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PREVALENCE OF ANAEMIA ASSOCIATED WITH ASYMPTOMATIC MALARIA INFECTION AMONG PREGNANT WOMEN IN LADOKE AKINTOLA UNIVERSITY OF TECHNOLOGY TEACHING HOSPITAL, OGBOMOSO, SOUTHWEST, NIGERIA

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ABSTRACT

Anaemia during pregnancy is a well-known medical condition most of the time under-recognized as it is overshadowed by the normal physiological condition during pregnancy. This study aimed at determining the prevalence of anaemia due to asymptomatic plasmodium parasitaemia among pregnant women attending antenatal clinic at Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso, Oyo State. Structured questionnaire that contained information pertaining to pregnant women was administered to each subject. Two hundred and forty (240) blood samples of pregnant women were collected and processed accordingly. Haemoglobin and packed cell volume (PCV) was done to determine the anaemic status of pregnant women while thin and thick blood films stained with 10% Giemsa was used for diagnosis of malaria parasite. Parasite density was estimated based on the World Health Organisation approved method. The overall prevalence of malaria and anaemia was 29.2% and 52.9% respectively. The mean haemoglobin level and mean packed cell volume of pregnant women with asymptomatic malaria parasite (10.25g/dl, 37.78%) respectively was lower than those without asymptomatic malaria parasite (11.37g/dl, 38.69%) respectively and the differences were statistically significant ($p < 0.05$). The prevalence of anaemia among pregnant women who were positive to malaria infection was 34.7% while that of subjects without malaria infection was 65.3%. There was no statistically significant difference in the prevalence of anaemia and asymptomatic malaria parasite among pregnant women ($p > 0.05$). The findings from this study show that malaria and anaemia are still prevalent among pregnant women. Thus, the practice of routine screening for malaria and anaemia followed by prompt management should be

encouraged to curb the effect of malaria and anaemia on the pregnant women as well as her foetus.

KEY WORDS: *prevalence, anaemia, pregnancy, asymptomatic, malaria*

INTRODUCTION

Anaemia is the most prevalent nutritional deficiency worldwide and over 90% of affected individuals live in developing countries (W.H.O., 2008a). It is estimated to affect 1.3 to 2.2 billion persons (W.H.O., 2008b). Anaemia is a clinical condition characterized by a reduction in haemoglobin (Hb) concentration of blood below a specified cut-off value for a particular age range and for the sex of the individual (WHO, 2008b). The World Health Organization (WHO) defines anaemia in man as Hb<13 g/dL, woman with Hb<12 g/dL, children 6 month to 6 years with Hb<11 g/ dL and those aged 6-14 years with Hb<12 g/dL (WHO, 2008b).

The main function of red cells is to carry haemoglobin-bound oxygen to tissues and return carbon dioxide from tissues to the lungs. Symptoms of anaemia are usually shortness of breath, weakness, lethargy, palpitations and headaches. Anaemia causes decreased physical activity, fitness and work capacity (Haas and Brownlie, 2001). The severity of symptoms depends on the degree of anaemia and the rate of its development (Hoffbrand and Petitit, 1993). Anaemia in developing countries may be caused by deficiencies in iron, folate, vitamins A and B12, infections such as malaria, HIV infection and tuberculosis and inherited red cell disorders (Fleming, 1994). Iron is an essential micronutrient that contributes to the production of haemoglobin, the transport of electrons in cells and the synthesis of a range of enzymes. When iron deficiency is sufficiently severe, red blood cell synthesis becomes impaired and anaemia results. Adverse consequences are most common and severe in women of reproduction age and young children (WHO, 2008a). Globally, the most common cause of anaemia is believed to be iron deficiency due to inadequate dietary iron intake, physiologic demands of pregnancy and rapid growth and iron losses due to parasitic infection (Ahmed *et. al.*, 2008).

Malaria is one of the aetiological factors responsible for the high incidence of anaemia during pregnancy in Sub-Saharan Africa (Ogbu *et. al.*, 2015). Both malaria and anaemia are among the highest contributors to the persistently high maternal and perinatal morbidity and mortality in West African sub region (Panti *et. al.*, 2012). Six million women are at risk of malaria during pregnancy every year (Okpere *et. al.*, 2010). Women are more susceptible to *Plasmodium falciparum* infection during pregnancy and experience a higher frequency and density of parasitaemia than non-pregnant women (Panti *et. al.*, 2012).

In Sub-Saharan Africa and other regions of high malaria transmission, most Plasmodium infections are asymptomatic (Falade *et. al.*, 2008). Malaria can cause adverse pregnancy outcomes for both mother and baby, even without symptoms (Falade *et. al.*, 2008). Several studies carried out in different countries in the sub region have implicated asymptomatic *Plasmodium falciparum* parasitaemia as a major cause of anaemia in pregnancy, especially among the primigravidae and secondigravidae (Ogbu *et. al.*, 2015; Falade *et. al.*, 2008). Asymptomatic Plasmodium parasitaemia is the commonest mode of presentation of malaria during pregnancy in Nigeria (Falade *et. al.*, 2008). This is also what obtains in other regions where malaria is endemic (Campos *et. al.*, 2012). There were a lot of research on the association of anaemia and malaria during pregnancy in Nigeria, but there is paucity of knowledge as regards it especially in asymptomatic plasmodium parasitized pregnant women in Ogbomoso metropolis. Therefore, this study was aimed at determining the prevalence of anaemia due to asymptomatic plasmodium parasitaemia among pregnant women attending antenatal clinic in the study area and the association of asymptomatic malaria infections in respect to anaemia among pregnant women.

MATERIALS AND METHODS

STUDY DESIGN. This study was a cross-sectional study carried out among apparently healthy pregnant women attending antenatal clinic in the Department of Obstetrics and Gyneacology at Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso, Oyo State. Since cross-sectional studies are good for determining disease burden; it will help in determining the current prevalence of anaemia. The teaching hospital was located in Ogbomoso North local Government area of Oyo state. It is located in the rain forest zone between latitude $8^{o}92^{i}$ and $8^{o}94^{i}$ East and longitude $4^{o}15^{i}$ and $4^{o}52^{i}$ north (National Population Commission, 2006). The said local government area has the estimated population of 210,547 according to 2006 population census. The local government area has a tropical climate with temperature ranging from 25 ℃ to 32 ℃ and is located in rain forest area with distinct rainy and dry season. The predominant religions are Christian and Islam. The indigenes of the local government area are well known for trading and subsistent farming**.**

STUDY POPULATION. Two hundred and forty (240) blood samples of pregnant women attending antenatal clinic at Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso were collected and processed accordingly. The sample size was calculated based on the prevalence of anaemia in pregnant women from the previous studied in Nigeria using the Cochran formula (Chanunn *et. al.*, 2021). Structural

questionnaires that contained information pertaining to pregnant women such as age, parity, gestational age and malaria treatment prior to the visit were administered to each subject. Pregnant women without sign of malaria fever and those who have not been taking any antimalarial drug in the preceding two weeks were included while the subjects with sign of malaria fever and those who have been taking any antimalarial drug in the preceding two weeks were excluded from the study.

SAMPLE COLLECTION. Five millimeter (5ml) of venous blood samples were collected from each pregnant woman using sterile syringes and needles and transferred into anticoagulant bottle containing ethylenediaminetetraacetic acid (EDTA) and it was mixed gently by rotation. The sample bottles were labeled serially. The samples were transported to Medical Microbiology and Haematology laboratories unit of the College of Health Science, Ogbomoso and Osun State University Teaching Hospical, Osogbo for processing.

SAMPLE ANALYSIS. Haemoglobin (Hb) and Packed Cell Volume (PCV) were done to determine the anaemic status of pregnant women for the study. Full blood counts were done to estimate the haemoglobin concentration of the blood samples using the Sysmex XP-300 automated haematology analyser. Packed Cell Volume (PCV) was estimated using the microhaematocrit centrifugation (Chessbrough, 2002). The blood samples were screened for malaria parasites microscopically. Thin and thick blood films were prepared from each of the blood samples and stained with 10% Giemsa stain (Chessbrough, 2002). The slides were read under oil immersion with a 100x objective magnification. Identification of species was done using the thin blood smear. Parasite enumeration (parasite density) was done using the World Health Organisation approved method (W.H.O, 2012). The parasite density was estimated on thick blood smears by counting malaria parasites against 200 or 500 white blood cells (WBC) depending on the number of parasites present (W.H.O, 2012).

DATA ANALYSIS. Data obtained was analyzed using statistical package for social sciences (SPSS) for windows version 20 software and was presented using tables. P-value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSIONS

Table 1 shows the socio-demographic characteristics of the pregnant women under study. A total of two hundred and forty (240) blood samples were collected and examined appropriately. The mean age of pregnant women tested was 28.8 ± 0.28 years, with majority of them (57.5%) falling on age bracket 19 – 34 years while the least (2.5%) are on age bracket >50 years. The mean haemoglobin and packed cell volume (P CV) of

pregnant women with standard deviation were 10.81 ± 0.05, 33.14 ± 0.02 respectively. Malaria parasite had the prevalence rate of 29.2%. Educationally, 67.5% had secondary education, 26.7% had tertiary education, while 5.8% had primary education.

TABLE 1. Demographic characteristics and malaria parasite among pregnant women in the study area

Variables	Frequency (%) N=240
Age Group (Year)	
≤18	07 (2.9)
19-34	138 (57.5)
35-50	89 (37.1)
>50	06 (2.5)
Mean age ± SD	28.82 ± 0.28
Mean Haemoglobin ±	10.81 ± 0.05
SD	33.14 ± 0.02
Mean Pack Cell Volume	70 (29.2)
(PCV) ± SD	
Malaria parasite	
Parity	
Primigravidae	131 (54.6)
Multigravidae	109 (45.4)
Gestational Age	
1st trimester	39 (16.3)
2nd trimester	146 (60.8)
3rd trimester	55 (22.9)
Education	
Primary	14 (5,8)
Secondary	162 (67.5)
Tertiary	64 (26.7)

The outcome characteristics of pregnant women according to gravidity, trimester and malaria prevalence by age is shown in Table 2. Among the primigravidae age group ≤ 18 years had the highest frequency (100%), followed by age group >50 (77.8%), and the least age group was 35-50 which had 37.7%. The age group 35 - 50 had the highest frequency of 62.3% among multigravidae, followed by age group 19-34 (40.7%) and age group years >50 (22.2%) had the least. With respect to first trimester, age group >50 years had highest frequency (33.3%) while the least was in age group ≤ 18 years (11.1%). For second trimester, age group 19 - 34 years had 66.9% frequency and age ≤ 18 years had the least frequency (33.3%), while the highest frequency (55.6%) was found in age group ≤ 18 years and the age group >50 years (17.6%) had the least in respect to third trimester. Total prevalence of malaria infection from asymptomatic pregnant women was 29.2% and was found in all age groups; ≤ 18, 19 – 34, 35-50 and >50 years at

prevalence rate of 22.2%, 36.5%, 15.6% and 33.3% respectively. Also, the mean haemoglobin (Hb) and standard deviation for all age groups; ≤ 18, 19 – 34, 35-50 and >50 years were 11.34 ± 12.28, 10.80 ±10.94, 10.81 ± 11.09 and 10.37 ± 9.15 respectively.

TABLE 2. Outcome characteristics of pregnant women according to parity, gestational age and malaria prevalence by age

Characteristics	**Age Group (Year)**					**P-value**
	≤18 (%) n= 9	**19-34(%) n= 145**	**35-50(%) n= 77**	**>50 (%) n= 9**	**Total (%) N= 240**	
Parity						
Primigravidae	9(100.0)	86(59.3)	29(37.7)	7(77.8)	131 (54.6)	0.000
Multigravidae	0(0.0)	59(40.7)	48(62.3)	2(22.2)	109 (45.4)	
Gestational Age						
1st trimester	1(11.1)	22(15.2)	13(16.9)	3(33.3)	39 (16.3)	
2nd trimester	3(33.3)	97(66.9)	41(53.3)	5(55.6)	146 (60.8)	
3rd trimester	5(55.6)	26(17.9)	23(29.9)	1(11.1)	55 (22.9)	0.158
Malaria parasite	2 (22.2)	53 (36.6)	12(15.6)	3 (33.3)	70 (29.2)	0.518
Mean Hb ± SD	11.34 ±12.28	10.80 ±10.94	10.81 ± 11.09	10.37 ± 9.15	10.81 ± 0.05	0.472

Table 3 shows the prevalence and parasite density of malaria parasite according to gestational age and parity. Gestational age showed that pregnant women in their second trimesters had the highest prevalence malaria infection of 22.1% with mean parasite density of 184.90 ± 47.83, follow by first trimesters (5.4%) with mean parasite density of 63.57 ± 29.42 and the least was third trimester (1.7%) with mean parasite density of 284.53 ± 67.15. According to parity of pregnant women, primgravidae had the highest prevalence malaria infection of 17.5% with mean parasite density of 249.52 ± 0.41while that of multigravidae had the lowest (11.7%) with mean parasite density of 301.85 ± 0.72. There were no statistical significant association among malaria parasite, gestational age and parity (P > 0.05).

Table 4 shows the mean haemoglobin and mean pack cell volume of distribution among pregnant women with and without malaria parasite. The mean haemoglobin level of pregnant women with asymptomatic malaria parasite (10.25 ± 1.83g/dl) was lower than those without asymptomatic malaria parasite (11.37 ± 1.65g/dl). Also, the mean pack cell volume with asymptomatic malaria parasite (37.78 ± 5.14%) was also lower than those without asymptomatic malaria parasite (38.69 ± 3.85%). The difference in mean haemoglobin level and mean pack cell volume among pregnant women with and without malaria parasite were statistically significant (P < 0.05). The association

between asymptomatic malaria infection and anaemia burden in relation to haemoglobin and packed cell volume among pregnant women is shown Table 5. Based on the definition of anaemia in pregnancy by World Health Organization (WHO) cut-off value which are haemoglobin (≤11.00 g/dl) and packed cell volume (≤ 33%), the prevalence of anaemia among pregnancy in this study was 52.9%. The prevalence of anaemia among pregnant women who were positive to malaria infection was 34.7% while that without malaria infection was 65.3%. The differences in proportions of anaemia across asymptomatic malaria parasite were not statistically significant (P > 0.05).

TABLE 3. Prevalence and Parasite density of Malaria parasite according to Gestational age and Parity

Variable	**Malaria Parasite N= 240**				**P- value**
	No. Positive (%)	**No. Negative (%)**	**Total (%)**	**Mean Parasite Density ± SD**	
Gestational Age					
1st Trimester	13 (5.4)	26 (10.8)	39 (16.3)	63.57 ± 29.42	
2nd Trimester	53 (22.1)	93 (38.8)	146 (60.8)	184.90 ± 47.83	0.180
3rd Trimester	4 (1.7)	51 (21.3)	55 (22.9)	283.53 ± 67.15	
Parity					
Primigravidae	42 (17.5)	89 (37.1)	131 (54.6)	249.52 ± 0.41	0.772
Multigravidae	28 (11.7)	81 (33.8)	109 (45.4)	301.85 ± 0.72	

TABLE 4. Mean haemoglobin and mean pack cell volume (PCV) distribution among pregnant women with and without malaria parasite.

Age Group (Year)	**Mean Haemoglobin (g/dl)**		**P- value**	**Mean Pack Cell Volume (%)**		**P- value**
	With MP	**Without MP**		**With MP**	**Without MP**	
≤18	10.41 ± 0.52	11.35 ± 0.83		38.16 ± 4.38	38.88 ± 5.17	
19-34	9.38 ± 1.65	10.97 ± 1.25		36.17 ± 3.37	38.61 ± 3.34	
35-50	10.72 ± 0.05	11.81 ± 0.41		38.62 ± 5.25	38.78 ± 3 .16	
>50	10.59 ± 1.49	11.63 ± 1.17	0.0017	37.25 ± 3.57	38.76 ± 3.19	0.0001
Total	10.25 ± 1.83	11.37 ± 1.65		37.78 ± 5.14	38.69 ± 3.85	

TABLE 5. Association between asymptomatic malaria infection and anaemia burden in relation to haemoglobin and packed cell volume among pregnant women.

Asymptomatic Malaria	Anaemia					
	Haemoglobin			Pack cell volume		
	Yes (≤11.00 g/dl) No. (%)	No (>11.00 g/dl) No. (%)	P-value	Yes (≤ 33%) No. (%)	No (> 33%) No. (%)	P- value
Present	44 (34.7)	26 (23.0)		44 (34.7)	26 (23.0)	
Absent	83 (65.3)	87 (77.0)	0.053	83 (65.3)	87 (77.0)	0.053
Total	127 (52.9)	113 (47.1)		127 (52.9)	113 (47.1)	

The present study attempted to assess the prevalence of anaemia associated with asymptomatic malaria infection among pregnant women in the study area. Anaemia is a very common condition affecting over 800 million women and children worldwide. Anaemia in pregnancy can lead to complications like low birth weight, pre-term delivery and other complications during delivery. The prevalence of anaemia found in this study was 52.9%, which was higher than those findings studies conducted in Sunyani with prevalence of 41.5% (Anlaakun, 2015), Ghana with prevalence of 40.1% (W.H.O., 2011), Ethiopia with prevalence of 23.53% (Zekarias *et. al.*, 2017), South Africa with prevalence of 42.7% (Tunkyi and Moodley, 2015) and in Nigeria with prevalence of 32.2% (Ikeanyi and Ibrahim, 2015). The prevalence of 52.9% found in this study was lower than another research done in Calabar, Southsouth Nigeria with prevalence of 95.4% (Agan *et. al.*, 2010). The difference in the prevalence rate could be due to differences in socio-demography, socio-economy, increased awareness of healthy behaviours and lifestyles and better nutrition and altitude of pregnant women in the study areas.

The prevalence of asymptomatic malaria parasitaemia in this study was 29.2%. This was lower than 32.4% reported in Ilorin (Adesina *et. al.*, 2009). Other studies from Nigeria also reported higher prevalence rates of malaria parasitaemia than what was observed in this study (Gajida *et. al.*, 2010; Ogbodo *et. al.*, 2009). Concerning parity, mean parasite density in multigravidae was significantly higher than in primigravidae. This was in agreement with the fact that this group of pregnant women has lower immunity to malaria. Most of the participants likely booked for antenatal care in the second trimester of pregnancy (60.8%), which was similar to report in Calabar (Agan *et. al.*, 2010). Gestational age was significantly related to asymptomatic plasmodium parasitaemia which agrees with the findings of Adesina *et. al.*, (2009). The finding of

the highest proportion of asymptomatic plasmodium parasitaemia occurring in pregnant women in their second trimester and lowest proportion among those in their third trimester in index study may not be unexpected. This may be due to prolonged exposure to mosquito bites by women in second trimester in comparison to those in their earlier trimesters.

The prevalence of anaemia was lower in those with parasitaemia (34.7%) in comparison to those without parasitaemia (65.3%). This was consistent with a Nigerian multi-center study by Erhabor *et. al*., (2010). The finding of lower proportion of anaemia among those with parasitaemia in comparison to those without parasitaemia may not be surprising as plasmodium parasites causes direct and indirect destruction of parasitized and non-parasitised erythrocytes leading to haemolytic anaemia (Haldar and Mohandas, 2009). From this study, malaria-associated anaemia was 34.7% while that of non-malaria associated-anaemia was 65.3%. This association was not statistically significant ($P > 0.05$). However, not all pregnant women who were anaemic were malaria positive. This could be as a result of other factors that cause anaemia during pregnancy such as Human Immunodeficiency Virus (HIV), helminth infections, folate and nutritional deficiencies (Glover-Amengor *et. al*., 2005).

Asymptomatic plasmodium parasitaemia had a significant effect on the mean haemoglobin concentration and mean packed cell volume as indices of anaemia which was consistent with the findings in Ilorin by Adesina *et. al.*, (2009). This was found by grouping mean haemoglobin and mean packed cell volume of pregnant women with malaria parasitic infections separately from those without malaria parasitic infections. The results indicated that those pregnant women with malaria parasites had lower value of mean hemoglobin and mean packed cell volume than those without malaria parasites.

In this study, the difference in mean haemoglobin level and mean pack cell volume among pregnant women with and without malaria parasite were statistically significant ($P < 0.05$). Lower values of mean haemoglobin concentration and mean packed cell volume noted among pregnant women with parasitaemia in comparison to those without parasitaemia was in tandem with other researches that have implicated malaria as a major cause of anaemia in pregnancy (Erhabor *et. al.*, 2010; Nwaneri *et. al.*, 2013). Reduced mean haemoglobin and mean packed cell volume in plasmodium positive pregnant women are attributed to chronic loss of blood and iron. The most important cause of pathological chronic loss of blood and iron in the tropics are malaria and soil transmitted helminths such as hookworm, *T. trichiura* and *S. mansoni* (Agan *et. al.*, 2010). Therefore, these findings along with the index study reiterates the need for routine screening for plasmodium parasites at antenatal clinic as this will provides

opportunity for asymptomatic plasmodium parasitaemia to be detected and optimal antimalarial treatment offered.

The present study had its own limitations; confounding factors such as the nutritional status of individuals, Iron and folic acid supplementation during the course of pregnancy, infection with Soil Transmitted Helminths (STH), Human Immunodeficiency Virus (HIV), and tuberculosis were not assessed to rule out the independent effect of asymptomatic malaria on anaemia among the pregnant women. The findings from this study suggest that malaria and anaemia are still prevalent among pregnant women. Malaria was significantly associated with anaemia during pregnancy. Thus, the practice of routine screening for malaria and anaemia followed by prompt management should be encouraged to curb the effect of malaria and anaemia on the pregnant women as well as her foetus. Furthermore, a study designed to test the effectiveness of the practice of routine screening for malaria and anaemia followed by prompt management is also needed. Education of women of child bearing age on the possible risk of malaria and anaemia during pregnancy on the pregnant woman and her foetus, should be intensified.

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