

Original Research Article**THE PREVALENCE OF MALARIA AND HELMINTH CO-INFECTION IN PREGNANCY
AND THEIR CORRELATION TO ANAEMIA AT BOOKING AT A TERTIARY HOSPITAL,
SOUTHERN NIGERIA.**

Abstract:-

Objectives: To determine the prevalence of malaria and helminth co-infection in pregnancy and their correlation with anaemia at booking at the University of Port Harcourt Teaching Hospital.

Materials and Methods: This was a cross sectional descriptive study of 192 pregnant women who booked for antenatal care at the University of Port Harcourt Teaching Hospital between August 1, 2015 and March 31, 2016. Socio-demographic data was collected through a structured questionnaire. Blood samples were collected and evaluated for malaria parasites, haemoglobin estimation and stool samples examined for ova of helminths. Data obtained was analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. The results are presented in frequency tables.

Results: The prevalence of malaria, helminth, and their co-infection at booking were 24.5%, 0.5% and 0.5% respectively while the prevalence of anaemia at booking was 16.7%. Malaria and helminth co-infection accounted for 3.1% of the study population with anaemia while 75% of those with anaemia had malaria infection alone. There was a statistically significant relationship between malaria and helminth co-infection, and the area of residence ($p = 0.036$).

Conclusion: The prevalence of malaria and helminth co-infection was very low and had no statistically significant relationship with anaemia. Malaria infection was mainly associated with anaemia at booking.

Key words:- Pregnancy, Malaria, Helminth, Co-Infection, Southern Nigeria.

30 1. INTRODUCTION

31 Parasitic infection during pregnancy is a major cause of anaemia in Africa [1].
32 Malaria and helminthiases are co-endemic especially in sub Saharan Africa, and
33 there is an extensive overlap between the area of malaria and helminth infection
34 in Africa [1,2]. Their co-infection is not uncommon, and its additive effect may
35 lead to worsening anaemia and other morbidities, this could have dire
36 consequences on pregnancy [1,2].

37 Malaria is an infectious disease caused by protists of the genus plasmodium, and
38 it is transmitted by bite from an infected female Anopheles mosquito. According
39 to the latest WHO estimate, there were about 207 million cases of malaria in 2012
40 and 627,000 deaths worldwide [3]. About 85% to 90% of all malaria morbidity and
41 death occur in Sub-Saharan Africa [3]. Nigeria is one of the most endemic
42 countries for malaria, and the susceptibility to this infection is increased by
43 pregnancy [3,4]. Malaria infection in pregnancy is a major health challenge as it
44 poses substantial risk to the mother, her fetus and the neonate. Many studies
45 have demonstrated the relationship between malaria in pregnancy and maternal
46 anaemia, miscarriage, placenta parasitaemia, low birth weight, congenital

47 malaria, stillbirth, and maternal death depending on the level of transmission [5-
48 8].

49 Helminths are parasitic worms. Helminth infections are more common in the
50 developing countries and produce a global burden of disease greater than that of
51 other known infectious diseases such as malaria or tuberculosis [9]. It is estimated
52 that approximately one third of the 3 billion people in the developing region of
53 Sub Saharan Africa, Asia and the Americas that live on less than 2 US dollar per
54 day are infected with one or more helminths [1,10]. Helminth infection during
55 pregnancy is associated with anaemia, prematurity, low birth weight, and
56 increased maternal morbidity and mortality [11].

57 Although the distribution of plasmodium and helminths widely overlap on the
58 African continent, reports on parasitic infections are usually solely made on
59 malaria or helminths alone [12]. Malaria and helminth co-infection in pregnancy
60 has not being widely reported especially in the south-south region of Nigeria,
61 hence the need for this study.

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63

64 2. MATERIALS AND METHODS

65 2.1 Study Site

66 The study was done at the ante-natal clinic of the University of Port Harcourt
67 Teaching Hospital. The hospital is located in Alakahia town in Obio Akpor Local
68 Government Area of Rivers State. It is the apex health institution in Port Harcourt
69 and provides specialized healthcare services for Port Harcourt and the entire
70 Rivers State, as well as neighboring states.

71 2.2 Methods

72 This cross sectional **descriptive** study was conducted among pregnant women
73 booking for ante-natal care at the University of Port Harcourt Teaching Hospital
74 from August 1, 2015 to March 31, 2016. The sample size for this study was
75 calculated using the formula for cross sectional studies, using a previous
76 prevalence of malaria hookworm co-infection which was 13% [13].

77 Pregnant women who had antimalarial drugs either as chemoprophylaxis or for
78 treatment prior to booking, those who had anti-helminthics prior to booking,
79 those with Human immunodeficiency virus infection (HIV), and pregnant women

80 with sickle cell disease and other haemoglobinopathies were all excluded from
81 the study.

82 All pregnant women who satisfied the criteria and gave consent were recruited
83 for the study. Socio-demographic data were collected using a structured
84 questionnaire and included age, level of education, occupation, marital status,
85 area of residence, religion and parity. The questionnaires were administered by
86 the principal investigator and some trained assistants.

87 **2.3 Blood and Stool sample collection**

88 The blood samples were collected by aseptic technique from the ante cubital
89 fossae. Five millilitres of blood were collected into an ethylene diamine tetra-
90 acetic acid (EDTA) bottle with sterile hypodermic needle. Thick and thin blood
91 films were made on a clean slide. The thick film was used to determine the
92 parasite densities. Non-heparinized capillary tubes were filled with blood sample
93 from the EDTA bottle. The tips of the capillary tubes were cleaned with cotton
94 wool, sealed and arranged inside a haematocrit centrifuge. They were centrifuged
95 for 5 minutes at 12,000 revolutions per minute. The Packed Cell Volume was
96 determined by using a haematocrit reader.

97 All patients were given clean labeled stool containers and instructed to bring
98 small quantities of their stool specimen on their next visit within an hour of
99 passing the stool to the laboratory. Wet mount was prepared from the stool
100 specimen using direct smear method with normal saline and iodine preparation,
101 and the concentration procedure using formol-ether for the identification of
102 helminth eggs as well as protozoan cyst.

103 **2.4 Statistical Analysis**

104 Statistical package for Social Sciences SPSS version 20 was used for data analysis.
105 The results are presented in means, standard deviation and frequency tables. Chi
106 square was used to determine correlation between variables. Statistical
107 significance was reported at $P < 0.05$.

108 **3. RESULTS**

109 Of the 192 women recruited into the study, 160 (83.3%) were aged between 18-
110 35 years, with a mean age at booking of 30.52 ± 4.75 years. The modal parity was
111 para 1-4 with 53.1% of the study population in this group. Most (87%) of the
112 women had tertiary education and majority (96.4%) of them resided in urban area
113 while 3.6% resided in semi-urban area. Almost all (98.4%) of the women were
114 Christians. These are shown in table 1.

115 The prevalence of malaria infection was 24.5%. Majority (89.4%) had mild
 116 parasite density and 10.6 % had moderate parasite density while that of helminth
 117 infection was 0.5%, and the infection was of moderate parasite density. The age,
 118 marital status, educational level and other variable had no significant association
 119 with the prevalence of helminth infection at booking. The prevalence of malaria
 120 and helminth co-infection in the study population was 0.5%. The mean Packed
 121 Cell Volume was 32.67 ± 3.33 %. The prevalence of anaemia at booking was
 122 16.7%. Majority 28 (87.5%) of the study population with anaemia had mild
 123 anaemia while 12.5% (4) had moderate anaemia. These are all shown in table 2.
 124 Those who resided in semi-urban areas had the highest prevalence of malaria
 125 infection at 42.9%, however this was not statistically significant ($p>0.05$). The
 126 prevalence of malaria by parity was 29.3% in para 0, 21.6% in para 1-4, and 12.5%
 127 in $\geq$ para 5. The distribution of malaria parasitaemia among other co variates were
 128 as shown in table 3.

129 Of the 192 women, only 1 had malaria and helminth co-infection, the malaria
 130 parasite and helminth infection density were both moderate in this participant
 131 who resided in a semi-urban area. There was a statistically significant relationship
 132 between malaria and helminth co-infection, and the area of residence ($p= 0.036$).

133 Other variables such as age, parity, marital status, level of education and religion

134 had no statistically significant relationship with malaria and helminth co-infection
 135 ($p>0.05$). Table 4 shows a cross tabulation of the results of malaria and helminth
 136 infection.

137 Most (71.4%) of the women with mild anaemia tested positive for malaria
 138 parasite while 28.6% (8) with mild anaemia were negative for malaria parasite. All
 139 the women with moderate anaemia tested positive for malaria parasite as shown
 140 in table 5. There was a very low negative correlation ($r = -0.13$) between malaria
 141 and helminth co-infection, and anaemia in this study.

142 TABLES

VARIABLE	NUMBER	PERCENTAGES
AGE (years)		
<18	0	0%
18-35	160	83.3%
>36	32	16.7%
MARRITAL STATUS		
Married	192	100%
Single	0	0%
Divorced	0	0%
Separated	0	0%
LEVEL OF EDUCATION		
Tertiary	167	87.0%
Secondary	24	12.5%
Primary	1	0.5%

PARITY		
0	82	42.7%
1-4	102	53.1%
>4	8	4.2%
AREA OF RESIDENCE		
Urban	185	96.4%
Semi-urban	7	3.6%
Rural	0	0%
RELIGION		
Christianity	189	98.4%
Islam	3	1.6%
Others	0	0%

143 **TABLE 1: Socio-demographic characteristics**

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145 **TABLE 2: Laboratory results**

VARIABLE	FREQUENCY	PERCENTAGE
RESULTS FOR MALARIA INFECTION		
Positive for malaria parasite		
No	145	75.5%
Yes	47	24.5%
Parasite density		
+	42	89.4%
++	5	10.6%
+++	0	0%
RESULTS FOR HELMINTH INFECTION		
Stool microscopy positive		
No	191	99.5%
Yes	1	0.5%
Density of infection		
Mild	0	0%
Moderate	1	100%
Severe	0	0%

MALARIA HELMINTH CO- INFECTION		
No	191	99.5%
Yes	1	0.5%
HAEMATOLOGICAL RESULT		
Normal PCV	160	83.3%
Anaemia	32	16.7%
DEGREE OF ANAEMIA		
Mild	28	87.5%
Moderate	4	12.5%
Severe	0	0%

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147 **TABLE 3: Distribution of malaria parasite infection among variables**

VARIABLE	MALARIA PARASITE		TOTAL
	YES	NO	
AGE			
18-35	42 (26.25%)	118 (73.75%)	160 (100%)
>3	5 (15.62%)	27 (84.38%)	32 (100%)
TOTAL	47	145	192
LEVEL OF EDUCATION			
TERTIARY	41 (24.55%)	126 (75.45%)	167 (100%)
SECONDARY	6 (25.00%)	18 (75.00%)	24 (100%)
PRIMARY	0 (0%)	1 (0%)	1 (100%)
TOTAL	47	145	192
PARITY			
PARA 0	24 (29.27%)	58 (70.73%)	82 (100%)
PARA 1-4	22 (21.57%)	80 (78.43%)	102 (100%)
>PARA 4	1 (12.50%)	7 (87.50%)	8 (100%)

TOTAL	47	145	192
AREA OF RESIDENCE			
URBAN	44 (23.78%)	141 (76.22%)	185 (100%)
SEMI-URBAN	3 (42.86%)	4 (57.14%)	7 (100%)
TOTAL	47	145	192

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150 **TABLE 4: Cross tabulation for malaria and helminth infection**

	POSITIVE FOR MALARIA INFECTION	NEGATIVE FOR MALARIA INFECTION	TOTAL
POSITIVE FOR HELMINT INFECTION	1	0	1
NEGATIVE FOR HELMINTH INFECTION	46	145	191
TOTAL	47	145	192

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154 **TABLE 5: Cross tabulation showing the of degree of anaemia and malaria infection**

MALARIA PARASITE	MALARIA PARASITE POSITIVE	MALARIA PARASITE NEGATIVE	TOTAL

ANAEMIA			
MILD ANAEMIA	20 (71.4%)	8 (28.6%)	28 (100%)
MODERATE ANAEMIA	4 (100%)	0 (0%)	4 (100%)
TOTAL	24	8	32

4. DISCUSSION

The findings from this study suggest that pregnant women were more susceptible to malaria than helminth infection at booking at the University of Port Harcourt Teaching Hospital. This was similar to reports from previous studies [13,14]. The prevalence of malaria was similar to that obtained in Gabon [15]. This may be because the study population were similar, although the sample size of this study was approximately half that of the one conducted in Gabon. It was however lower than that reported in some other studies [13, 14, 16]. The higher prevalence in these studies could be as a result of the study location, since all the study participants resided in semi-urban areas with a lot of bushy surroundings, poor sanitation and waste disposal facility while majority of the participants in our study resided in urban areas. In this study, those residing in semi-urban areas had

170 the highest prevalence of malaria compared to those who resided in urban areas.

171 It can therefore be deduced that residence in a semi-urban area was associated
172 with a higher prevalence of malaria. The study further reaffirms a higher
173 prevalence of malaria infection among primigravidae when compared to
174 multigravidae which was also reported in earlier studies [13,15,16].

175 The prevalence of helminth infection in this study was 0.5%, which was very low
176 when compared to reports from other studies [13,15,17]. This very high
177 prevalence can be attributed to the methodology used in those studies, the
178 sample population and their area of residence. In the study done in Gabon, stool
179 samples were tested a minimum of three times for helminth infection at monthly
180 interval if the initial stool sample tested was negative unlike in this study where
181 the stool samples of participants were tested only once. The high prevalence of
182 helminth infection as reported in Enugu and Anambra when compared to this
183 study could be attributed to the fact that the studies were done in a semi-urban
184 and rural areas respectively, which were surrounded by thick forest with no
185 modern toilet and water drainage facilities. In contrast, majority of participants in
186 this study were well educated, and resided in urban area with modern toilet and
187 water drainage facilities, which may have accounted for the low prevalence of
188 helminth infection in the study.

Malaria and helminth co-infection in this study was rather low when compared to previous reports [13-16]. The high prevalence of malaria and helminth co-infection in these studies could be attributed to the methodology used, socio-demographic variables such as residence in rural area or semi-urban area, parity and low socio-economic status. Participants in this study were highly educated and resided mainly in urban area, which could account for the low prevalence of malaria and helminth co-infection. However, there was a statistically significant relationship between malaria and helminth co-infection and area of residence, which showed an association between those residing in semi-urban area and malaria and helminth co-infection.

The prevalence of anaemia in this study was lower than the findings from other reports [13,17,18]. However, there was no statistically significant association between malaria and helminth co-infection with anaemia. Majority of the women with anaemia had malaria, this suggested that malaria infection was a more common cause of anaemia than helminth infection or their co-infection in our centre. A similar finding was also reported in other studies [18,19].

5. LIMITATION

206 This study was carried out at a tertiary centre located in an urban area, therefore
207 it may not reflect the true picture of malaria and helminth co-infection and their
208 effect on anaemia in the rural communities of Rivers State.

209 **6. CONCLUSION**

210 There was a very low prevalence of malaria and helminth co-infection at booking
211 at the University of Port Harcourt Teaching Hospital. Larger studies and rural
212 community-based studies are warranted.

213 **CONSENT**

214 A written informed consent was given by the patients to participate in the study
215 and a verbal informed consent was obtained from them for the publication of this
216 work.

217 **ETHICAL APPROVAL**

218 The authors hereby declare that the research was approved by the hospital ethics
219 committee. The ethical approval protocol number is
220 UPTH/ADM/90/S.II/VOL.X/500.

221 **COMPETING INTERESTS**

222 The authors have declared that no competing interests exist.

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224 REFERENCES

- 225 1. Hotez PJ, Molyneux DH, Fenwick A, Ottesen E, Ehrlich Sachs S, Sachs JD.
 226 Incorporating a rapid-impact package for neglected tropical diseases with
 227 programs for HIV/AIDS, tuberculosis and malaria. Plos Med 2006; 3: 102.
- 228 2. Broker S, Akhwale W, Pullan R, Estambale B, Clarke SE, Snow RW, Hotez PJ.
 229 Epidemiology of plasmodium-helminth co-infection in Africa: Population risk,
 230 potential impact on anaemia and prospects for combining control. Am J Trop
 231 Med Hyg 2007; 77: 88-98.
- 232 3. WHO Factsheet on the World malaria report 2013. Geneva: World Health
 233 Organization;2013:[http://www.who.int/malaria/media/world_malaria_report](http://www.who.int/malaria/media/world_malaria_report_2013/en/)
 234 [_2013/en/](http://www.who.int/malaria/media/world_malaria_report_2013/en/). Accessed March 17 2014
- 235 4. WHO. A strategic framework for malaria prevention and control during
 236 pregnancy in the African region. Brazzaville 2004, WHO Regional Office for
 237 Africa;[http://www.afro.who.int/.../147-a-strategic-framework-for-malaria-](http://www.afro.who.int/.../147-a-strategic-framework-for-malaria-prevention-and-control-during-pregnancy-in-the-african-region.html)
 238 [prevention-and-control-during-pregnancy-in-the-african-region.html](http://www.afro.who.int/.../147-a-strategic-framework-for-malaria-prevention-and-control-during-pregnancy-in-the-african-region.html). Accessed
 239 March 17 2014.

- 240 5. Steketee RW, Warima JJ, Campbel CC. Developing effective strategies for
 241 malaria prevention programme for pregnant African women. *Am J Trop Med*
 242 *Hyg* 1996; 55:95-100.
- 243 6. Luxemburger C, Ricci F, Nosten F, Raimond D, Bathet S, White NJ . The
 244 epidemiology of severe malaria in area of low transmission in Thailand. *Trans R*
 245 *Soc Trop Med Hyg* 1997; 91: 256-262.
- 246 7. Ezechukwu CC, Ekejindu IM, Ugochukwu EF, Egbuonu I, Oguata M, Chukwuka
 247 JO. Congenitally acquired malaria in hyperendemic area: A cohort study. *Trop J*
 248 *Med Res* 2004; 8: 44-48.
- 249 8. Ekejindu IM, Udigwe GO, Chijioke IRC. Malaria and Anaemia in pregnancy in
 250 Enugu Southeastern Nigeria. *Afr J Med Sci* 2006; 351-353.
- 251 9. Hotez PJ, Brindley PJ, Bethony JM, King CH, Pearce EJ, Jacobson J. Helminth
 252 infections: The great neglected tropical diseases. *J Clin Invest* 2008; 118: 1311-
 253 1321.
- 254 10. Hotez PJ, Molyneux DH, Fenwick A, Kumaresan J, Ehrlich Sachs S, Sachs JD,
 255 Savioli L. Control of neglected tropical diseases. *N Engl J Med* 2007; 357: 1018-
 256 1027.
- 257 11. Christian P, Khatry SK, West JP. Antenatal anthelmintic treatment,
 258 Birthweight and infant survival in rural Nepal. *Lancet* 2004; 364:981-983.

- 259 12. Fuseini G, Edoh D, Kalifa BG, Knight D. Plasmodium and intestinal helminth
260 distribution among pregnant women in the Kassena-Nankana District of
261 Northern Ghana. J Entomol Nematol 2009; 1: 19-24.
- 262 13. Ekejindu IM, Okeke EK, Akah B, Okpala E, Ezeagwuna DA, Onwurah O. Malaria
263 and Hookworm co-infection among pregnant and non-pregnant women in a
264 semi-urban area in Anambra State, Nigeria. World J of Med Sci 2011; 6: 33-35.
- 265 14. Egwunyenga AO, Ajayi JA, Nmorsi OPG, Duhlinska-Popova DD. Malaria/
266 intestinal helminth co-infection among pregnant Nigerian women. Mem Inst
267 Oswaldo Cruz 2001; 96: 1055-1059.
- 268 15. Adegnika AA, Ramharther M, Agnandji ST, Ngoa UA, Issifou S, Yazdanbakhsh M,
269 Kremsner PG. Epidemiology of parasitic co-infections during pregnancy in
270 Lambarene Gabon. Trop Med Int Health 2010; 15: 1204-1209.
- 271 16. Yatich NJ, Yi J, Agbenyega T, Turpin A, Rayner JC, Stiles JK, Ellis WO,
272 Funkhouser E, Ehiri JE, Williams JH, Jolly PE. Malaria and intestinal
273 helminth co-infection among pregnant women in Ghana: Prevalence and Risk
274 factors. Am J Trop Med Hyg 2009; 80: 896-901.
- 275 17. Agu P, Ogbosi JS, Akpoigbe K, Okeke T, Ezugwu E. Impact of plasmodium

falciparum and hookworm infections on the frequency of anaemia in pregnant women of rural communities in Enugu, South East Nigeria. Pan Afr Med J 2013; 14: 27.

18. Muhangi L, Woodburn P, Omara M, Omoding N, Kizito D, Mpairwe H, Nabulime

J, Ameke C, Morison LA, Elliott AM. Association between mild to moderate anaemia in pregnancy and helminth, malaria and HIV infection in Entebbe, Uganda. Trans R Soc Trop Med Hyg 2007; 101: 899-927.

19. Mwangi TW, Bethony J, Brookers S. Malaria and helminth interactions in human: an epidemiological viewpoint. Ann Trop Med Parasitol 2006; 100: 551-570.