive bleeding was avoided.

Questionnaire

A structural questionnaire was used to elicit information from the patients. The questionnaire obtained information on: Age, Drugs Usage, Hygiene, Herbs Usage, Use of Mosquito Nets, Trimester Stages of the Pregnancy, Use of Insecticides. The questions in the questionnaires were asked from the patients and answers were given immediately. The answers to the questions were used for data analysis.

Rapid kit test method to detect plasmodium

Rapid Diagnostic Test (RDT), a lateral flow Immuno-chromatographic antigen-detection test was employed. It relied on the capture of dye-labeled antibodies to produce a visible band on a strip of nitro-cellulose. With malaria RDTs, the dye-labeled antibody first binds to a parasite antigen, and the resultant complex is captured on the strip by a band of bound antibodyforming a visible line (test line). A control line gives information on the integrity of the antibody-dye conjugate.

Microscopy

Microscopy, astandard for laboratory confirmation of malaria was employed. A drop of the patient's blood was collected by finger prick, or from a larger venous blood specimen. It was spread on a glass slide (blood smear), dipped in a reagent that stains the malaria parasites (Giemsa stain) and then examined under a microscope at a 1000-fold magnification. Malaria parasites are recognizable by their physical features and by the appearance of the red blood cells that they infect. They can then be counted using the following method:

+ 1-10 asexual parasites per 100 thick film fields

++ 11-100 asexual parasites per 100 thick film fields

+++ 1-10 asexual parasites per single thick film field

++++ More than 10 asexual parasites per single thick film field

Data analysis

The data obtained from the information on the questionnaires were subjected to statistical analysis using statistical package (SPSS) to determine any significant relationship between: Age, Drugs usage, Hygiene, Herbs usage, Use of mosquito nets, Trimester stages of pregnancy, Use of insecticides.

Results

As observed in **Table 1**, out of the total 54 individual tested for *Plasmodium falciparum* using malaria kit, 2 (3.7%) were below 20 years, 39 (72.2%) were between 21 and 30 years, 12 (22.2%) were between 31 and 40 years and 1 (1.9%) were above 40 years.

Out of the 2 (3.7%) that were below 20 years 0 (0 %) were positive, while 2 (4.9%) were mp negative. Out of the 39 (72.2%) that were between 21 and 30 years, 9 (69.2%) were mp positive while 30 (73.2%) were mp negative. For the 12 (22.2%) that were between 31 and 40 years, 3 (23.1%) were mp positive and 9 (22.0%) were mp negative. On the bar chart, for the positive results of the test for *Plasmodium falciparum* using malaria kit, women within the age group 21 and 30 years had the highest prevalence rate of 9 (23.1%) followed by women within the age group 31 and 40 years with prevalence rate of 3 (25.0%) **(Figure 1)**. This was followed by women at age group greater than 40 years with prevalence rate of 1 (100.0%). Women at age group lesser than 20 years had the least prevalence rate of 0 (0.0%).

Table 2 above shows the prevalence of malaria parasite in pregnant women and trimester stages of pregnancy. Out of the

Table 1 The prevalence of malaria parasite among pregnant women tested for malaria using malaria parasite kit in relation to age of the women.

Malaria kit* age			Age				Total
			<20	21-30	31-40	>40	
MP test	Positive	Count	0	9	3	1	13
		% within MP test	0.00%	69.20%	23.10%	7.70%	100.00%
		% within age	0.00%	23.10%	25.00%	100.00%	24.10%
	Negative	Count	2	30	9	0	41
		% within MP test	4.90%	73.20%	22.00%	0.00%	100.00%
		% within age	100.00%	76.90%	75.00%	0.00%	75.90%
Total		Count	2	39	12	1	54
		% within MP_test	3.70%	72.20%	22.20%	1.90%	100.00%
		% within age	100.00%	100.00%	100.00%	100.00%	100.00%

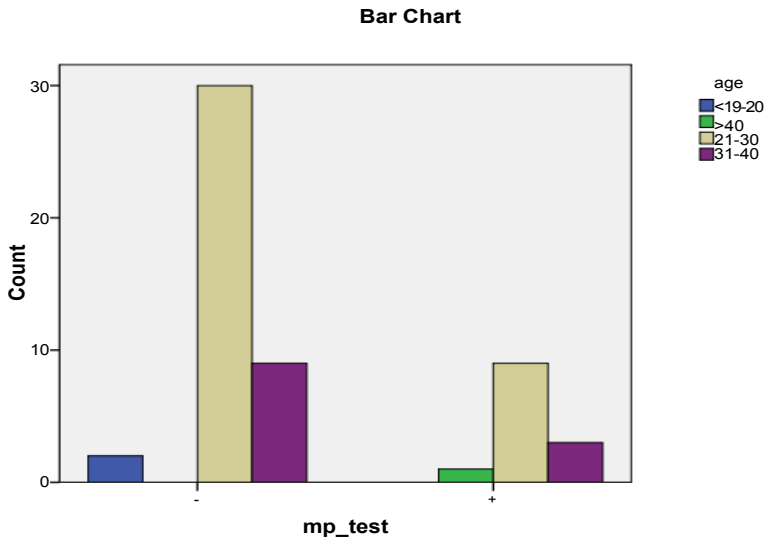

Figure 1 Bar chart showing the prevalence of malaria parasite among pregnant women screened for malaria parasitemia. Samples collected from Mother and Child Hospital, Ondo town, Ondo State, Nigeria.

Table 2 The prevalence of malaria parasite at different trimester stages of pregnancy among women subject.

			Trimester stages			Total
			1st stage	2nd stage	3rd stage	
Mp test	Positive	Count	0	6	7	13
		% within MP test	0.00%	46.20%	53.80%	100.00%
		% within trimester stage	0.00%	22.20%	29.20%	24.10%
	Negative	Count	3	21	17	41
		% within MP test	7.30%	51.20%	41.50%	100.00%
		% within trimester stage	100.00%	77.80%	70.80%	75.90%
Total		Count	3	27	24	54
		% within MP test	5.60%	50.00%	44.40%	100.00%
		% within trimester stage	100.00%	100.00%	100.00%	100.00%

total 54 women that were tested for the presence of *Plasmodium falciparum* using malaria kit 3 (5.6%) were in the first trimester stage, 27 (50.0%) were in the second trimester stage, 24 (44.4%) were in the third trimester stage.

Out of the 3 (5.6%) that were in the first trimester stage, show no malaria parasitemia in their blood sample 3 (7.3%) show negative results. Out of the 27 (50%) that were in the second trimester stage, 6 (46.2%) were mp positive while 21 (51.2%) were mp negative, of 24 (44.4%) that were in the third trimester stage, 7 (53.8%) show mp positive, while 17 (41.5%) were mp negative **(Figure 2)**.

On the bar chart **(Figure 3)** showing positive result of the test for malaria parasite using malaria kit, women in the third trimester stage has the highest prevalence rate of 7 (29.2%), followed by women in the second trimester stage with prevalence rate of 6 (22.2%). The women in the first trimester stage has the lowest prevalence rate of 0 (0.0%)

Table 3 above shows the prevalence of malaria parasite in pregnant women in relation to the use of mosquito nets. Out of the total 54 women that were tested for the presence of *Plasmodium falciparum* using malaria kit, 27 (50.0%) said they did not use mosquito nets, while 27 (50.0%) said they did use mosquito nets.

Out of the 27 (50.0%) that do not use mosquito nets, 6 (46.2%) were positive while 21 (51.2%) were negative. Of the 27 (50.0%) that do use mosquito nets 7 (53.8%) were mp positive while 20 (48.8%) were negative.

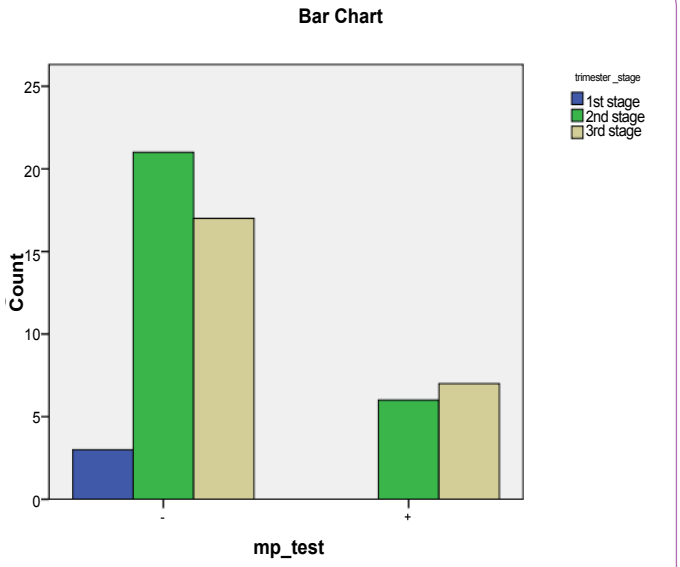

Figure 2 Bar chart showing the prevalence of malaria parasite at trimester stages of pregnancy among pregnant women in Mother and Child Hospital, Ondo Town, Ondo State, Nigeria.

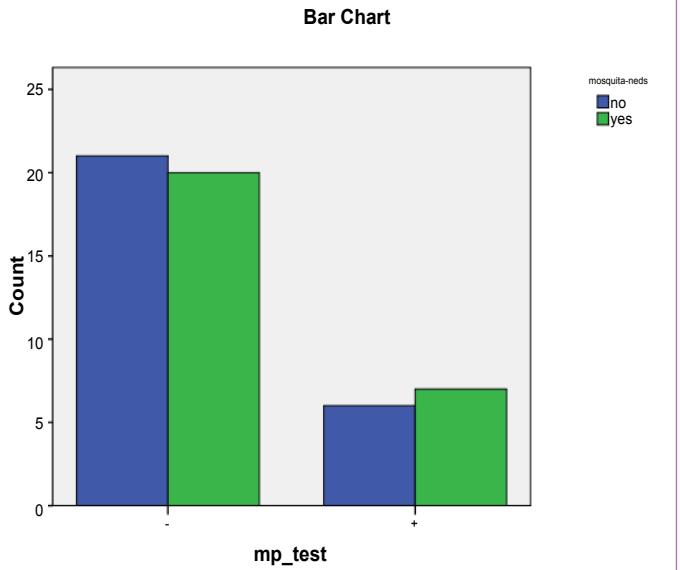

Figure 3 Bar chart showing the prevalence of malaria parasite in relation to usage of mosquito nets at Mother and Child Hospital, Ondo Town, Ondo State, Nigeria.

On the bar chart, for the positive results of the test for malaria parasite using malaria kit, women who do always use mosquito nets had the highest prevalence rate 7 (25.9%) while the women who do not use mosquito nets had the lowest prevalence rate 6 (22.2%).

As observed in **Table 4** above, of the total 54 individual tested for *Plasmodium falciparum* using malaria kit, 41 (75.9%) denied usage of herbs for treatment for malaria while 13 (24.1%) confirmed the use of herbs as treatment for malaria.

Out of the 41 (75.9%) that denied usage of herbs as treatment for malaria, 8 (61.5%) were positive, while 33 (80.5%) were negative. Out of 13 (24.1%) that confirmed the usage of herbs for malaria treatment, 5 (38.5%) were positive while 8 (19.5%) were negative **(Figure 4)**.

On the bar chart, for the positive results of the test for *Plasmodium falciparum* using malaria kit, women who denied the use of herbs as malaria treatment had the highest prevalence rate of 8 (19.5%) while the women who confirmed the use of herbs as treatment for malaria treatment had the lowest prevalence rate 5 (38.5%).

Out of the total 54 individual tested for *Plasmodium falciparum* using malaria kit, 30 (55.6%) denied the use of drugs as treatment for malaria, 24 (44.4%) confirmed the use of drugs as treatment for malaria **(Table 5)**.

Out of the 30 (55.6%) that denied the use of drugs as treatment for malaria, 7 (53.8%) tested mp positive while 23 (56.1%) tested mp negative, Out of the 24 (44.4%) that confirmed the use of drugs as treatment for malaria, 6 (46.2%) tested positive while 18 (43.9%) tested negative **(Table 5)**.

On the bar chart, for the positive results of the test for *Plasmodium falciparum* using malaria kit, women who denied the use of drugs as treatment for malaria had the highest prevalence rate 7 (23.3%). Women who confirmed the use of drugs as treatment of malaria had the lowest prevalence rate 6 (25.0%) **(Figure 5)**.

Out of the total 54 individuals tested for *Plasmodium falciparum* using malaria kit, 28 (51.9%) denied the use of insecticides as preventive measures against malaria. 26 (48.1%) confirmed the use of insecticides as preventive measures against malaria **(Table 6)**.

Out of 28 (51.9%) that denied the use of insecticides as preventive measures against malaria, 5 (38.5%) tested positive, 23 (56.1%) tested negative. Out of the 26 (48.1%) that confirmed the use of insecticides as preventive measures against malaria, 8 (61.5%) tested positive, 18 (43.9%) tested negative **(Table 6)**.

On the bar chart, for the positive result of the test for *Plasmodium falciparum* using malaria kit, women who confirmed the use of insecticides as preventive measures against malaria had the highest rate 8 (30.8%) and women who denied the use of insecticide as preventive measures against malaria had the lowest prevalence rate 5 (17.9%) **(Figure 6)**.

Out of the total 54 individuals (pregnant women) tested for *Plasmodium falciparum* using malaria kit, 26 (48.1%) had a clean environment, 10 (18.5%) had a dirty environment, 14 (25.9%) had mosquitoes in their environment, 4 (7.4%) kept their environment clean personally **(Table 7)**.

Table 3 The prevalence of malaria parasite in pregnant women in relation to usage of mosquito nets.

Mosquito nets			No	Yes	Total
Mp test	Positive	Count	6	7	13
		% within MP test	46.20%	53.80%	100.00%
		% within mosquito nets	22.20%	25.90%	24.10%
	Negative	Count	21	20	41
		% within MP test	51.20%	48.80%	100.00%
		% within mosquito nets	77.80%	74.10%	75.90%
Total		Count	27	27	54
		% within MP test	50.00%	50.00%	100.00%
		% within mosquito nets	100.00%	100.00%	100.00%

Table 4 The prevalence of malaria parasite among pregnant women tested using malaria Parasite kit in relation to their usage of herbs as treatment for malaria.

Malaria kit * herbs			Herbs		Total
			NO	YES	
Mp test	Positive	Count	8	5	13
		% within MP test	61.50%	38.50%	100.00%
		% within herbs	19.50%	38.50%	24.10%
	Negative	Count	33	8	41
		% within MP test	80.50%	19.50%	100.00%
		% within herbs	80.50%	61.50%	75.90%
Total		Count	41	13	54
		% within MP test	75.90%	24.10%	100.00%
		% within herbs	100.00%	100.00%	100.00%

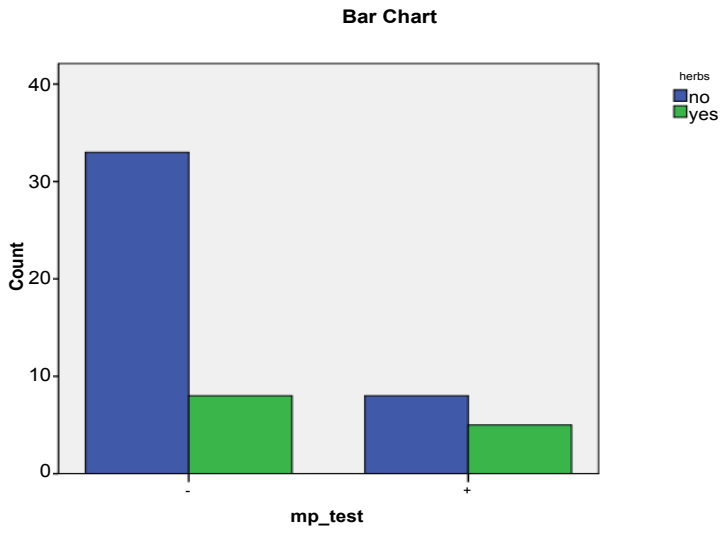

Figure 4 Bar chart showing the prevalence of malaria among pregnant women tested using malaria parasite kit in relation to their usage of herbs as treatment for malaria, samples collected from other and Child Hospital, Ondo Town, Ondo State, Nigeria.

Out of the 26 (48.1%) pregnant women that had a clean environment, 4 (30.8%) tested positive while 22 (53.7%) tested negative. Out 10 (18.5%) that had a dirty environment 3 (23.1%) tested positive while 7 (17.1%) tested negative. Out of 14 (25.9%) women that has mosquitoes in their environment, 6 (46.2%) tested positive while 8 (19.5%) tested negative. Out of the 4 (7.4%) pregnant women that kept their environment clean personally 0 (0.0%) tested positive, 4 (9.8%) tested negative **(Table 7)**.

On the bar chart, for the positive results of the test for the *Plasmodium falciparum* using malaria kit, women that had mosquitoes in their environment had the prevalence rate of 6 (42.9%) followed by women who had a clean environment with prevalence rate of 3 (30.0%). Women who personally kept their environment clean had the lowest prevalence rate of 0 (0.0%) **(Figure 7)**.

Table 5 The prevalence of malaria parasite among pregnant women tested for malaria using malaria parasite kit in relation to their usage of drugs as treatment for malaria.

Malaria kit* drugs			Drugs		Total
			No	Yes	
Mp test	Positive	Count	7	6	13
		% within mp_test	53.80%	46.20%	100.00%
		% within drugs	23.30%	25.00%	24.10%
	Negative	Count	23	18	41
		% within mp_test	56.10%	43.90%	100.00%
		% within drugs	76.70%	75.00%	75.90%
Total		Count	30	24	54
		% within mp_test	55.60%	44.40%	100.00%
		% within drugs	100.00%	100.00%	100.00%

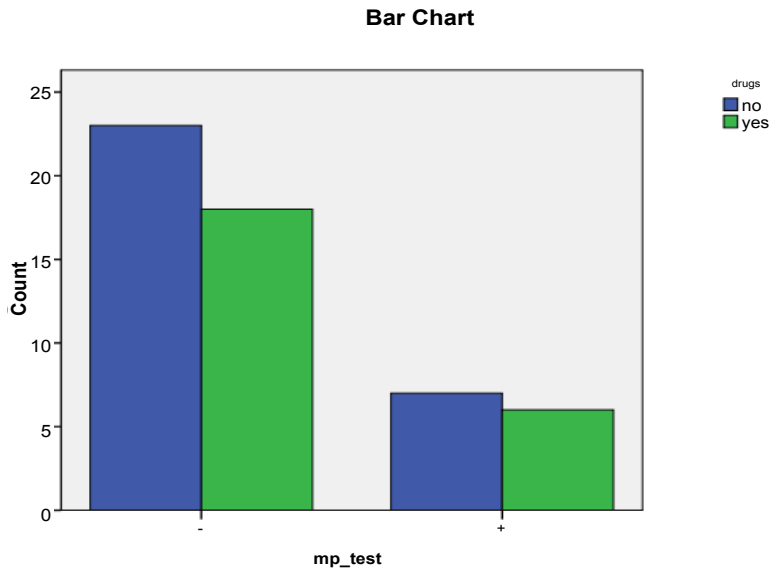

Figure 5 Bar chart showing prevalence of malaria parasite among pregnant screened for malaria in relation to their usage of drugs as treatment. Samples collected from Mother and Child Hospital, Ondo town, Ondo State, Nigeria.

Table 6 The prevalence of malaria parasite in pregnant women tested for malaria using malaria parasite kit in relation to their usage of insecticides.

Malaria kit* insecticide			Insecticide		Total
			No	Yes	
Mp test	Positive	Count	5	8	13
		% within MP test	38.50%	61.50%	100.00%
		% within insecticide	17.90%	30.80%	24.10%
	Negative	Count	23	18	41
		% within MP test	56.10%	43.90%	100.00%
		% within insecticide	82.10%	69.20%	75.90%
Total		Count	28	26	54
		% within MP test	51.90%	48.10%	100.00%
		% within insecticide	100.00%	100.00%	100.00%

Microscopic Analysis

According to **Table 8** above, out of the total 54 individuals screened for *Plasmodium falciparum* using microscopic analysis. 2 (3.7%) were below 20 years, 39 (72.2%) were between 21 and 30 years, 2 (22.2%) were between 31 and 40 years and 1 (1.9%) was above 40 years.

Of the 2 (3.7%) that was below 20 years, 0 (0.0%) had low positive parasitaemia count (+). 1 (5.6%) had high positive parasitaemia count (++). 0 (0.0%) had very high positive parasitaemia count (+++) while 1 (11.1%) had negative parasitaemia count (-). Out of 39 (72.2%) that were between 21 and 30 years, 8 (72.7%) had low positive parasitaemia count (+), 15 (83.3%) had high positive

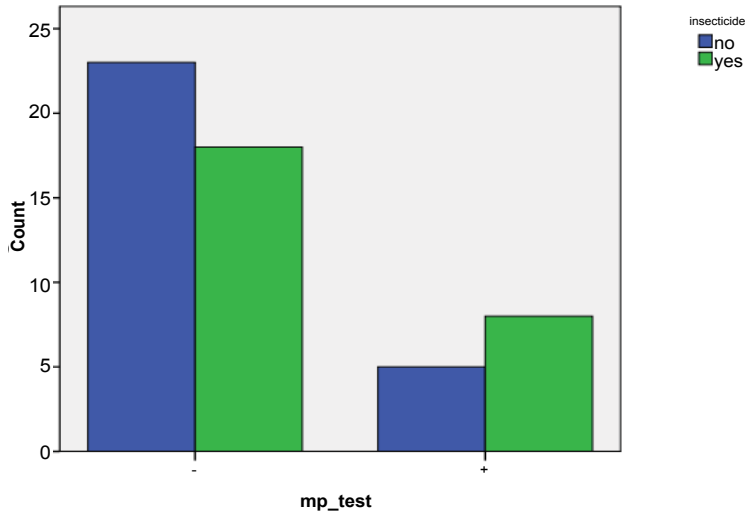

Figure 6 Bar chart showing the prevalence of malaria parasite in pregnant women screened for Malaria in relation to their usage of insecticides. Mother and Child Hospital, Ondo Town, Ondo State, Nigeria.

Table 7 The prevalence of malaria parasite in pregnant women tested for malaria using malaria parasite kit in relation to hygiene.

Malaria kit* hygiene			Hygiene				Total
			Clean	Dirty	Mp present	Well kept	
MP test	Positive	Count	4	3	6	0	13
		% within MP_test	30.80%	23.10%	46.20%	0.00%	100.00%
		% within hygiene	15.40%	30.00%	42.90%	0.00%	24.10%
	Negative	Count	22	7	8	4	41
		% within MP test	53.70%	17.10%	19.50%	9.80%	100.00%
		% within hygiene	84.60%	70.00%	57.10%	100.00%	75.90%
Total		Count	26	10	14	4	54
		% within MP test	48.10%	18.50%	25.90%	7.40%	100.00%
		% within hygiene	100.00%	100.00%	100.00%	100.00%	100.00%

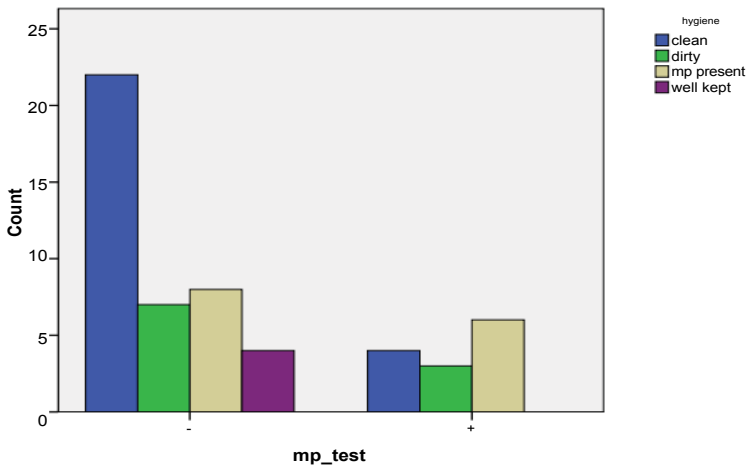

Figure 7 Bar chart showing the prevalence of malaria parasite in pregnant women tested for malaria using malaria parasite kit in relation to hygiene, samples collected from Mother and Child Hospital, Ondo Town, Ondo State, Nigeria.

parasitaemia count (++), 11 (68.8%) had very high positive parasitaemia count while 5 (55.6%) had negative parasitaemia count (-), Out of 12 (22.2%) that were between 31 and 40 years, 3 (27.3%) had low positive parasitaemia count (+), 2 (11.1%) had high positive parasitaemia count (++), 4 (25.0%) had very high positive parasitaemia count (+++) while 3 (33.3%) had negative parasitaemia count (-). Out of the 1 (1.9%) that were above 40 years, 0 (0.0%) had low positive parasitaemia count (+), 0 (0.0%) had high positive parasitaemia count (++), 1 (6.2%) had very high positive parasitaemia count (+++), while 0 (0.0%) had negative parasitaemia count **(Figure 8)**.

Out of the total 54 individual tested for *Plasmodium falciparum* using microscopic analysis. 3 (5.6%) were in the first trimester stage of pregnancy, 27 (50.0%) were in the second trimester stage, 24 (44.4%) were in the third trimester stage of pregnancy **(Table 9)**.

Out of the 3 (5.6%) that were in the first trimester stage of pregnancy, 1 (9.1%) had low positive parasitaemia count (+), 0 (0.0%) had high positive parasitaemia (++), 0 (0.0%) had very high positive parasitaemiacount (+++), while 2 (22.2%) had negative parasitaemia count (-). Out of the 27 (50.0%) that were in the second trimester stage, 6 (54.5%) had low positive parasitaemia (+), 9 (50.0%) had high positive parasitaemia count (++), 8 (50.0%) had very high positive parasitaemia count (+++), while 3 (33.3%) had negative parasitaemia count **(Figure 9)**.

Out of the total 54 individuals tested for *Plasmodium falciparum* using microscopic analysis: 27 (50.0%) confirmed the use of mosquito nets, 27 (50.0%) denied the use of mosquito nets **(Table 10)**. Out of the 27 (50.0%) that confirmed the use of mosquito nets, 6 (54.5%) had low positive parasitaemia count (+), 8 (44.4%) had high positive parasitaemia count (++), 7 (43.8%) had very high parasitaemiacount (+++), while 6 (66.7%) had negative

Table 8 The prevalence of malaria parasite among pregnant women tested for malaria using microscopic analysis in relation to age of the women.

Microscopic analysis* age			Age				Total
			21-30	31-40	<20	>40	
Microscopic analysis	+	Count	8	3	0	0	11
		% within microscopic analysis	72.70%	27.30%	0.00%	0.00%	100.00%
		% within age	20.50%	25.00%	0.00%	0.00%	20.40%
	++	Count	15	2	1	0	18
		% within microscopic analysis	83.30%	11.10%	5.60%	0.00%	100.00%
		% within age	38.50%	16.70%	50.00%	0.00%	33.30%
	+++	Count	11	4	0	1	16
		% within microscopic analysis	68.80%	25.00%	0.00%	6.20%	100.00%
		% within age	28.20%	33.30%	0.00%	100.00%	29.60%
	-	Count	5	3	1	0	9
		% within microscopic analysis	55.60%	33.30%	11.10%	0.00%	100.00%
		% within age	12.80%	25.00%	50.00%	0.00%	16.70%
Total		Count	39	12	2	1	54
		% within microscopic analysis	72.20%	22.20%	3.70%	1.90%	100.00%
		% within age	100.00%	100.00%	100.00%	100.00%	100.00%

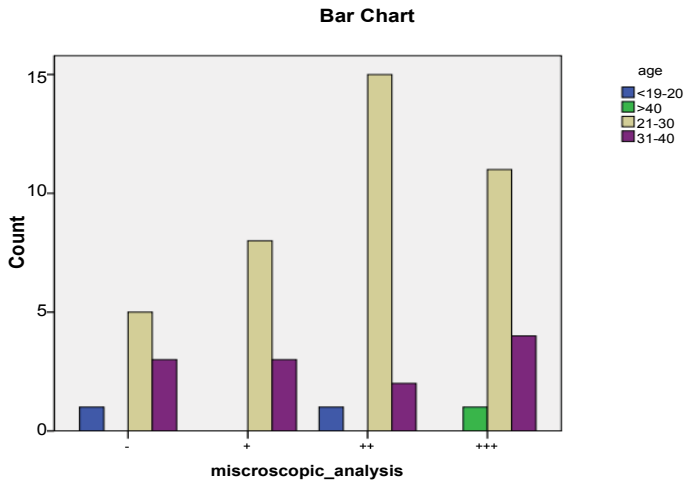

Figure 8 Bar chart showing the prevalence of malaria parasite among different age range of pregnant women screened for malaria using microscopic analysis. Mother and Child Hospital, Ondo Town, Ondo State, Nigeria in relation to the age of the women.

Table 9 The prevalence of malaria parasite among pregnant women tested for malaria using microscopic analysisof blood samples in relation to trimester stage of pregnancy.

Microscopic analysis *trimester stage			Trimester_stage			Total
			1st stage	2nd stage	3rd stage	
Microscopic analysis	+	Count	1	6	4	11
		% within microscopic analysis	9.10%	54.50%	36.40%	100.00%
		% within trimester stage	33.30%	22.20%	16.70%	20.40%
	++	Count	0	9	9	18
		% within microscopic analysis	0.00%	50.00%	50.00%	100.00%
		% within trimester stage	0.00%	33.30%	37.50%	33.30%
	+++	Count	0	8	8	16
		% within microscopic analysis	0.00%	50.00%	50.00%	100.00%
		% within trimester stage	0.00%	29.60%	33.30%	29.60%
	-	Count	2	4	3	9
		% within microscopic analysis	22.20%	44.40%	33.30%	100.00%
		% within trimester stage	66.70%	14.80%	12.50%	16.70%
Total		Count	3	27	24	54
		% within microscopic analysis	5.60%	50.00%	44.40%	100.00%
		% within trimester stage	100.00%	100.00%	100.00%	100.00%

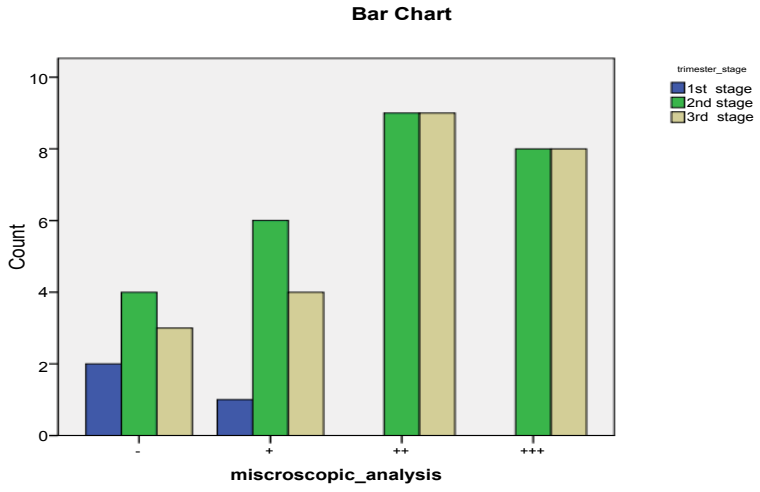

Figure 9 Bar chart showing the prevalence of malaria parasite among pregnant women screened for malaria using microscopic analysis from blood samples collected.

parasitaemia count (-). Out of the 27 (50.0%) that denied the use of mosquito, 5 (45.5%) had low positive parasitaemia count (+), 10 (55.6%) had high positive parasitaemia count, 9 (56.2%) had very high positive parasitaemia count, while 3 (33.3%) had negative parasitaemia count **(Figure 10)**.

From **Table 11** above, out of the total 54 individuals tested for *Plasmodium falciparum* using microscopic analysis. 41 (75.9%) denied the use of herbs as treatment against malaria, 13 (24.1%) confirmed the use of herbs as treatment against malaria.

Out of the 41 (75.9%) that denied the use of herbs as treatment against malaria, 10 (90.9%) had low positive parasitaemia count (+), 15 (83.3%) had high positive parasitaemia count (++), 10 (62.5%) had very high positive parasitaemia count (+++), while 6 (66.7%) had negative parasitaemia count.

Out of the 13 (24.1%) that confirmed the use of the herbs as treatment against malaria, 1 (9.1%) had low positive parasitaemia count (+), 3 (16.7%) had high positive parasitaemia count (++), 6 (37.5%) had very high positive parasitaemia count (+++), while 3 (33.3%) had negative parasitaemia count (-) **(Figure 11)**.

From **Table 12** above, out of the total 54 individual tested for *Plasmodium falciparum* using microscopic analysis. 30 (55.6%) denied the use of drugs as treatment against malaria, 24 (44.4%) confirmed the use of drugs as treatment against malaria.

Out of the 30 (55.6%) that denied the use of drugs as treatment

Table 10. The prevalence of malaria parasite among pregnant women screened for malaria using microscopic analysis of blood samples in relation to usage of mosquito nets.

Microscopic analysis* mosquito nets			Mosquito_nets		Total
			No	Yes	
Microscopic analysis	+	Count	5	6	11
		% within microscopic analysis	45.50%	54.50%	100.00%
		% within mosquito_nets	18.50%	22.20%	20.40%
	++	Count	10	8	18
		% within microscopic analysis	55.60%	44.40%	100.00%
		% within mosquito_nets	37.00%	29.60%	33.30%
	+++	Count	9	7	16
		% within microscopic analysis	56.20%	43.80%	100.00%
		% within mosquito_nets	33.30%	25.90%	29.60%
	-	Count	3	6	9
		% within microscopic analysis	33.30%	66.70%	100.00%
		% within mosquito_nets	11.10%	22.20%	16.70%
Total		Count	27	27	54
		% within microscopic analysis	50.00%	50.00%	100.00%
		% within mosquito_nets	100.00%	100.00%	100.00%

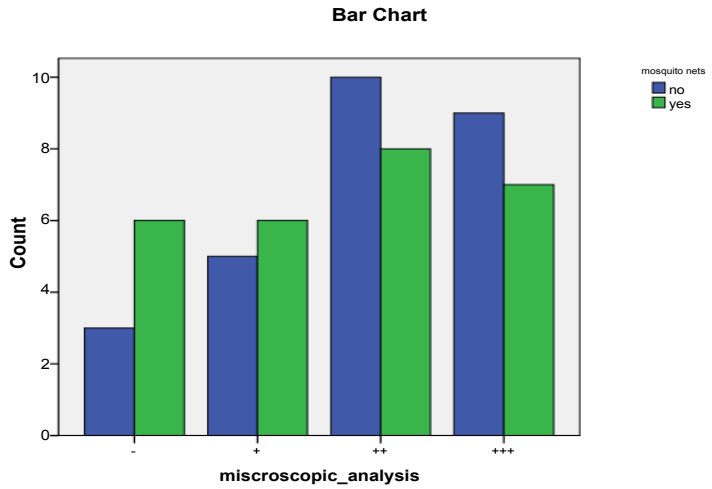

Figure 10 Bar chart showing the prevalence of malaria parasite among pregnant women screened for malaria using microscopic analysis of blood samples.

against malaria, 7 (63.6%) had low positive parasitaemia count (+), 9 (50.0%) had high positive parasitaemia count (++), 9 (56.2%) had very high positive parasitaemiacount (+++), while 5 (55.6%) had negative parasitaemia count (-). Out of the 24 (44.4%) that confirmed the use of drugs as treatments against malaria. 4 (36.4%) had low positive parasitaemia count (+), 9 (50.0%) had high positive parasitaemia count (++), 7 (43.8%) had very high positive parasitaemia count (+++) while 4 (44.4%) had negative parasitaemia count (-) **(Figure 12)**.

Out of the total 54 individuals tested for *Plasmodium falciparum* using microscopic analysis. 28 (51.9%) denied using insecticides to prevent malaria. 26 (48.1%) confirmed using insecticides to prevent malaria **(Table 13)**.

Out of the 28 (51.9%) that denied using insecticides to prevent malaria, 5 (45.5%) had low positive parasitaemia count (+), 11 (61.1%) had high positive parasitaemia count (++), 8 (50.0%) had very high parasitaemiacount (+++), while 4 (44.4%) had negative parasitaemia count **(Table 13)**.

Out of the 26 (48.1%) that confirmed using insecticides to prevent malaria, 6 (54.5%) had low positive parasitaemia count (+), 7 (38.9%) had high positive parasitaemia count (++), 8 (50.0%) had very high positive parasitaemia count (+++) while 5 (55.6%) had negative parasitaemia count **(Figure 13)**.

Discussion

The results obtained, from the laboratory diagnosis of the blood samples collected from the total 54 pregnant women screened using malaria rapid kit method and microscopic analysis showed that women within the age group 21 and 30 years had the highest prevalence rate compared to other age groups. Younger women seem to be more susceptible to malaria in this study area which contradicts the findings of Adefioye et al. who reported 36-39

Table 11 The prevalence of malaria parasite among pregnant women tested for malaria based on their usage of herbs for treatment.

Microscopic analysis * herbs			Herbs		Total
			No	Yes	
Microscopic analysis	+	Count	10	1	11
		% within microscopic analysis	90.90%	9.10%	100.00%
		% within herbs	24.40%	7.70%	20.40%
	++	Count	15	3	18
		% within microscopic analysis	83.30%	16.70%	100.00%
		% within herbs	36.60%	23.10%	33.30%
	+++	Count	10	6	16
		% within microscopic analysis	62.50%	37.50%	100.00%
		% within herbs	24.40%	46.20%	29.60%
	-	Count	6	3	9
		% within microscopic analysis	66.70%	33.30%	100.00%
		% within herbs	14.60%	23.10%	16.70%
Total		Count	41	13	54
		% within microscopic analysis	75.90%	24.10%	100.00%
		% within herbs	100.00%	100.00%	100.00%

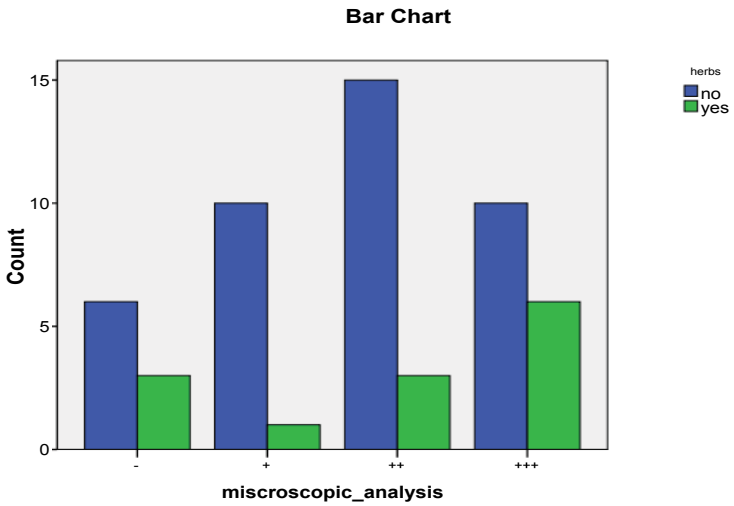

Figure 11 Bar chart showing prevalence of malaria parasite among pregnant women screened for malaria using microscopic analysis in relation to their usage of herbs for treatment of malaria.

age groups to be more susceptible [7]. Although this must have been due to their low immunity against malaria and number of child births they had had earlier because immunity increases with age and childbirths. However our result corresponds with the findings of Chimere et al. who reported that women within age group of 15-19 years had the highest prevalence, proving further that young maternal age increases the risk of malaria infection among patients [8]. Similar findings have been reported by other investigators in Gabon and Eastern Sudan where malaria prevalence was observed to decrease as age increased.

From the results of this study, women in the third trimester stage have shown the highest prevalence rate of 7 (29.2%) followed by women in the second trimester stage with prevalence rate of 6 (22.2%). The women in the first trimester stage had the lowest prevalence rate. This report is consistent with the findings of Thomas. et al. who reported that pregnant women in their third trimester stage were more infected than those at their first trimester because at the first trimester stage of pregnancy, women tend to protect themselves more and as the stages increases, their level of malaria prevention decreases, increasing the infection rates and this might also be due to the weak immunity of the women in the third trimester stage [9]. It is usually when they are very close to delivery that they become able to re-acquire their pre-pregnancy immunity. Also most of these pregnant women registered late for antenatal, which does not gives them opportunity to be well taken care of and given

Table 12 Screening analysis of blood samples in relation to their usage of drugs for treatment of malaria.

Microscopic analysis* drugs			Drugs		Total
			No	Yes	
Microscopic analysis	+	Count	7	4	11
		% within microscopic analysis	63.60%	36.40%	100.00%
		% within drugs	23.30%	16.70%	20.40%
	++	Count	9	9	18
		% within microscopic analysis	50.00%	50.00%	100.00%
		% within drugs	30.00%	37.50%	33.30%
	+++	Count	9	7	16
		% within microscopic analysis	56.20%	43.80%	100.00%
		% within drugs	30.00%	29.20%	29.60%
	-	Count	5	4	9
		% within microscopic analysis	55.60%	44.40%	100.00%
		% within drugs	16.70%	16.70%	16.70%
Total		Count	30	24	54
		% within microscopic analysis	55.60%	44.40%	100.00%
		% within drugs	100.00%	100.00%	100.00%

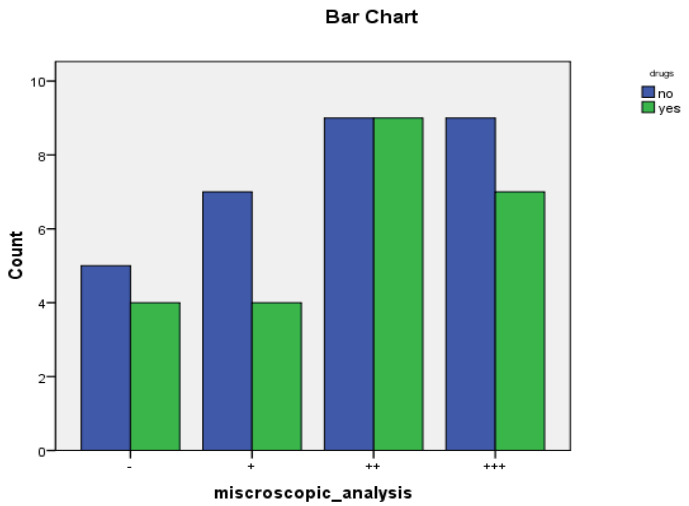

Figure 12 Bar chart showing the prevalence of malaria parasite among pregnant women tested for malaria parasite using microscopic analysis of blood samples collected from Mother and Child Hospital, Ondo Town, Ondo State, Nigeria in relation to their usage of drugs for treatment of malaria.

proper treatment and awareness, against the malaria infection and how to prevent it during pregnancy.

It can be deduced that women who always use mosquito nets seem to have the highest prevalence rate 7 (25.9%). The women who do not the mosquito nets had the prevalence rate 6 (22.2%). This corresponds with the findings of Ayaehieet al. who reported that there was a sustained but insignificant rise in asymptomatic malaria parasitaemia post-distribution of insecticide treatment nets [10]. Although the report survey at Enugu, Nigeria by Ugwuet al. proves that women who used insecticide treated nets are significantly less likely to have acute malaria, anaemia and babies with low birth weight than women who did not use insecticide treated nets. This result could have been due reasons such as the right use of mosquito nets, which might have required chemical washing, also some might have claimed to use these net sand might have not been using them effectively and constantly. Another reason might have been due to exposure to the vector (mosquitos) from the environment probably before sleeping under the nets. The mosquito nets will only be effective when the individuals are staying under them.

Women who denied the use of herbs had the highest prevalence rate, while the women who confirmed the use of herbs as treatment against malaria infections had the lowest prevalence rate. It commemorates the research work of Adefioye et al. in Osogbo, Nigeria reported that the use of herbs by pregnant women as both preventive and anti-malaria agents was 100% sensitive to *Plasmodium falciparum* infection [7]. In other words, the use of herbs as a cure against malaria is very effective although the Nigeria Federal Government needs to educate those involved in the practice of use of herbs as curatives or preventives on the

Table 13 The prevalence of malaria parasite among pregnant women tested for malaria parasite using microscopic analysis of blood samples in relation to their usage of insecticides.

Microscopic analysis* insecticide			Insecticide		Total
			No	Yes	
Microscopic analysis	+	Count	5	6	11
		% within microscopic analysis	45.50%	54.50%	100.00%
		% within insecticide	17.90%	23.10%	20.40%
	++	Count	11	7	18
		% within microscopic analysis	61.10%	38.90%	100.00%
		% within insecticide	39.30%	26.90%	33.30%
	+++	Count	8	8	16
		% within microscopic analysis	50.00%	50.00%	100.00%
		% within insecticide	28.60%	30.80%	29.60%
	-	Count	4	5	9
		% within microscopic analysis	44.40%	55.60%	100.00%
		% within insecticide	14.30%	19.20%	16.70%
Total		Count	28	26	54
		% within microscopic analysis	51.90%	48.10%	100.00%
		% within insecticide	100.00%	100.00%	100.00%

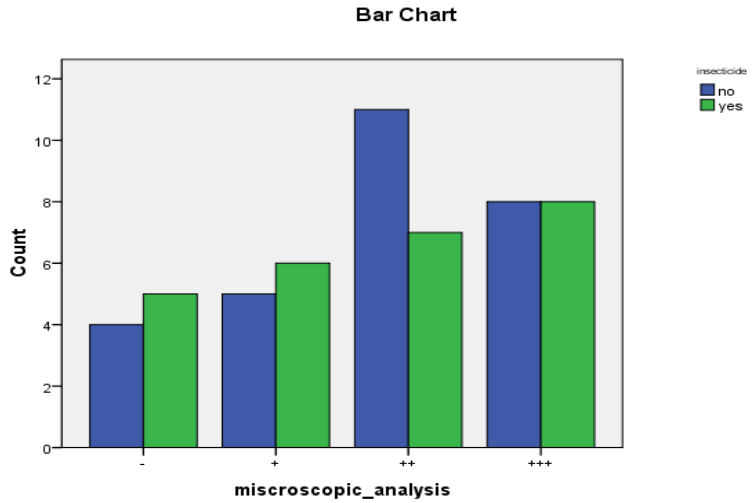

Figure 13 Bar chart showing the prevalence of malaria parasite among pregnant women screened for malaria using microscopic analysis of blood in relation to their usage of insecticides.

normal dosage to be taken to avoid toxicological side effects. It is also advisable that the Food and Drug agencies of Nigeria should encourage more research into local herbs in order to develop new and more effective drug for prevention and control of malaria especially in the tropics where malaria is endemic.

Women who denied the use of drugs as control measures against malaria had the highest prevalence rate of infection while women who attested to the use of drugs had the lowest prevalence rate. This result further proves the effectiveness of chemoprophylaxis. This finding is consistent with reports from Ibadan and other African countries which found intermittent preventive treatment to be protective against malaria in pregnancy [8,11]. It has been reported that use the of un-recommended malaria chemo prophylactic medication such as chloroquine did not significantly reduce malaria infection among patients warning against wrong use of drugs [12]. Although prescription of drugs has a lot to do with the early detection of malaria parasite in pregnancy, once detected, effective drug usage depending on the trimester stage should be prescribed and administered immediately and should be well monitored to avoid complications. The use of drugs has been proven over the years to help in combating malaria and anaemia in pregnant women.

Women who confirmed the use of insecticides as effective in combating malaria infection had a higher prevalence rate than women who denied the use of insecticides. This contradicts investigations of Micheal et al. who reported in their study that 32.8% of 400 pregnant women used insecticide sprays with 2.3% of this population having the lowest malaria infection [13]. They suggested insecticide sprays as effective control measures against malaria. The findings of this research work might be due to the mutant and resilient nature of mosquitoes and also to the nature of the insecticide. Most insecticides are no longer

as effective combating the new species of mosquitoes now prevalent in some parts of tropical Nigeria. It is suggestive and most preferable to use mosquito nets and probably effective insecticide creams which also serves as powerful agent in preventing mosquito bites. The use of insecticide spray is not a policy in Nigeria, but it is equally an effective malaria control strategy and if properly implemented, will impact positively on malaria control in Nigerian communities. As a recommendation it is advised that various uses of different classes of insecticides in conjunction with strict monitoring and public education should be strengthened in Nigeria.

Women in mosquito infested environments had the highest prevalence rate as compared the other prevailing environments. Mosquito infested environments pose a great deal of threat and risk to pregnant women. Women living in such environments stand 100% chances of contracting malaria parasite infections Environments such as stagnant pools, unkempt gutters, heaps of dirt, dirty and unused kitchens, keeping used water for long periods of time serve as factors promoting the breeding of different species of mosquitoes. This is consistent with the reports of Shr-jie et al. who in Ouagadougou, Burkina Faso found out that higher prevalence ratio of malaria occurred in areas where larvae breeding sites were semi-permanent [14]. Such sites include presence of dustbins, grasses, congesting, congestion, polluted gutter, stagnant waters and dirty surroundings covered with weeds in the rivers [15]. Therefore it is expedient to take good care of our environment and keep them well kept to avoid malaria parasite infection.

Conclusion

In conclusion, malaria in pregnant women is very threatening and could lead to high mortality rates. Therefore delivery of cost effective malaria prevention to pregnant women will require increased awareness of the problem among communities most affected with malaria. The use of insecticides, treated nets and drugs (chemoprophylaxis) may be beneficial to all women irrespective of their age or trimester stage during pregnancy. Also education and training programs in malaria prevention and early detection of malaria and treatment coupled with better health care delivery systems and enlightenment on the malaria transmission will be helpful [16].

It is also essential to avoid stagnant pools and poor environmental conditions which encourage the breeding and proliferation of mosquitoes. Much work needs to be done to educate the community and producer of herbs to strictly adhere to environmental hygiene since herbs are also effective in the prevention and cure of malaria.

Study Design Limitation

Based on our available procedures and constraint on Study Population at the center, the findings may not be translated to outcome of malaria parasitaemia associated with pregnant women of other Health Care Centers in the Country. However, the data obtained is of useful findings widely applicable as they will assist in control measures and effective therapeutic approach to malaria in pregnancy among women in all part of the world.

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Conflict of Interest

Authors have no conflict of interest.

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