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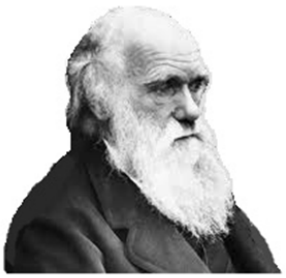

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Malaria, hepatitis B and their co-infection among pregnant women visiting maternity centers in Akure, Nigeria

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ABSTRACT

The state of pregnancy is considered a high-risk factor for acquisition of malaria and hepatitis B infections due to hormonal changes that occur during pregnancy. The research was aimed at determining the prevalence of malaria, hepatitis B and their co-infection among pregnant women visiting maternity centers in Akure South Local Government. Five hundred pregnant women were examined from Comprehensive Health Centre, Arakale and Mother and Child Hospital, Oke- Aro for malaria and hepatitis B. Thick and thin blood smears were prepared to detect the presence of malaria parasites, hepatitis B virus kit was used to detect hepatitis B virus antigen. The results showed that 65.6% of the pregnant women were infected with malaria parasites, while 3.8% were infected with hepatitis B virus. It was further observed that 2.2% pregnant women who had malaria also had Hepatitis B. Malaria was more prevalent among the age group 21-25years (68.1%), and women in their third trimester (66.7%), while hepatitis B virus was more prevalent among age group 41-45years (14.3%) and women in their second trimester (4.6%). The study therefore revealed high prevalence of malaria and low prevalence of Hepatitis B infections among pregnant women in this study area. Therefore, prompt diagnosis and treatment of the two infections among pregnant women should be intensified to prevent maternal and neonate mortality.

***Keywords*:** Co-infection, Prevalence, Malaria, Hepatitis B, Pregnancy, *Plasmodium falciparum*

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1. INTRODUCTION

Pregnant women are at risk to complications of malaria infection than non-gravid women. During pregnancy, these women experience a considerable decline in their levels of immunity to malaria [1]. Majorly, *Plasmodium falciparum* results in most Malaria-associated maternal illness and low birth weight and this is predominant in Africa [2]. *P. falciparum* expresses proteins on the surface of parasite-infected erythrocytes (IE) helping them bind to an unusually low-sulfated form of chondroitin sulfate A (CSA) in the placental intervillous space [3]. By this process, the parasite avoids being filtered through the spleen where it would be cleared from the bloodstream and killed [4]. It thereby interferes with transmission of vital substances through the fetal placenta [5], often resulting in birth complications [5]. Malaria during pregnancy is a major cause of morbidity among pregnant women worldwide and leads to poor birth outcomes. Malaria accounts for 30% of childhood mortality and 11% of maternal deaths in Nigeria [6].

Hepatitis B is an infectious disease caused by Hepatitis B Virus (HBV). It can lead to both acute and chronic infections [7]. Annually, HBV related disease results in about 1.2 million deaths making HBV infection the 10^{th} leading cause of death globally [8, 9] and majority of the carriers got the infection during perinatal period or early childhood [10].

HBV is prevalent and widespread in Nigeria and about 75% of the total population is exposed to it and virus is transmitted by exposure to infectious blood and body fluids; infection at the period of child birth or from contact with other people's blood during childhood is the most frequent way by which hepatitis B is transmitted especially in area where the disease is common [7].

Hepatitis B Virus (HBV) infection in pregnancy has a few curious views among which are the impact of pregnancy on HBV infection, the potential viral transmission from mother to infant, it's possible prevention through antiviral drugs, and the potential teratogenic (relating to substances that can interfere with normal embryonic development) impact of these medications. Pregnant women are one of the susceptible groups and there is high risk of transmitting infection to the new-born if mother is infectious, hepatitis B virus acquired by the fetus and neonates from mother during pregnancy or childbirth leads to impaired mental ability and physical development in later life of the children [11].

Therefore, the research aimed to determine the prevalence of single infections of malaria, hepatitis B and patterns of co-infection among pregnant women visiting maternity centers in Akure South Local Government, also to determine the effects of different demographics factors on susceptibility of the pregnant women to the infections.

2. MATERIALS AND METHODS

2. 1. Study Area

The study was conducted in Mother and Child Hospital, Oke Aro (7°14'25.9"N 5°11'01.2"E) and Comprehensive Health Centre, Arakale (7°15'05.3"N 5°11'36.6"E) in Akure South Local Government Area of Ondo State, Southwest Nigeria. The two study centers (Mother and Child Hospital and Comprehensive Health Centers) serve as the focal centers for pregnant women in the study area.

2. 2. Sample size and collection

A total number of five hundred (500) pregnant women were examined for the presence of malaria parasites and hepatitis B virus. 241 pregnant women were examined in Comprehensive Health Centre, Arakale, while 259 were examined in Mother and Child Hospital, Oke Aro.

2. 3. Blood sample analyses

Thin and thick blood films obtained through venipuncture were prepared on a clean glass slide for the detection of malaria parasites. After the thin smear has been allowed to air dry, it was fixed with 99.9% methanol and stained with Giemsa. The thick blood smear was stained with Giemsa after it has been allowed to air dry, it was left for fifteen minutes and the stain was rapidly flooded off with water. The smears were examined under ×10 and ×100 objective lens of the light microscope. The Hepatitis B infection was analyzed using the HBV surface antigen Rapid Diagnostics Test kit (Chemtron test kit, China) following a standard procedure of [12]. A single purple line indicated a negative reaction and two purple lines indicated a positive reaction.

2. 4. Data collection and analysis

The Pregnant women were interviewed through a well-structured questionnaire, the structured questionnaire was designed to collect demographic information such as age, blood group, trimester period, number of previous pregnancies and use of insecticide treated net. The data was analyzed using SPSS 26.0. Comparisons of prevalence by subject age, parity, trimester period and blood group were done using Pearson Chi square test. *P*-value less than 0.05 was considered statistically significant.

3. RESULTS

Table 1 showed that out of 241 pregnant women examined in CHC, 169 (70.1%) were positive for malaria, 9(3.7%) were positive for Hepatitis B while out of 259 women in Mother and Child Hospital, 159(61.4%) were positive for malaria and 10(3.9%) were positive for Hepatitis. Generally, a total number of 328 pregnant women were observed to be positive for malaria, given a total prevalence of 65.6% and a total number of 19 women were positive for Hepatitis B with a prevalence of 3.8%. 11(2.2%) of the pregnant women were co-infected with malaria and Hepatitis B.

The distribution of the infections and co-infection in relation to different age groups were presented in Table 2. It was observed that pregnant women within the age group 21-25 were the most prevalent (68.1%) for malaria, while hepatitis B was more prevalent (14.3%) among women within age group 41-45. Co-infection of Malaria with Hepatitis B was observed to be highest (3.9%) among pregnant women within the age group 26-30.

Table 3 presents the distribution of Malaria, Hepatitis B and their co-infection among the pregnant women at different trimester periods. The highest prevalence of Malaria (66.7%) was observed among the pregnant women in their third trimester period, the prevalence of hepatitis B was observed to be highest (4.6%) among pregnant women in their second trimester.

Co-infection of the two diseases was observed to be highest (2.5%) among women in their second trimester.

Table 1. Prevalence of Malaria, Hepatitis B and their Co-infection among the Pregnant Women.

Location	Number Examined	Number Infected		
		Malaria n (%)	Hepatitis B n (%)	Malaria and Hepatitis B n (%)
CHC	241	169(70.1)	9(3.7)	6(2.5)
MCH	259	159(61.4)	10(3.9)	5(1.9)
Total	500	328(65.6)	19(3.8)	11(2.2)

$\chi^2 = 4.220$ df = 1, P-value 0.04, CHC: Comprehensive Health Centre, MCH: Mother and Child Hospital

Table 2. Prevalence of Malaria, Hepatitis B and their co-infections among Age Groups

Age Group	Number Examined (n)	Number Infected		
		Malaria n (%)	Hepatitis B n (%)	Malaria and Hepatitis B n (%)
16 -20	25	12(48.0)	0(0)	0(0.0)
21-25	116	79(68.1)	3(2.6)	2(1.7)
26-30	152	102(67.1)	9(5.9)	6(3.9)
31-35	142	93(65.5)	4(2.8)	1(0.7)
36-40	58	38 (65.5)	2(3.4)	2(3.7)
41-45	7	4(57.1)	1(14.3)	0(0.0)
Total	500	328(65.6)	19(3.8)	11(2.6)
P value		0.53	0.29	

Parity refers to the number of times a female has been pregnant and carried the pregnancies to a viable gestational age. Table 4 presented the prevalence of malaria, typhoid fever and hepatitis B virus among the pregnant women in relation to parity. Women who were pregnant for the first time were classified as primigravidae while women with one or more previous pregnancies or children were classified as multigravidae. The result of the prevalence

of the infections in relation to parity was presented in Table 4. It shows that malaria was more prevalent (72.2%) among the Primigravidae. Highest prevalence (4.2%) of Hepatitis B was recorded among the Multigravidae, multigravidae was observed to have the highest (2.2%) co-infection rate.

Table 3. Prevalence of Malaria, Hepatitis B and their Co-infection across Different Trimester Periods

Trimester Period	Number Examined (n)	Number Infected		
		Malaria n (%)	Hepatitis B n (%)	Malaria and Hepatitis B n (%)
1st	71	46(64.8)	1(1.4)	1(1.4)
2nd	282	184 (65.2)	13(4.6)	7(2.5)
3rd	147	98 (66.7)	5(3.4)	3(2.0)
Total	500	328(65.6	19(3.8)	19(3.8)

Table 4. Prevalence of Malaria, Hepatitis B and their Co-infection in relation to Parity

Parity	Number Examined (n)	Number Infected		
		Malaria n (%)	Hepatitis B n (%)	Malaria and Hepatitis B n (%)
Primigravidae	144	104(72.2)	4(2.8)	3(2.1)
Multigravidae	356	224(62.9)	15(4.2)	8(2.2)
Total	500	328(65.9)	19(3.8)	11(2.2)

The distribution of the infections across the different blood groups of the pregnant women was presented in Table 5. The highest prevalence (100%) of malaria was observed among pregnant women with blood group A (negative rhesus), while Hepatitis B was highest (14.3%) among AB (positive Rhesus). Co-infection rate (2.2%) was the same among pregnant women with the B (Positive rhesus factor) and O (positive rhesus factor).

The answer given by the pregnant women in response to the question about the use of Insecticide Treated Net was classified into Yes or No. Women who sleeps under Insecticide Treated Net answered “Yes” while women who do not answered “No”. Table 6 showed that there was higher prevalence of malaria (66.4%) among pregnant women who sleeps under Insecticide Treated Net compared to women who don’t sleep (65.0%). Chi-square analysis of

the data showed that there was no significant difference in the prevalence of malaria in relation to the use of Insecticide Treated Net.

Table 5. Prevalence of Malaria, Hepatitis B and their Co-infections across Different Blood Groups

Blood group	Number Examined (n)	Number Infected		
		Malaria n (%)	Hepatitis B n (%)	Malaria and Hepatitis B n (%)
A-ve	8	8(100)	0(0)	0(0)
A+ve	106	65 (61.3)	6(5.7)	2(1.9)
AB+ve	7	2(28.6)	1(14.3)	0(0.0)
B-ve	5	4(80.0)	0(0)	0(0)
B+ve	82	54(65.9)	5(6.1)	2(2.4)
O-ve	5	4(80.0)	0(0)	0(0)
O+ve	287	191(66.6)	7(2.4)	7(2.4)
Total	500	328(65.6)	19(3.8)	11(2.2)

Table 6. Prevalence of Single-Infection of Malaria in Relation to the Use of Insecticide Treated Net

Use of Insecticide Treated Net	Number Examined	Number Infected	Prevalence (%)	χ^2	Df	P-value
Yes	217	144	66.4	0.10	1	0.75
No	283	184	65.0			
Total	500	328	65.6			

4. DISCUSSION

This report further confirms the susceptibility of pregnant women to the three infections under study, this susceptibility has been previously attributed to immune-suppression induced by pregnancy [13]. The findings of [14] who recorded a prevalence of 65.8% among pregnant women in Lagos State conforms with the general prevalence of 65.6% recorded in this study.

Also, the work of [15, 16] who reported a prevalence 78.9% and 72.7% in Benin City and Akwa-Ibom respectively agree with this finding. The high prevalence of malaria recorded might also be due to the fact that pregnant women who were screened for malaria during this study were women visiting the ante-natal clinic for the first time, they have not been previously exposed to intermittent preventive treatment, the administration of a full treatment course of an effective anti-malaria, given at regular ante-natal visits which is usually a month apart.

Also, a total of 3.8% hepatitis B virus which can be considered as low prevalence recorded among the pregnant women in this study area concurs with the findings of [17, 18] who observed a prevalence of 2.8% and 2.19% in Port Harcourt and Benin city respectively. However [19] reported that when hepatitis B virus seroprevalence is greater than 7% in an adult population in a given location, the location thereby should be classified as highly endemic for HBV infection. The low prevalence of hepatitis B recorded is contrary to high endemicity of 12.3% and 13.3% recorded in Niger State [20] and Zaria, Kaduna State [21]. Previous study by [22] suggested that differences in hepatitis B virus prevalence rate follow a course of low prevalence from the southern parts of Nigeria increasing to a higher prevalence in the Northern parts of Nigeria. The report of [23] elucidated that the differences can be attributed to socio demographic factors in the southern parts, such as higher economic status, higher educational level, higher level of health education on preventive practices, effective use of health care facilities and early seeking of health care assistance in the southern region. Risk factors such as early marriage and high risk of sexual behaviour which is higher in the northern parts may also be part of the contributing factors to the increased prevalence. The study further revealed the co-infection rate of malaria and hepatitis B among the pregnant women to be 2.2%, the result of [24] who recorded a malaria-hepatitis B co-infection rate of 1% agrees with this finding.

Statistically, no significant difference was recorded among different age groups of the pregnant women, nevertheless highest prevalence (68.1%) of malaria was recorded among pregnant women within age group 21-25years, this can be attributed to the fact that pregnant women in this age group might be getting pregnant for the first time, as higher prevalence was also recorded among the primigravidae. Beck *et al.* [25] noted that with successive pregnancies, pregnant women develop an efficient mechanism against infections, primigravidae are therefor more susceptible to malaria as compared to multigravidae. The factors responsible for susceptibility of primigravidae was identified by [27] to be inhibition of type 1 cytokine responses (interferon, interleukin 2 and 12 and TNF). In contrast, Hepatitis B was more prevalent among older pregnant women within age group 41-45years and the multigravidae. The increased prevalence of Hepatitis B among the older women and multigravidae might be due to their increased exposure to risk factors such as blood transfusion, multiple sexual partners, exposure to intravenous drugs and surgical procedures.

The result indicated that malaria infection was highest (66.7%) among women in their third trimester. The findings of Idowu *et al.* [28] who reported the highest prevalence (47.5%) of malaria among pregnant women in their third trimester in Abeokuta agrees with this. However, this result is in contrast to the report of Udoidung and Eyoh [16] who recorded highest prevalence 87.87% among women in their first trimester in Uyo. Pregnant women in their second trimester had the highest prevalence of Hepatitis B virus followed by the third trimester, this is similar to the findings of [23] who recorded highest prevalence 10.3% among pregnant women in their second trimester.

It was observed that malaria was more prevalent among pregnant women who has blood group with a no rhesus factor, this might suggest that absence of rhesus factor increases

the susceptibility of pregnant women to malaria infections. Consequently, malaria was observed to be more prevalent among pregnant women who use insecticide treated. Although there was no significant difference among pregnant women that use Insecticide Treated Net and women that do not, nevertheless, the result showed that this intervention which was aimed at lowering malaria cases among pregnant women have not achieved the desired result and the possible reasons for this might be due to inappropriate use of Insecticide Treated Net and the possibility of the pregnant women staying outdoor for longer periods especially at night, where they are already exposed to mosquito bites before getting indoors. This further suggests that outdoor control of mosquitoes for pregnant women should be emphasized and Integrated Pest Management mechanism must be emphasized.

5. CONCLUSIONS

This study has revealed that pregnant women are still very much at risk of malaria and hepatitis B and that the two infections can co-infect a pregnant woman. The prevalence recorded for hepatitis B implies that the area under study and study group showed a low endemicity for the infection, nevertheless the severity of this disease and the possibility of its vertical transmission to neonates implies that the prevalence recorded cannot be overlooked. Furthermore, demographic factors such as gravidity, trimester period, blood group and age all influenced and contributed to the high prevalence of these diseases among the pregnant women.

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