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Full Length Research Paper

Malaria and Soil Transmitted Helminthes co-infection among Abia State Polytechnic Students, Aba, Southeastern Nigeria

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Soil transmitted helminthes and malaria infections are among the endemic parasitic diseases that have caused over half a million deaths in most tropical parts of the world, where both have similar geographical distribution and co-infections are common. In Nigeria and other tropical countries, malaria and helminthes infections are reportedly endemic and pose significant health problems. It becomes very necessary therefore to determine the impact of malaria and helminthes co-infection. Fresh stool and blood samples were collected from 400 students of Abia State Polytechnic, Aba, aged 18 years and above. The stool samples were analyzed using saline wet mount method. Blood was collected by finger prick to determine malaria parasitemia using thick film method. Univariant analysis and chi-square statistical tests were used to analyze the data. Out of 400 students sampled, consisting of 160(40.0%) males and 240(60.0%) females, 141(35.3%) and 72(18.0%) students were infected with malaria and intestinal helminthes respectively. The percentage co-infection was 53(13.3%). The males were more infected for both malaria (36.9%) and helminthes infection (18.1%) than the females (34.2%) for malaria and 17.9% for helminthes infection. However, the statistical analysis showed that co-infection of malaria and helminthes infections do not depend on sex. Species of soil transmitted helminthes isolated from the stool samples include *Ascaris lumbricoides* (4.5%), Hookworm (6.0%) and *Trichuris trichura* (4.8%). Malaria and soil helminthes infection may co-exist without clinical symptoms, yet they pose serious health threats to the public. Interventions and improvement in sanitation, drainage of stagnant water, health education and the need to sleep on insecticide- treated bed net are highly recommended.

Keywords: Malaria, Helminthes infection, Co-infection.

INTRODUCTION

Soil transmitted helminthes and malaria are among the endemic parasitic diseases that have caused over half a million deaths in most tropical parts of the world, where both diseases have similar geographical distribution and co-infections are common (Snow *et a*l., 2005; Mwangi *et al*., 2006; Brooker *et al*., 2007; Brooker, 2010). Analysis showed that a quarter of African school children may be coincidentally at risk of both malaria and soil transmitted helminthes (Brooker *et al*., 2006). Although the World Health Organization reported that malaria deaths have been reduced by 33% in the African region, people especially children still die as a result of malaria (WHO, 2012). This disease commonly found in the tropics and transmitted by parasites of the genus *Plasmodium* is a major public health problem with a consequent high morbidity and mortality to people living in an environment with inadequate sanitation (Ziegelbaur *et al*., 2012). Usually, deprived communities in malaria endemic areas are likely to be infected with at least one of the three main soil-transmitted helminthes species: Ascaris lumbricoides, Trichuris trichuira and hookworms (Bethony *et al.,* 2006; Mupfasoni *et al.,* 2009; Ayalew *et al*., 2011). Intestinal helminthes infections causes abdominal pain, diarrhea, anaemia, malnutrition, intestinal obstruction and in severe chronic and

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untreated infections could even lead to death (Crompton and Nesheim, 2002; Hotez *et al*., 2008). Continuous exposure to anopheles mosquitoes will worsen the situation with asymptomatic malaria parasites, which often results to co-infection with Plasmodium putting one's life at risk of clinical diseases (Mwangi *et al.*, 2006; Achidi *et al*., 2008). In addition, co-infection with helminthes and malaria parasites have negative impact upon host nutrition through a number of mechanisms which may have additive or multiplicative impacts, especially in childhood (Pullan and Brooker, 2008). Analysis has indicated that the coincidental malaria-soil transmitted helminthes at risk population is greatest for hookworm; then either *Ascaris lumbricoides* or *Trichuris trichiura*. Occurrence of parasitic infections could reduce the function of the specific immune response to each pathogen (Le Hesran *et al.,* 2004).

In Nigeria, malaria and helminthes infections are reported endemic and pose a significant health problem among children (Ogungbamigbe *et al*., 2007). Helminthes infection may alter susceptibility to clinical malaria or malaria may influence the clinical consequences of helminthes infections. Children infected with intestinal helminthes are said to be more susceptible to acute malaria attacks (Lyke *et al*., 2005). This study seeks to investigate the health status of the students in relation to malaria and helminthes parasites, so as to give evidence- based proportion for timely intervention.

MATERIALS AND METHODS

Study Area

Abia State Polytechnic is one of the tertiary institutions located in Aba, a major settlement and commercial center in the southeastern part of Nigeria. The geographical co-ordinates for Aba are 5º 07' N latitude and 7^{o} 22' E longitude and 205m (673ft) above sea level. Aba is within the rainforest zone of Eastern Nigeria, thickly populated with stagnant water and refuse dumps particularly during the rainy seasons that favor malaria and helminthes transmission.

Research Ethics

Ethical review and clearance of the research protocol were obtained from the Ethical Review Committee of the Department of Biology/Microbiology, Abia State Polytechnic, Aba. Permission was sought from the school authority. Each of these students involved in this survey gave consent to their willingness to participate in this study.

Sample Collection and Laboratory Analysis

A cross-sectional study of students was recruited into this study, between the months of January and April, 2015. Those who were not willing to participate were excluded. About 1ml of venous blood was collected from each subject into an EDTA bottle (labeled with code numbers, age and sex) using 5ml syringe. The samples were collected with care with adequate safety precautions and taken immediately to Microbiology Laboratory, Abia State Polytechnic, Aba for screening.

Stool samples were collected from the same group of students into clean universal containers with an applicator stick and the container screw-capped. The samples were collected in the morning when the larvae and eggs of the helminthes were still active and fresh. Each container was labeled appropriately with code number, sex and age and taken immediately for analysis. The sample size was determined using kreijcie and Morgan (1970) formula for determining sample size: $S= X_2NP\ (1-P)/d_2\ (N-1) +X_2P\ (1-P)$.

Microscopic Examination for malaria Parasites and Helminthes Infection

The screening for malaria parasites was done within 30 minutes to 1 hour of collection using Giemsa- stained thick and thin blood films. The films were examined using the 100x oil immersion objective. A slide was considered negative if malaria parasites were not detected after examination; but the presence of Plasmodium species in the films is considered positive.

The stool samples collected from the same students were investigated for parasitic helminthes using normal saline and lugol's iodine (direct wet mount method). A small quantity (0.05g) of each stool sample was picked using an applicator stick. This was emulsified with one drop of physiological saline (0.85%) placed on a clean grease-free slide. The emulsified samples were covered with clean cover slip and examined unstained under the microscope (Fleck and Moody, 1992). In the same vein, small quantity (0.05g) of the stool samples were collected and emulsified in a drop of lugol's iodine and examined under the microscope. The eggs and larvae of helminthes were identified using certain features (Cheesbrough, 1992). Whenever there was delay in the examination of the stool samples, 10% formalin was used to preserve the samples (Francis et al., 2003).

Statistical Analysis

Statistical analysis was done using statistical package for social sciences (SPSS) version 20.0. Statistical significance tests included the use of *p-value* to assess the role of chance and $\chi 2$ (Chi square) test to account for the association between different variables. In this study, p-*value* < 0.05 was used to disapprove the null hypothesis.

Table 1. Sex-related Prevalence of Malaria and Soil Transmitted Helminthes Co-infection

Sex	Number Examined	Number infected with Malaria (%)	Number infected with Helminthes (%)	Co-infection (%)
Male	160	59(36.9)	29(18.1)	21(13.1)
Female	240	82(34.2)	43(17.9)	32(13.3)
Total	400	141(35.3)	72(18.0)	53(13.3)

Table 2. Age-related Prevalence of Malaria and Soil Transmitted Helminthes

Age (years)	Number Examined	Number infected with Malaria (%)	Number infected with Helminthes (%)	Co-infection (%)
18-24	170	86(50.6)	39(22.9)	22(12.9)
25-31	140	34(24.3)	18(12.9)	17(12.1)
>31	90	21(23.3)	15(16.7)	14(15.6)

Table 3. Prevalence of Single/Multiple Helminthes Infections

Single/Multiple Infections	Number sampled	Number infected (%)
Single Helminthes Infection		
Ascaris lumbricoides	400	18(4.5)
Hookworm	400	24(6.0)
Trichuris trichiura	400	19(4.8)
Total	400	61(15.3)
Double Helminthes Infection		
T. trichiura and hookworm	400	6(1.5)
Hookworm and *A. lumbricoides*	400	5(1.3)
T. trichiura and A. lumbricoides	400	Nil
Total	400	11(2.8)
Triple Helminthes infection		
T. trichiura, A. lumbricoides and hookworm	400	Nil

RESULT

A total of 400 students were involved in the survey (Table 1), out of which 160(40.0%) were males and 260(60.0%) were females. From the result, a total of 141 (35.3%) were infected with malaria while 72(18.0%) were positive with helminthes. A total of 53(13.3%) were co-infected with malaria and helminthes. The result also revealed that 21(13.1%) of the male and 32(13.3%) of the females were co-infected. The statistical analysis showed that co-infection of malaria and soil transmitted helminthes does not depend on sex (*p-value* > 0.05).

The age-related prevalence is shown in Table 2. Out of the 400 students sampled, ages 18-24 years had the highest rate of malaria and helminthes infections of 50.6 % and 22.9% respectively. The ages above 31 years had the highest rate of co-infection with infection rate of 14(15.6%). However, co-infection of malaria and soil transmitted helminthes do not depend on age (*p-value*> 0.05).

Table 3 shows the prevalence of single/multiple helminthes infections on the students. From the result, hookworm had 24(6.0%) infection, while *Trichuris trichiura* and *Ascaris lumbricoides* had 19(4.8%) and 18(4.5%) respectively. Sixty one (15.3%) had single infection while 11(2.8%) had double infection. There was no triple helminthes infection observed.

DISCUSSION

Malaria and intestinal helminthes co-infection are common in sub-Saharan Africa because of supportive environmental factors. Aba is located in the rainforest zone of Nigeria with frequent pools of water and refuse dumps particularly in the rainy seasons that favor

mosquito breeding and soil helminthes infections (geo-helminthes). Socio-cultural practices such as barefoot walking and eating without washing hands are additional factors that increase susceptibility of the indigenous population to helminthic infections. The overlapping distribution of helminthes and malaria causes problems of poor nutrition and anaemia in humans (Stenphenson *et al*., 2000). It appears, therefore, that co-infections compromise the health condition of the patient. The present study showed the occurrence of malaria parasite and intestinal helminthes among the students of Abia State Polytechnic, Aba. The high prevalence rate of asymptomatic malaria (35.3%) and helminthes infection (18.1%) obtained in this study shows that these infections are endemic in the studied area. Earlier studies among school children in Southwestern Nigeria recorded higher prevalence of helminth infections (Ojurongbe et al., 2011; Dada-Adegbola et al., 2013). The lower prevalence recorded in this study might reflect the increase awareness and improved sanitary conditions among the students. While the previous studies were conducted among children, the present study was conducted in a tertiary institution. A co-infection rate of 13.3% corroborates with the findings of Egwunyenga *et al* (2001). The results also revealed the presence of single/double helminthic infection; no triple infection was observed. Hookworm has the highest infection rate of 6.0%, while Ascaris *lumbricoides* has the least prevalence of 4.8%.

CONCLUSION

Co-infection of malaria and helminthes parasites was obtained in this study. Given the plausible biological interaction between malaria and helminthes parasites, and the increasing advocacy for de-worming of helminthes parasites in schools, there is a need to intensify the control measures and to extend the control measure into the tertiary institutions.

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