Original Research Article

Prevalence of Malaria among Pregnant Women in Braithwaite Memorial Specialist Hospital, Port Harcourt and General Hospital, Bori by Haemoglobin Level

ABSTRACT

Comparative observational study was carried out on the prevalence of malaria among pregnant women attending antenatal clinics in General Hospital, Bori (GHB) and Braithwaite Memorial Specialist Hospital, Port Harcourt (BMSH). Four hundred women were involved in this study of which two hundred per study location. Pregnant women with pyrexia of unknown origin, HIV and those on anti malarial drugs were excluded. Consents were obtained from participants and confidentiality remained key. Ethical approval was obtained from the ministry of health and permission from the selected health facilities. Sample collection was performed according to the recommended reference guideline for phlebotomy. Collected samples were used to assay for Haemoglobin using cyanomethamoglobin method, and malaria parasite using the Giemsa staining technique. Statistical analysis was performed for percentage, frequency, for descriptive statistics and inferences deduced at p=0.05. All statistical analysis were performed using Statistical Package for Social Sciences. Questionnaires were issued to obtain their demographic data. The prevalence of malaria was high among pregnant women with haemoglobin level 8.0 – 10.9g/dl from BMSH (17.9%) and GHB (35.9%). Infection was not dependent on locality at $P < 0.05$. Awareness of malaria in pregnancy should be supported. Aniaemia in pregnancy should be treated and comorbidity of malaria and anaemia in pregnancy should be handled with urgency. Early detection is key.

Keywords: Prevalence, Malaria, Pregnancy, Haemoglobin

1.0 Introduction

Malaria is a serious health burden of developing nations, including Nigeria (Nwokocha, 2007). It is very simple to diagnose and treat, yet it claims more lives than any other infectious disease in the world (Narasimhan & Attaran, 2003). Malaria is a serious and devastating infection. It is the commonest cause of pyrexia in many parts of the tropics among various age groups.

Epidemiology of Malaria

Although pregnancy predisposes women to physiologic anaemia, malaria in pregnancy is believed to account for up to 25% of the severe maternal anemia cases, and could account for 10-20% of neonatal and infant deaths based on effects of low birth weight (Greenwood *et al.,* 2005).

The mortality of malaria is especially difficult to measure because most deaths occur at home, and the symptoms are non-specific (Guerin *et al.,* 2002).

Recent world malaria report indicates that Nigeria accounts for quarter of all malaria cases in the 45 malaria endemic countries in Africa thus showing the challenge malaria poses in Nigeria. This may also be due to the large population of the country as approximately 150 million people live in the areas of high malaria transmission and 1% of maternal deaths are attributed to malaria (Imeausen *et al.,* 2005). The Federal Ministry of Health had documented the association of malaria with 11.0% of all maternal death and 70.5% of morbidity in pregnant women in Nigeria.

Malaria in Pregnancy

In pregnancy, malaria infection is a major cause of morbidity and mortality in both the mother and her newborn baby. The situation is worse in first pregnancies as they are yet to develop immunity against *Plasmodium falciparum*, the major species that has been implicated. Uniquely, *P. falciparum* infested red cells sequestrate in the placenta, causing maternal anaemia and intrauterine growth retardation or even fetal demise.

Over 30 million women become pregnant in Africa annually, and are at great risk of malaria infection especially from *Plasmodium falciparum,* and this can prove fatal for both mother and foetus. Prevention of malaria in pregnancy is one of the main challenges of public health in Africa and also the priority for the Roll Back Malaria partnership. Effective management of malaria infections, use of Insecticide Treated Nets (ITNs) and, in areas of stable transmission, Intermittent Preventive Treatment (IPT) is the three major recommended approaches of the Roll Back Malaria programme.

Generally, malaria is an aggravating medical condition, with its associated pathological effects. So also is pregnancy, with its associated physiological changes. These pathological and physiological changes have synergistic effects on the progression of each other thereby worsening the conditions in pregnancy. This is more so in infection by *P. falciparum*.

In endemic regions of sub-Saharan Africa, malaria during pregnancy (MIP) is a major preventable cause of maternal and infant morbidity and mortality (Menendez *et al*., 2007). Malaria during pregnancy compounds or provokes anaemia, which, when severe, increases the risk of maternal death (estimated at around 10,000 deaths annually) (Guyatt & Snow, 2004). Low birth weight (linked to around 100,000 annual infant deaths in Africa) (Guyatt & Snow, 2004), pre-term delivery, congenital infection and reproductive loss are also linked to MIP (malaria in pregnancy) (Desai *et al*., 2007). Nonetheless, in spite of its associated high burden of morbidity and mortality, MIP was recognized as a neglected area of research (Greenwood *et al*., 2007).The effects of malaria infection on the mother may range from negligible to severe, depending on the level of immunity to malaria infection that the mother has acquired prior to pregnancy. This is because pregnancy reduces their immunity to malaria (Omosun *et al.,* 2009; Akanbi *et al.,* 2009). This makes them more prone to malaria infection, increasing the risk of illness, maternal anaemia, spontaneous abortion, pre-term labor, stillbirths, placental infection and maternal mortality from severe anemia (Curtis *et al.,* 2003). More worrying is that unborn children of pregnant mothers are also vulnerable to malaria. Pregnant women may be infected with malaria parasites despite the absence of obvious symptoms. These can have detrimental effects on the mother and foetus.

Invasion of Red Blood Cells and Anaemia in Pregnancy

There are ample evidence of parasites invasion of the red cells based on receptor, adhesion and intracellular signaling pathway mechanism (Chitnis, 2001). On binding, apical reorientation occurs (Dvorak *et al*., 1975 ; (Miller *et al*., 1997). (Aikawa *et al.,* 1978). Effective invasion is consequent to malaria parasiteamia (Adams, 1990). Erythrocyte invasion of malaria parasites results to destruction of red cell resulting to anemia. Anemia is known to cause serious complications such as cerebral malaria, hypoglycemia, metabolic acidosis, and also respiratory distress. (Chotivanich, 2000).

The biological basis of malaria in pregnancy is that the red cells that are infected with malaria parasite especially *P. falciparum* adhere to the chondroitin A in the placenta, thus accumulating therein (Rogerson *et al*., 2007). Furthermore, malaria parasite invades the placenta and causes changes that impede oxygen-nutrient transfer. This may lead to foetal anaemia, premature delivery, congenital infection, intra-uterine growth retardation, intra-uterine fetal death, low birth

weight and infant death (WHO, 2002). Severe parasitaemia is a public health concern due the consequent devastating effects.

Severe malaria occur when parasite invade and proliferate within the red blood cell. The parasite produces many variant antigenic proteins encoded by multigene families which are present on the surface of infected erythrocyte and play important roles in virulence. The high virulence of *P. falciparum* as against other malarial parasites is its possession of surface antigens which mediate binding of infected erythrocytes (rosetting) as well as the fact that infected erythrocytes expresses adhesive determinants termed *P. falciparum E*rythrocyte Membrane Protein-1 (PEMP-1). These surface antigens are rifins encoded by the RIF (Receptive Interspersed Family) genes. They are the largest variant (Chen *et al.*, 2000) Surface antigen family in *Plasmodium falciparum* with one hundred and fifty (150) genes present in the genome of the parasite. Their function is unknown but rifins are immunogenic and high levels of anti-rifin antibodies are associated with rapid parasite clearance and asymptomatic infection.

These mechanisms and the devastating effects of malaria in pregnancy have not been exhaustively been studied and understood therefore, an investigation in this direction is apt. However, this will require a knowledge on the distribution at interval to better understand the infection frequency and the impact of the prevention and control measures on a given population. The population of this study is well represented hence, this research. The study compared the prevalence of Malaria among pregnant women in General Hospital, Bori and Braithewaite Memorial Specialist Hospital, Port Harcourt based on the Haemoglobin level.

2.0 Materials and Methods

2.1 Study Area

The study area was limited to Port Harcourt metropolis and Bori Town in Port Harcourt and Khana local government areas of Rivers state, Nigeria. The selected study area is marked with industrial activities particularly oil and gas. Its population was 541, 115 and by 2015 it grew to 2million with an urban density of 14,800/km^2 (38,000/sq mi). It has a tropical wet climate with lengthy heavy rainy seasons and short dry seasons. Temperature throughout the year in the city is relatively constant showing little variation throughout the year. Average temperatures are

typically 25^0C – 28^0C in the city. Port Harcourt is one of Nigerias leading industrial centres (Janice, 2003).

2.2 Study Population

The observational study involved patients accessing healthcare at the antenatal clinics in Braithwaite Memorial Specialist Hospital, Port Harcourt (BMSH) and General Hospital, Bori (GHB) both in Rivers State. Only participants who met the inclusion criteria were recruited into the study otherwise excluded. A structured questionnaire was the study instrument used here to capture sociodemographics and questions related to malaria in pregnancy and more.

2.3 Sampling technique/Sample Size Determination

Simple random sampling technique was the method of choice for the study and participants had equal chances of being selected using a number system (Faith *et al.*, 2021; Catherine *et al.*, 2021). Sample sized was determined according to Araoye (2004) based on previous prevalence

2.4 Sample/Laboratory Analysis

Haemoglobin estimation and malaria blood films were performed according the convention technique (Cheesbrough, 2009). Film preparation was by smearing the blood on a clean grease free microscope glass slide and the use of Geimsa stain.

Haemoglobin estimation was done by dispensing 5mls of Drabkins solution into test tube and 0.20ml (20ul) of well mixed blood was added, mixed and allowed to stand at room temperature for 10 minutes to allow complete conversion to cyanomethamoglobin. The absorbance of the solution was read at 540nm using Drabkins solution as blank. The value of unknown was extrapolated from the chart prepared for the colorimeter (Cheesbrough, 2009).

2.5 Ethical Approval

Ethical approval was sought and obtained from the Ethics committee of Ministry of Health, Rivers State. The subjects were briefed on the objectives and procedure of the study and reassured of confidentiality, hence their consents were obtained. The investigations were carried out at no cost to the participants.

2.6 Statistical Analysis

Statistical Package for Social Sciences version 25 was the statistical tool used to estimate mean, standard deviation, frequency and percentage. Mean comparison was performed and deduction made at 0.05 level of significance.

3.0 Results

The study included a total of four hundred (400) pregnant women accessing antenatal care at Braithwaite Memorial Specialist Hospital (BMSH) and General Hospital Bori (GHB). The sample was distributed in equal proportion for both healthcare facilities used. Age distribution revealed mean age of 29±4.97 years and equal distribution of marital status was observed with 393 (98.3%) married and 7 (1.75%) single. Other socio-demographic information can be found on charts below.

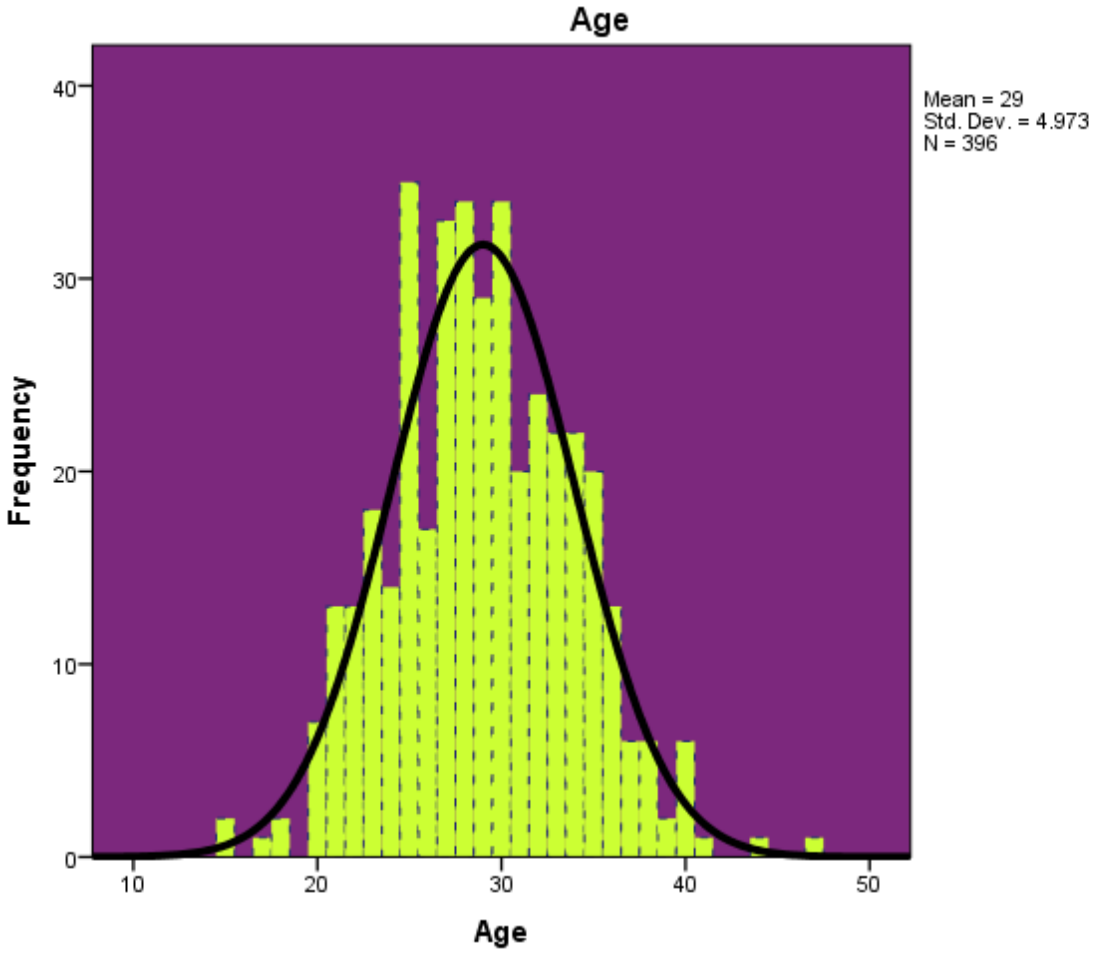

Figure 1: Histogram showing Age Distribution of Subjects

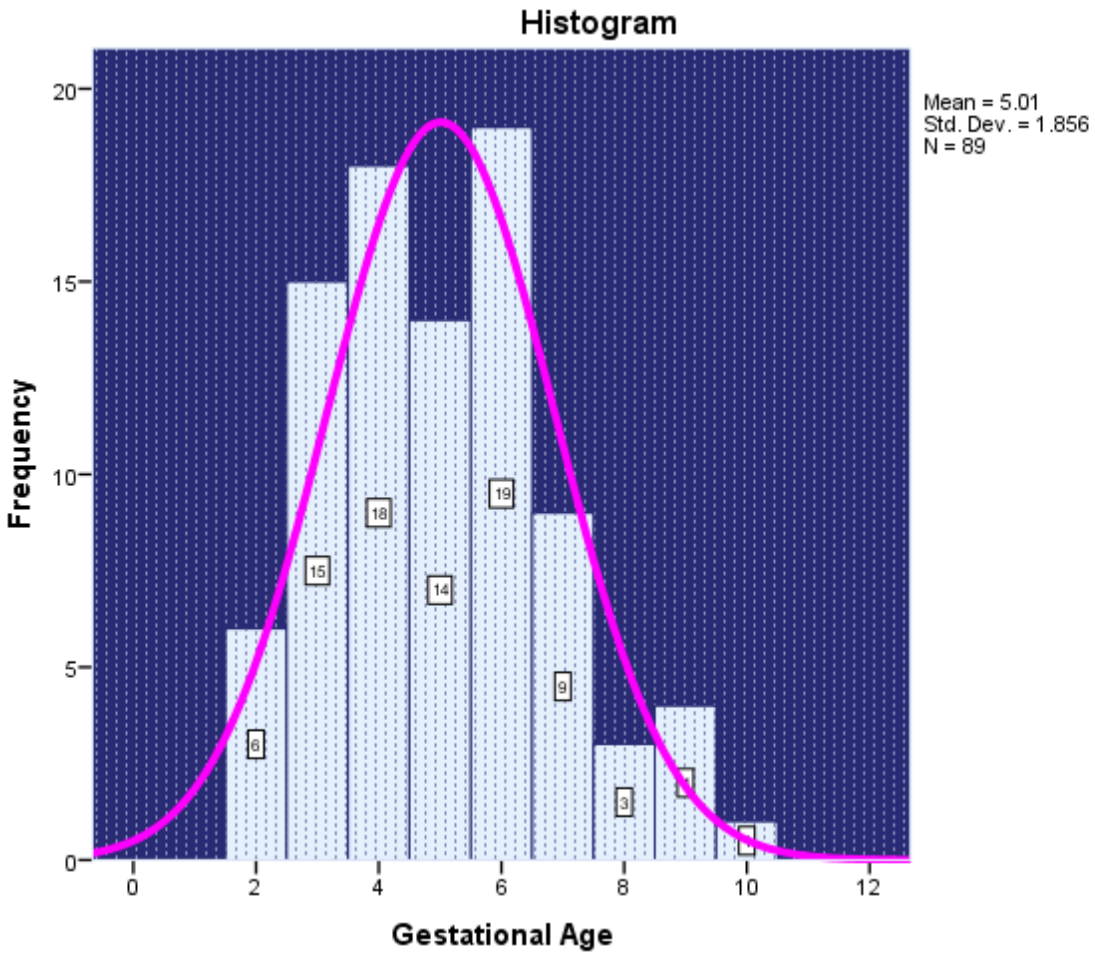

Figure 2: Histogram showing Gestational Age

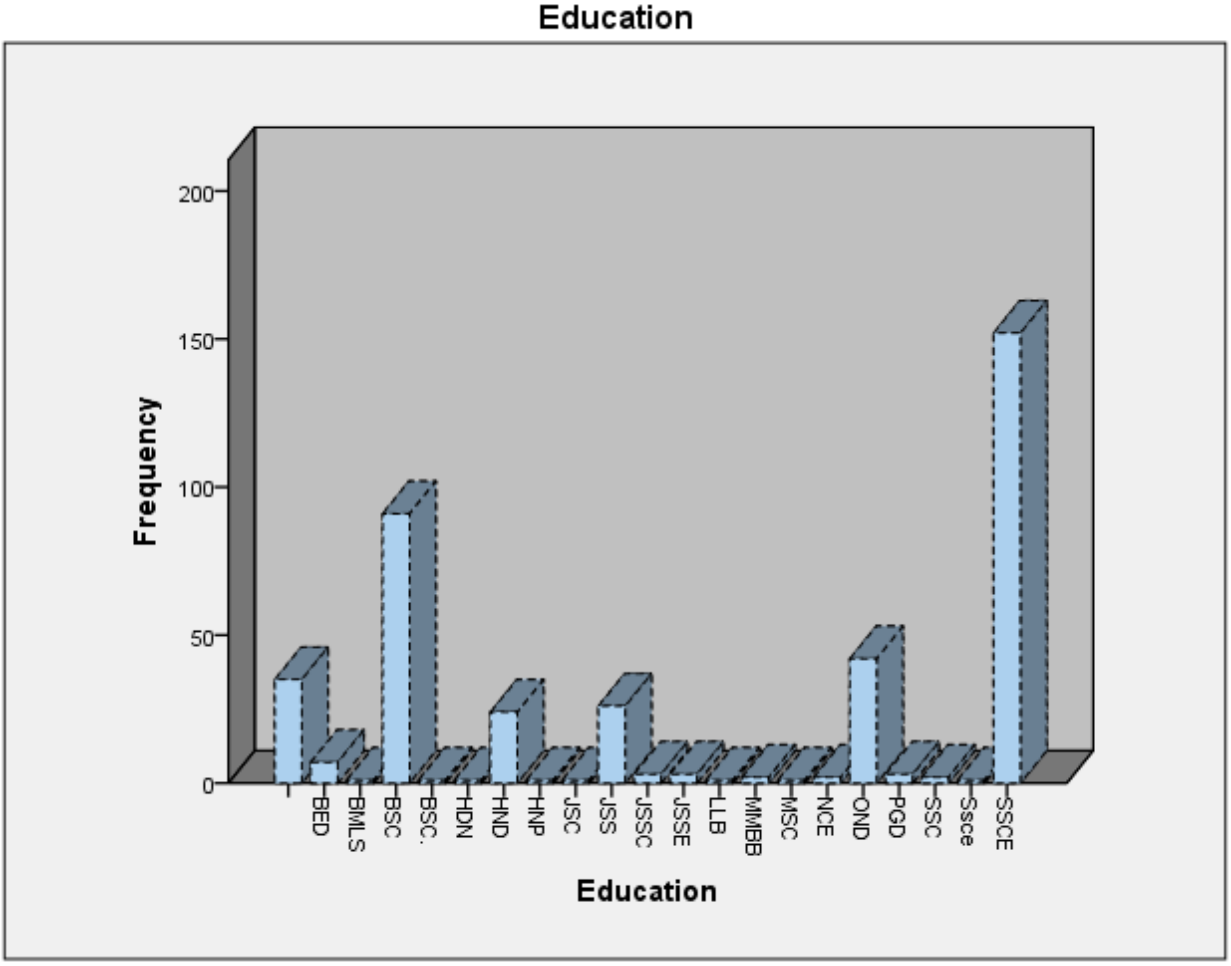

Figure 3: Bar Chart showing Level of Education

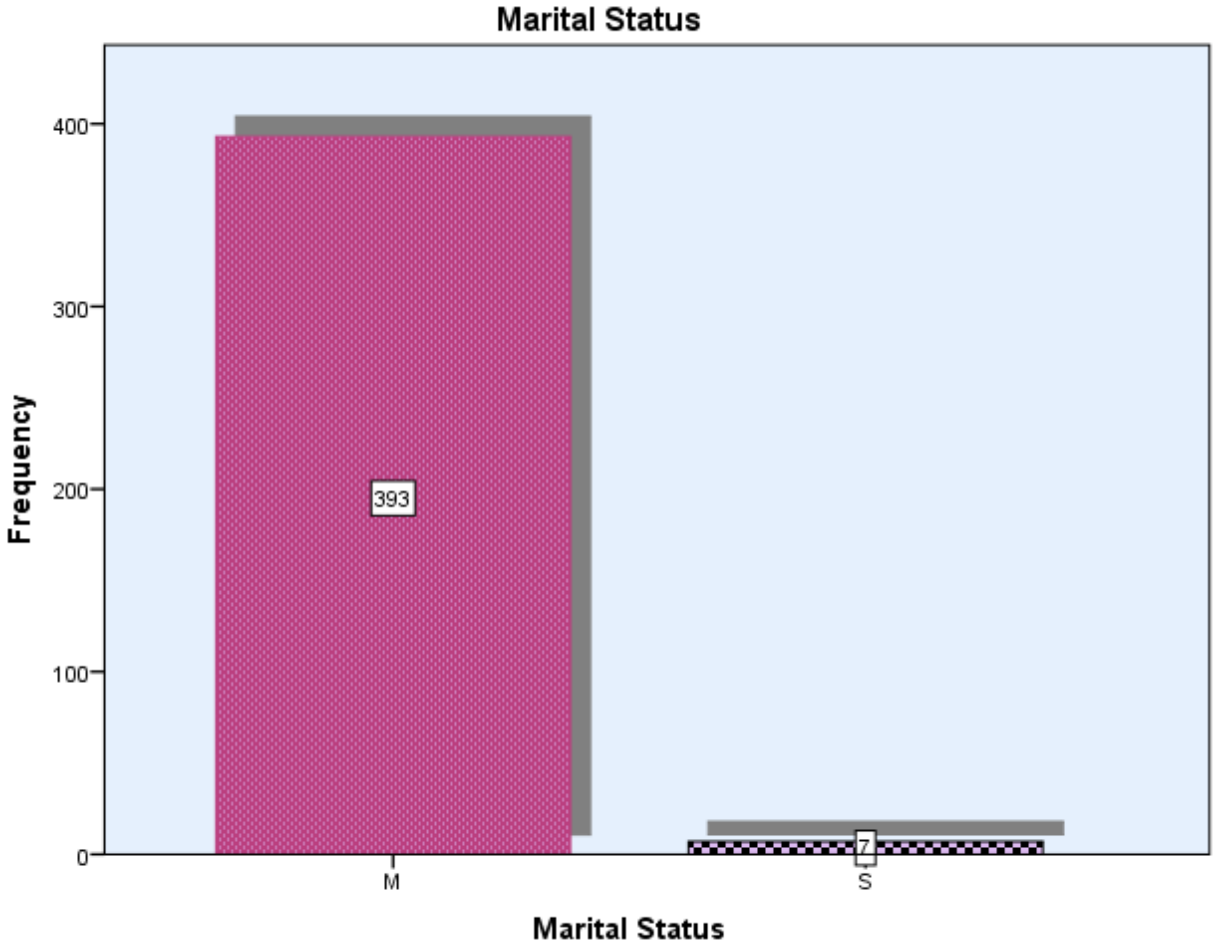

Figure 4: Bar Chart showing Marital Status of Subjects

Table 1.0: Overall Frequency Distribution of Malaria Parasite in the Sampled Population

Statistics	BMH	GHB
Number Tested	200	200
Number Negative	145	130
Number Positive	55	70
Prevalence	27.5%	35.0%

Table 2.0: Specific Frequency Distribution of Malaria Parasite among Pregnant Women in BMH by Haemoglobin Level

Haemoglobin Level (g/dl)	Number Tested	Number Negative	Number Positive
8.0 – 10.9	176	123 (69.9%)	53(30.1%)
11.0 – 13.9	24	22 (91.7%)	2(8.0%)
14.0 – 16.0	0	0 (0.0%)	0(0.0%)
Total	200 (100.0%)	145 (72.5%)	55(27.5%)

Table 3.0: Specific Frequency Distribution of Malaria Parasite among Pregnant Women in GHB by Haemoglobin Level

Haemoglobin Level (g/dl)	Number Tested	Number Negative	Number Positive
8.0 – 10.9	170	109 (64.1%)	61(35.9%)
11.0 – 13.9	30	21 (7.0%)	9(30%)
14.0 – 16.0	0	0 (0.0%)	0 (0.0%)

Table 4.0: Comparison of Malaria Parasit Distribution among Pregnant Women between BMSH and GHB

	BMSH		**GHB**	
Hb(g/dl)	Number Tested	Number Positive	Number Tested	Number Positive
8.0 – 10.9	176	53(30.1%)	170	61(35.9%)
11.0 – 13.9	24	2(8.0%)	30	9(30%)
14.0 – 16.0	0	0 (0.0%)	0	0 (0.0%)

p-value = 0.0001. P<0.05=Significant; p>0.05=Not Significant

The prevalence of malaria parasite by haemoglobin concentration (g/dl) among pregnant women from Braithwaite Memorial Specialist Hospital showed that women with haemoglobin levels 8.0-10.9g/dl (30.1%) had the highest prevalence followed by pregnant women with haemoglobin levels 11.0-13.9g/dl (8.0%). The prevalence was also high among pregnant women with haemoglobin levels 8.0-10.9g/dl (35.9%) from General Hospital Bori. There was significant statistical difference at $P < 0.0001$.

4.0 Discussion

From this study, a total number of 400 subjects participated in the study. 200 of them were sourced from BMSH while the other 200 were sourced from GHB. According to the resulted presented in Table 1.0, 55 subjects tested positive for malaria while 145 participants tested negative. This accounts for the 27.5% prevalence of malaria in BMH. In GHB, of the 200 subjects who participated, 70 subjects tested positive to malaria and 130 tested negative to malaria which accounted for the 35.0% prevalence of malaria in GHB.

The prevalence of malaria infection among individuals with haemoglobin at 8.0-10.9g/dl showed significant statistical difference from both hospitals at P< 0.0001. GHB had a prevalence of 35.9% and BMSH had a prevalence of (30.1%). Malaria is thought to cause anaemia through a number of different mechanisms including, haemolysis of parasitized red cells, immune and non-immune haemolysis of non-infected cells, increased spleenic clearance and reduced red cell survival (Maltech *et al.*, 1994) other factors like nutrition and non-nutrition (helminthiasis and bacterial infection) can cause anaemia in malaria endemic areas (White, 1998). The result agrees with the findings by Amadi *et al.* (2002) in Abuja who showed that the prevalence of malaria is higher in anaemic pregnant women than in non-anaemic pregnant women. This could be as a result of immune depression to anaemia.

The haemoglobin level of women from Braithwaite Memorial Specialist Hospital, Port Harcourt was low compared to those of General Hospital, Bori. By implication, pregnant women in the urban had more cases of anaemia than pregnant women in the sub-urban area. This could be attributed to their eating habits and lifestyle. Since most women in the sub-urban are mainly farmers, they feed more on fresh vegetables and farm produces which are rich in essential vitamins and iron needed for blood production. However, although BMSH pregnant women had lower Hb level, they had lower malaria prevalence than pregnant women in GHB. The women from Braithwaite Memorial Specialist Hospital, Port Harcourt are mostly educated and career women who understand the need for antenal care and compliance with health instructions, therefore the significant low prevalence in malaria may be due to these characteristics. This changes in health awareness and compliance among women in urban and sub-urban women was reported in studies in Rivers state, buttressing that women in the urban area would readily approach healthcare facilities in pregnancy and post pregnancy than when in the sub-urban area

and this could be a vital factor to consider in the general wellbeing of mother and child because environmental characteristics either good or bad have impact on human health. (Catherine *et al.*, 2021; Biambo *et al.*, 2021). Therefore, the

Conclusion

In this study, malaria was more prevalent in Bori than in BMSH. Pregnant women with haemoglobin levels 8.0 - 10.9g/dl had the highest prevalence of malaria and pregnant women. From this study, there is an indication of interplay between prevalence of malaria among pregnant women and Haemoglobin level. However, a more robust study to this effect is needed

Recommendations

This study showed that malaria was more prevalent in GHB than in BMSH. The study emphasized that malaria among pregnant women was not dependent on locality but on exposure as no indication of evidence exists between both hospitals

Based on the information obtained from the outcome of this study, there is need to follow the government initiatives such as the Roll Back Malaria (RBM) which aimed at significantly reduction malaria mortality. Increased awareness, governmental and non governmental supports are recommended. Moreover, early detection through testing and treatment remains paramount not neglecting haemoglobin estimation routinely in addition to appropriate feeding and nutrition diets rich in vegetables and fruits.

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