

Practique Clinique et Investigation

Interplay of Malaria and Intestinal Helminths Co-infection among Pregnant Women in Port Harcourt, Niger Delta Region of Nigeria

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ABSTRACT

Background: This study was conducted to investigate the interplay of malaria parasiteamia and intestinal helminth co-infection among pregnant women in Port Harcourt metropolis. The study area of this descriptive research outcome comprises of three Health Care facilities namely, Churchill Health Centre, Naval Medical Centre and one tertiary Health care institution (Braithwaite Memorial Specialist Hospital), all are located in Port Harcourt metropolis of Rivers State, Nigeria.

Methodology: Interestingly, a cross sessional research design was used to collect 160 blood and stool samples, using convenient sampling technique from the apparently healthy pregnant subjects, even as personal data of the subjects and socio-economic status were obtained from the subjects after due consent were obtained from the subjects through the use of structured questionnaire. The screening for malaria and intestinal helminth among subjects were explored through the application of standard clinical parasitological laboratory techniques. However, descriptive statistical method was explored for the analysis of the data generated and results were presented, using tables and graphical presentations to show percentage of positive, negative and frequency distribution outcome analysis. Also, correlation was performed to relate the association of different variables respectively.

Results: The result of the study showed that the occurrence of malaria in the general population of the study stood at 53 (32.9%), while that of intestinal helminthes was 48 (29.8%). The rate of co infection stood at 20 (12.4%). However, 5 out of the 20 presented mixed intestinal helminth infections. Also, the study showed a decrease in positive rate relative to educational level with the highest of 33.3% among those with primary education and 25.5% for those with tertiary education. In addition, the occurrence of intestinal helminths among malaria Parasitemic subjects showed highest percentage of 18.9% in hookworm infection, followed by 13.2% in *Ascaris lumbricoictes* while the least was seen in *Schistosoma mansoni* having 1.8%. However, infection distribution of malaria and helminthes based on parity; according to the results seems to reduces with parity and those in their first pregnancies (primigravids) having over 46% and 39% for malaria and helminthes respectively and falls as low as zero for multigravids among the study population. Malaria was however found to have a negative relationship with parity ($r = -0.75$, $p < 0.05$) while intestinal helminthes showed a weak relationship of $r = 0.10$ which is not significant ($p > 0.05$).

Conclusion: Pregnant women should be routinely checked for malaria and helminthes infections to avoid the negative Public Health implication accruable such as anaemia. Thus, it is strongly recommended that mass education, good water supply and effective waste disposal system should be provided in our urban and remote communities to reduce the parasitic burden of all kind. Also, poverty eradication programme by the government aimed at improving the socio economic standards and conditions of living of the citizens should be well encouraged in a sustainable manner, as these would help to improve the Health status of the pregnant mothers in our communities.

Keywords: *Co-Infection; Malaria; Intestinal Helminthes; Pregnant; Women; Port Harcourt; Health; Implications*

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INTRODUCTION

Following the evolutionary history of man on the surface of the earth, humans have been infected with parasites, and thus, helminthes parasitic infections are among the most common chronic infections in the tropical regions of the world. Nonetheless, Plasmodium infection remains the most deadly among all the parasitic infections [1]. However, it is strongly believed that these two groups of parasites have similar geographical distribution, thus, with the nature of shared endemicity, co infection is often common in our remote communities. Today, it is estimated that over 33% of the world's population, mainly those individuals living in the tropics and sub Saharan regions or sub tropics are infected by parasitic intestinal helminthes (worms) or one or more of the species of plasmodium [2,3]. The ubiquity and complexity of these parasites with respect to their life cycle and high fecundity potentials, results in the high rates of co-infection in an infected host [4]. Therefore much attention is now being given to the interaction between intestinal helminthes and plasmodium in a situation of co-infection given it's negative Public Health consequences. In sub-Saharan Africa, up to 24 million women may become pregnant each year. In this condition, there is an increase in susceptibility to infections because it is a time of high hormone activity which may probably exert immuno suppressive effects [5] on the child bearing women, thereby making them more vulnerable to myriad of parasitic infections

Malaria and intestinal helminth co-infection aggravates maternal anaemia which contributes significantly to maternal mortality and causes an estimated 10 000 deaths per year [6]. Low birth weight is the greatest risk factor for neonatal mortality and a major contributor to infant mortality [7]. Nevertheless, malaria and intestinal helminth infections serves as major factors which aggravates and many time promotes low birth weight alongside with poor nutrition and anaemia which are amenable to intervention once a woman becomes pregnant. Nonetheless, it has increasingly been speculated that helminth infections may alter susceptibility to clinical malaria [8,9], and existing evidence is consistent with the hypothesis that intestinal helminthes are associated with continued and possibly increased incidence of malaria infection [10] with data from clinical fieldwork suggesting protection from cerebral malaria in the setting of helminth co-infections. Furthermore, it was also suggested nearly thirty years ago that infection with the intestinal nematode *Ascaris lumbricoides* was associated with the suppression of malaria symptoms and that anti-helminthic treatment led to a recrudescence of malaria [11]. The mechanism underlying this finding are based on the assumption that helminth infections induce a potent immune response [12] which has been proposed to modify the acquisition of immunity to malaria. In animal models, there is evidence suggestive of both synergism and antagonism in *Plasmodium* and intestinal helminthic co-infections [13,14] .

Nevertheless, there is now an increased vent of research interest that helminth infections may alter susceptibility to clinical malaria (Tabitha *et al.* 2006) and also an increasing interest in investigating the consequence of co-infection [15-20]. However, the hookworm infection prevalence among pregnant women in sub Saharan Africa for instance has been estimated to be 32%. Given the high fertility rate, low nutritional status and poor hygiene and environmental conditions predominant in developing societies, thus, it is firmly believed that intestinal helminth infections during pregnancy may probably contribute significantly to the degree of anaemia and other unnoticed clinical condition in pregnant women if the trend is not checked and in good time. However, the con-committal occurrence of plasmodium and intestinal helminth infections in pregnant women in Nigeria, their clinical manifestations and the association of the infections are largely unreported as reported by Egwunyenga *et al.* [21]. Hence, this study was performed to consider this including the speculation of existing literatures and to ascertain the likelihood of the available facts to the current study population.

Therefore, this study investigated the occurrence of plasmodium and helminth parasites in pregnant women in Port Harcourt, Rivers State, Nigeria. It analyzed various mono infections of Plasmodium (malaria) and intestinal helminthes alongside the co-infection status with respect to educational level and parity of the study participants. It is therefore, strongly believed that data generated would be used to raise very robust advocacies that would engender and step up intervention programmes by government at all levels and her relevant agencies towards improving living condition of subjects and the eradication of parasitic diseases of all kind, using millennium development goal intervention sustainable approach.

MATERIALS AND METHODS

Study Location

The study area of the descriptive research comprises of three Health Care Centres (Churchill Health Centre and Naval Medical Centre) in addition to one tertiary health care institution (Braithwaite Memorial Specialist Hospital), all located within the heart city of Port Harcourt. These health care facilities help to provide health care services to people residing within the catchment areas mainly of highly populated slums and moderately populated uplands. The health care facilities are owned and managed by government as well are quite affordable thus; accommodate even the lower class of individuals in the society who seek medical care attention. Exclusively, 161 pregnant women were randomly selected and screened for malaria and helminthes infections. The subjects predominantly represent the lower class of the society particularly in the area of this study.

Inclusion criteria

The study was limited to pregnant women who visited the above health facilities as at the time of this study, and only those who agreed to participate were engaged in the research. Only apparently healthy pregnant women were only enrolled in the study.

Exclusion criteria

Non pregnant women were not allowed to participate, even as those who never consented to participate were not engaged to participate in the study. Those who are sick and treatment already on malaria drugs were excluded from the study.

Ethical Approval

The ethical approval of this study was granted by the ethical committee of the Rivers State Hospital Management Board, even as the consent of the subjects that participated in the study were sought and approval was granted by individual who verbally agreed to get involved in the study. The right of those who refused to get involved were fully respected and were not in any way engaged in the study process.

MATERIALS AND METHODS

Collection of Samples

2 ml of whole blood were aseptically collected through the vein of the pregnant subjects after due consent was granted and it was dispensed into an EDTA bottle container and was properly mixed very well for thick blood film preparation. Furthermore, clean wide mouth open stool bottle container was used to collect 5 to 10 grams of stool sample for parasitic microscopic identification

Experiment

The screening for malaria and intestinal helminthic parasite was done with the use of thick blood film and formaldehyde ether concentration techniques and wet preparation (iodine and normal saline) respectively as described by Chessbrough (1998). Both methods involved collection of blood samples, making of films and staining with geimsa stain and the stool samples analysis was achieved by the use of formal ether concentration technique to concentrate the parasites, even in scanty proportion, before it would be examined on loges iodine and normal saline smear preparation as described by [22]

Structured questionnaire

The use of structured questionnaire was used to collect, personal data of the subjects relating to age, parity, educational level and socio-economic status/occupation were obtained. Also, the questionnaire will uncover whether the subjects reside in high density urban areas with inadequate waste disposal facilities and poor water supply.

Statistical analysis

The SPSS statistical tool was used to analyse the data generated. Descriptive statistical method was employed using table and graphical representation to indicate percentages in positive, negative and frequency distribution. Also, correlation was performed to relate variables and to ascertain different type of associations

RESULTS

The analysis was carried out to determine the infection rate of intestinal helminth among plasmodium pregnant women as well as other related parameters. A total of 161 samples (blood and stool) were collected and the results are as shown below. The occurrence of malaria in the general population from observation is 32.9%, while that of intestinal helminthes is 29.8%. The rate of co infection is 12.4%. However, 5 out of the 20 presented mixed intestinal helminth infections.

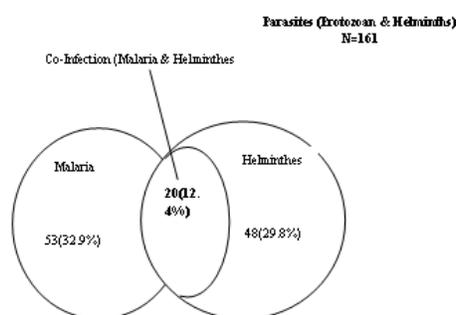


Figure 1: Distribution of parasites (Protozoan & Helminthes).

Education level	No. of subjects	No. positive	Positive %age
Primary	3	1	33.3
Secondary	103	33	32
Tertiary	55	14	25.5

Table 1: Prevalence of *Helminth* infection with relative to educational level.

Table 1 shows a decrease in positive rate relative to educational level with the highest as 33.3% among those with primary education and 25.5% for those with tertiary education.

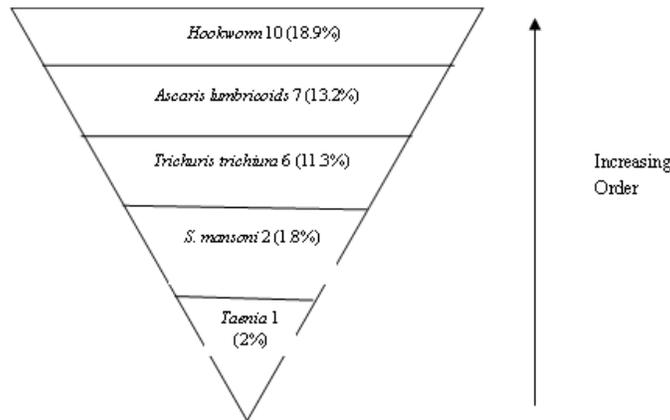


Figure 2: Distribution of intestinal *Helminthes* in plasmodium positive pregnant women.

Figure 2 shows the occurrence of intestinal helminths among malaria Parasitemic subjects to highest 18.9% in hookworm followed by 13.2% *Ascaris lumbricoictes*. It is least with *Schistosoma mansoni* having 1.8%.

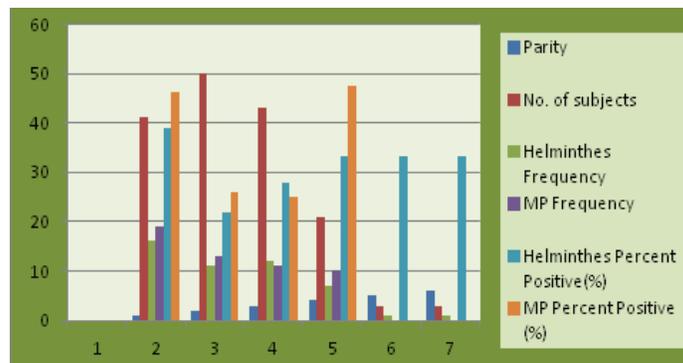


Figure 3: Distribution of malaria and *Helminthes* with reference to parity.

In addition, Figure 4 demonstrates that Malaria was found to have a negative relationship with parity ($r = -0.75$) while intestinal helminthes showed a weak relationship of $r = 0.10$ which is not considered significant.

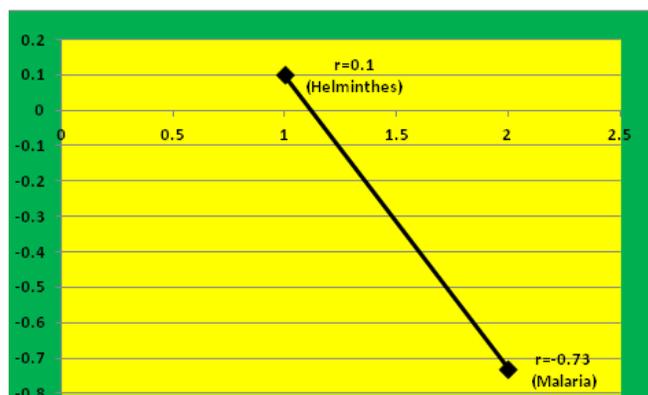


Figure 4: Correlation of parity with malaria and *Helminthes* infection rates.

DISCUSSION

The study shows that the rate of positive infection of malaria and intestinal helminths among the study population was low. It has further demonstrated that women on antenatal care in the study area harbours various species of intestinal helminths, lower than the results reported by [21] among pregnant Nigerian women. This rate of infection may probably be indicative of faecal contamination of soil and water, which may be due to poor sanitation and improper sewage disposal systems in the study location. However, studies conducted in this direction in another parts of Nigeria in the past strongly suggest hyperendemicity of soil transmitted helminthes especially among children, who are exposed to the contaminated environment because of their level of activities [23]. Consequently, mothers are at high risk of infection because of their close relationship with their children even as mothers has continued to share food ration with their children when feeding them in our remote communities.

Co-infection of malaria with intestinal helminthes was higher with hookworm and *Ascaris lumbricoides* having prevalence of 18.9% and 13.2% respectively as shown in this study. Although quite different from the 14.3% and 19.1% prevalence for hookworm and *Ascaris lumbricoides* respectively gotten by Egwunyenga *et al.* [21] in Nigeria. This is probably due to the tropical climatic conditions experienced in this area, which favours the parasites free living stage especially hookworm which has a very wide thermal range [24]. Also, this study corresponds to earlier studies which shows that, the largest clinical disease burden due to infections of both *Plasmodium falciparum* and intestinal helminth species is carried by populations living in sub Saharan Africa [2,3,25].

In addition, the distribution of helminthes in this study is similar to Brooker [26] study which opined that, analysis using geographical information system suggesting that, of the three main soil transmitted helminth (geohelminth) species, hookworm is more geographically widespread, occurring throughout most of sub Saharan Africa compared to *Ascaris lumbricoides* and *Trichuris trichiura* which are typically restricted to equatorial regions. However, outside sub Saharan Africa, co-distribution data remains inadequate but in south East Asia and china, both *Plasmodium falciparum* and *Plasmodium vivax* appear to overlap equally with all the three soil transmitted helminths. Besides, the effects of intestinal helminths and malaria co-infections in pregnancy are burdensome. An interaction between helminthes and malaria could work in either direction. Helminth infection may alter susceptibility to clinical malaria or malaria may influence the clinical consequences of helminth infection [1]. In Nigeria, although plasmodium infection is generally more prevalent, the occurrence of intestinal helminth infection is also high and hookworm infections and *Ascaris lumbricoides*, have been associated with iron deficiency anaemia as observed, even since the nineties [27-29].

Nonetheless, the occurrence of helminth relative to educational level revealed the highest prevalence of 33.3% among those with primary education. This could be as a result of the low level of awareness and knowledge of certain risk factors that predispose them to infection from the environment [30]. In the same manner, several studies indicate that low education levels are associated with poor malaria prevention and access to effective antimalarial preventive mechanism [31-33]. This may also determine hygienic and water contact behaviors, thereby influencing exposure to helminth infective stages in the external environment [30]. Such domestic related risk factors may partially explain the empirical observation that malaria as well as helminth infections tend to cluster within certain households [34].

As relates to parity, malaria tends to show a negative relationship, which is suggestive of the fact that it reduces with parity. This however, may be due to the sudden breakdown of host acquired immunity especially in first pregnancies (primigravids) which is greatly due to the altered immunity of immune inexperience of primigravids resulting from the presence of a new organ - the placenta that allows for the multiplication of placenta specific phenotypes of *plasmodium falciparum* as opposed to the diminished parasite load in multigravids [8]. Moreover, malaria and hookworm are also prevalent among pregnant women especially so in primigravidae [35]. Thus, it is among school aged children and pregnant women that helminthes most likely affect the clinical consequences of malaria infections [1].

In addition, in high endemic areas; acquired immunity in high mortality is less common, asymptomatic and incidental parasitemia are not uncommon [36]. Sequestration of malaria in the placenta and long standing placental malaria occur and peripheral blood may be negative for malaria parasite. Higher parasitemia particularly is second and third trimester; anaemia and altered placental integrity result in less nutritional support leading to low birth weight, spontaneous abortion, stillbirth, preterm birth and excess infant mortality/morbidity. These problems are more common in first pregnancies as parasitemia level decreases with increasing number of pregnancy [7].

Malaria infection remains a very huge Public Health challenge among pregnant women and children in Sub-Sahara Africa, this could be linked to our very weak Health Care System, especially in the hinterland [37] and the inability of our leaders to invest massively in Health Care infrastructure, probably due to the inherent corruption matrix that has always hindered our expansion in the development of our land. Thus, the scenario has to change if we must win the war against some of the neglected tropical diseases which parasitic worms are an integral part and parcel of, and we must win the battle in a sustainable manner with very robust interventions. Nonetheless, one critical Public Health challenge facing pregnant mothers that are infected with malaria or co-infected with some parasitic worms, remains the ability to cope with the burden of anaemia and loss of appetite, which has always left them vulnerable to myriads of diseases and complications that are always associated with pregnancy conditions in woman. Thus, the need for regular routine screening monitoring and evaluation remains the way forward to reduce the negative impact of the interplay among pregnant women.

CONCLUSION

WHO started malaria eradication in the 1960s and have proposed that malaria infections would in the nearest future become history. It is expected however, that with increased awareness of source of infection and proper education, improved sanitary conditions as well as improved economic development, the rate of incidence of malaria and intestinal helminthes would be reduced to the barest minimum.

The observed prevalence of malaria and intestinal helminthes co-infection in this study is low, however it may be for reasons the woman being exposed to health care are probably on anti-malarial and anti-helminthic drugs as well routine drugs. This could have possibly resulted in their decreased rate of infection among the study population. However, the infection with intestinal helminthes and malaria is due to poor sanitary conditions of the environment as well as poor living conditions, which is very much below standard. Also, the study has also indicated that infections among the study population is associated with poor living conditions, poor sanitary conditions of the environment and inadequate provisions of accessible social amenities.

On other hand, the infections could be prevented and controlled by the use of effective chemotherapy which will include appropriate anti-malarial and anti-helminthic drugs, provision of adequate social amenities as well as improved living conditions. Therefore, the infections can be adequately managed by the provision of effective chemotherapy, improved living standards and controls of vectors to reduce transmission.

RECOMMENDATION

Malaria and intestinal helminths infection constitute a major public health concern in Nigeria, and based on the outcome of this study, the following recommendations have been made. Mass education on sources of infections and possible risk factors including effective provision of basic social amenities such good water supply and adequate waste disposal system by the government.

Initiating poverty eradication programme by the government aimed at improvement of socio economic standards and conditions of living of individuals considered to belong to the lower class of society.

Government should also initiate and implement policies and programmes such as roll back malaria programme which is aimed at controlling the spread of malaria.

Control of vectors from their sources by carrying out sanitation measures — drains must work proper and ditches must be filled, unnecessary collection of water in potholes that serves as mosquito breeding sites must be removed.

Early treatment of active infection by administration of anti-malarial drugs to treat active infections and prevent infections in endemic areas. Also treatment of helminthes should be by use of anti-helminthic drugs as well as folate and iron supplements which improve and boost blood cell production.

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CONFLICT OF INTEREST

Non observed among researchers.

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