MALARIA AND INTESTINAL PARASITE AMONG CHILDREN IN MUSLIM SCHOOLS, PORT HARCOURT, RIVERS STATE, NIGERIA

ABSTRACT

Introduction: Malaria and intestinal helminthes infections are major public health problem in low and middle-income countries affecting over 2 million people across the globe.

Objectives: This survey was carried out to determine the prevalence of malaria and intestinal parasites among Muslim school children in Port Harcourt, Rivers State.

Methodology: Four Muslim schools: kab model school Rumuagolu, Manbaul hikma Eliozu, An-nur school Rumuodomaya and Al-ameen school Eneka. One hundred and fifty (150) blood and stool samples were collected randomly from the pupils (70 males and 80 female; age range 5-12 years) and examined between the Months of May to July 2018.

Results: The overall prevalence of 50.7%, and 43.3% was recorded for malaria and intestinal helminthes respectively. The prevalence for malaria was 32.5%, 63.0%, 58.0% and 50.0%. Intestinal helminthes was 30%, 53.3%, 42.0% and 53.0% for kab, Manbaul hikma, An-nur and Al-ameen Schools respectively. The frequency of parasites encountered was as follows, *Strongyloides stercoralis* 8.7%, *Ascaris lumbricoides* 14.0%, *Enterobious vermicularis* 1.3%, *Necator americanus* 5.3%, *Ancylostoma duodenale* 4.7%, and *Trichuris trichuria* 9.3%. Malaria and intestinal helminthes infection was highest in females with 51.2% and 45.0% respectively. Pupils between ages 9-10 had the highest infection rate of (54.0%) for malaria while ages 7-8 had the highest prevalence of 47.7% for intestinal helminthes. Co-infection was 22.0%, 23.0%, 22.0% and 32.0% for kab, Manbaul hikma, An-nur and Al-ameen Schools Respectively.

Conclusions: The overall infection for malaria and intestinal helminthes was high. Therefore, regular de-worming of the pupils by parents, and health education are necessary to keep the prevalence in check. This study may also be used to predict risk for communities under consideration.

Key words: Malaria, helminthes, Muslim, Schools, Pupils

1. INTRODUCTION

Malaria is a life threatening disease caused by parasites that are transmitted to man through the bites of infected female Anopheles mosquitoes. It is a vector borne infectious disease caused by a eukaryotic protista of the genus *Plasmodium.* Currently there are five known species of *Plasmodium* that are capable of infecting humans which

are *Plasmodium falciparum, Plasmodium ovale, Plasmodium vivax, Plasmodium malaria, and Plasmodium knowlesi.* The latter causes malaria in humans but is also capable of infecting macaque monkeys Of these species *P*. *falciparum* and *P*. *vivax* are the most virulent. *P*. *ovale* and *P*. *malariae* are generally less virulent than *P. vivax* and *P. falciparum*. Combined, these parasites had contributed to over 228 million reported cases of malaria infection globally in 2018 [1]. This is the most important of life threatening protozoan disease which is responsible for at least 750,000 deaths per year, mostly in young children in Africa [2]. In 2018, there were an estimated 405,000 deaths from malaria globally, compared with 416 000 estimated deaths in 2017, and 585,000 in 2010. [3]. Malaria deaths reduced from about 400,000 in 2010 to about 260,000 in 2018, the largest reduction being in Nigeria, from almost 153,000 deaths in 2010 to about 95,000 deaths in 2018 [3]., 3]. In 2013, there were 198 million cases and 584,000 deaths as a result of malaria worldwide [4]. Over half of the world's population is at risk of malaria infection and as it stands, it's currently endemic in 109 countries in four continents, and of 500 million cases of malaria estimated to occur annually, approximately one million results in death [5]. Global prevalence is concentrated around the equator in tropical and subtropical regions because of ample rainfall, warm temperatures and stagnant waters that provide ideal habitats for Anopheles mosquito larva. Most of the fatalities are in children under the age of five years old and pregnant women [4]. Malaria accounts for at least $12 billion in economic losses each year in Africa and a reduction in annual economic growth estimated at 1.3% [5]. In 2018, an estimated US$ 2.7 billion was invested in malaria control and elimination efforts globally by governments of malaria endemic countries and international partners – a reduction from the US$

3.2 billion that was invested in 2017. The amount invested in 2018 fell short of the US$ 5.0 billion estimated to be required globally to stay on track towards the GTS milestones. Nearly three quarters of investments in 2018 were spent in the WHO African Region, followed by the WHO Region of the Americas (7%), the WHO South-East Asia Region (6%), and the WHO Eastern Mediterranean Region and the WHO Western Pacific Region (5% each) (3). Malaria is the leading cause of child death in the country and around 250,000 Nigerian children die every year from the disease. While children under the age of five and pregnant women are particularly vulnerable, almost the entire population of Nigeria is at risk of contracting malaria [6].

Intestinal parasitic infections have been associated with problems such as vitamin deficiencies, inducing intestinal bleeding, protein energy malnutrition which in turn affects cognitive ability and intellectual development. Soil transmitted helminthes is a major public health problem in low and middle-income countries affecting about 2 million people across the globe [7]. Schistosomiasis along with other soil transmitted helminthes comprises over 40% of the illness caused by all tropical diseases apart from malaria [7]. Intestinal parasitic infections are particularly rampant in areas of the world where climate and poor sanitary conditions promote their survival, reproduction and transmission [8]. Intestinal parasitic infection may have serious consequences on human health, such as hepatomegaly, esophageal varices and bleeding [9]. Besides helminthes, infected individuals could be susceptible to other infections such as malaria and HIV [10].

Intestinal parasites and malaria are diseases associated with poverty due to poor sanitary and environmental conditions, low level of education or illiteracy and low socio-economic class. They are among the common infections throughout the developing countries and have been associated with numerous deaths. This study was carried out to determine the prevalence of malaria and intestinal parasites among children in Muslim Schools in Port Harcourt Rivers State. **METHODOLOGY**

2.1 Study area

The study was conducted in Port Harcourt City; the capital of Rivers State, Nigeria. Obio/Akpor and Port Harcourt city Local governments are commonly referred to as Port Harcourt city [12]. It is situated on the bonny river and is located in the Niger delta. The study area lies within the latitude $4^{0}49'27N$ and longitude $7^{0}2^{1}E$ of the Greenwich meridian. It is about 60km from the open sea, which is immediately where the coastal marshes give way to the land of the interior [13]. Four (4) primary schools that are Muslim owned were used for this study; Al-ameen, kab model, An-nur and Manbaul hikma from Eneka, Rumuagholu, Rumuodomoya and Eliozu Communities.

2.2 Collection of stool sample

Children were given sterile vials containing 10% formalin for stool collection and adequately educated on how to get a little portion of their stool into clean and dried plastic container with which the faecal samples were transported to the Parasitology Laboratory University of Port Harcourt, Rivers State for processing.

2.3. Blood sample collection

The left thumb finger of each pupil was cleaned using a swab moistened with 70% alcohol and allowed to dry. Thereafter, it was pricked using a sterile lancet and

squeezed to obtain a small drop of blood which was smeared onto a slide to make thin blood smear.

2.4 Examination of Samples

2.4.1 Macroscopic examination of stool

This examination involves direct physical observation of the stool, the consistency of the stool and its general form such as hard stool (either formed or semi-formed stool), watery stool (unformed stool), bloody stool, diarrheic or stool containing mucus etc., were observed.

2.4.2 Direct smear examination of stool

About 2 grams of faeces was placed on a clean glass slide using an applicator stick. To it was added a saline solution to emulsify the specimen, so as to enhance the clarity of the cysts which may be observed. A cover slip was then placed on the preparation, avoiding the introduction of air bubbles and viewed with the light microscope using an x10 and x40 objectives respectively for egg/ova, of the parasites.

2.4.3 Formaldehyde-ether concentration method

This method was adopted from [14]. About 1 gram of faeces was emulsified in about 4ml of 10% formol water contained in a test tube. The formol water was prepared by mixing 50ml of strong formaldehyde solution with 150ml of distilled water. About 4ml of the formol water was added to the solution and mixed properly by shaking. The mixture was filtered into a test tube using a cloth gauge and about 3-4ml of diethyl ether was added and shaken vigorously and allowed to stand for 2 minutes. The mixture was then centrifuged at 1000 revolutions per minute (1000rpm) for 3 minutes. Using a glass rod, the faecal debris from the side of the tube was loosened and the supernatants poured

off by inverting the tube. The tube was returned to its original upright position and the fluid from the side of the tube allowed draining to the bottom. The deposit was mixed by tapping the tube with the finger and using a Pasteur pipette, a drop of the sediment was applied on a microscope slide, mixed with Lugol's iodine and covered with a cover slip and examined under the microscope using X10 and X40 objectives respectively.

2.4.4 Examination of blood

The blood was allowed to air dry with the slide in a horizontal position on a staining rack and placed in a safe place to avoid contaminants or flies. A small drop of methanol is added to the thin film, then the thin film was fixed with methyl alcohol for 3-5 minutes and allowed to dry, and then it was stained with 10% Giemsa stain and was then taken to the Department of Animal and Environmental Biology laboratory, University of Port Harcourt for examination, where it was examined under oil immersion lens for detection of malaria parasites.

2.5 Statistical Analysis:

The statistical analysis was done using chi square data analyzing software.

2. RESULTS

A total of 150 blood and stool samples were obtained from four (4) Muslim primary schools during the study as follows; 40, 30, 50, and 30 for Kab model, Al-ameen, An-nur, and Manbal hikma respectively. Seventy-six (50.7%) were positive for malaria parasites as follows; 13 (32.5%), 15 (50.0%), 29 (58.0%), and 19 (63.3%) for Kab model, Al-ameen, An-nur, and Manbal hikma respectively, while 65 (43.3%) was positive for gastrointestinal helminthes as follows; 12 (30.0%), 16 (53.3%), 21 (42.0%),

and 16 (53.3%) for Kab model, Al-ameen, An-nur, and Manbal hikma respectively (Table 1).

Table 1. Prevalence malaria and gastrointestinal helminthes in the study area.

P-value= .87

Schools	No. examined	(%) No. positive for Malaria parasites	(%) No. positive for Gastrointestinal helminthes
Kab model	40	13 (32.5)	12 (30.0)
Al-ameen	30	15 (50.0)	16 (53.3)
An-nur	50	29 (58.0)	21 (42.0)
Manbal hikma	30	19 (63.3)	16 (53.3)
Total	150	76 (50.7)	65 (43.3)

One hundred and fifty pupils were examined for malaria and gastrointestinal helminthes in the study area, 76(50.7%) were positive for malaria as follows; 35(50.0%) and 41(51.2%) for males and females. While 65(43.3%) were positive for gastrointestinal helminthes as follows; 29(41.1%) and 36(45.0%) for males and females respectively (Table 2).

Table 2. Sex related prevalence of malaria and gastrointestinal helminthes in the study area.

P-value= .04

Sex	No. examined	(%) No. positive for Malaria parasites	(%) No. positive for Gastrointestinal helminthes
Male	70	35(50.0)	29(41.1)
Female	80	41(51.2)	36(45.0)
Total	150	76(50.7)	65(43.3)

Age related prevalence of malaria parasites were as follows; 27(50.9%), 22(50.0%), 13(54.2%) and 14(48.3%) for ages 5-6, 7-8, 9-10 and 11-12, while prevalence for

gastrointestinal helminthes were as follows; 24(45.3%), 21(47.7%), 10(41.7%) and 10(34.5%) (Table 3).

Table 3. Age related prevalence of malaria and gastrointestinal helminthes in the study area.

P-value= .87

Age	No. examined	(%) No. positive for Malaria parasites	(%) No. positive for Gastrointestinal helminthes
5-6	53	27(50.9)	24(45.3)
7-8	44	22(50.0)	21(47.7)
9-10	24	13(54.2)	10(41.7)
11-12	29	14(48.3)	10(34.5)
Total	150	76(50.7)	65(43.3)

Sixty-five (43.3%) of the pupils were positive for gastrointestinal helminthes as follows; 21 (14.0%), 13 (8.7%), 2 (1.3), 8 (5.3%), 7 (4.7%), and 14 (9.3%) for *Ascaris lumbricoides, Strongyloides stercoralis, Enterobius vermicularis, Necator americanus, Ancylostoma duodenale and Trichuris trichuria* respectively. Twelve (30.0%) pupils were positive in Kab school as follows; 3(7.5%), 3(7.5%), 1(2.5%), 3(7.5%) and 2(5.0%) for *Ascaris lumbricoides, Strongyloides stercoralis, Necator americanus, Ancylostoma duodenale and Trichuris trichuria* respectively. Sixteen (53.3%) pupils were positive in Al-ameen as follows; 6(20.0%), 3(10.0%), 2(6.7%), 5(16.7%) and 5(16.7%) for *Ascaris*

lumbricoides, Strongyloides stercoralis, Necator americanus and Trichuris trichuria respectively. Twenty-one (42.0%) pupils were positive in An-nur school as follows; 6(12.0%), 6(12.0%), 1(2.0%), 3(6.0%), 3(6.0%) and 2(4.0%) for *Ascaris lumbricoides, Strongyloides stercoralis, Enterobius vermicularis, Necator americanus, Ancylostoma duodenale and Trichuris trichuria* respectively, while 16 (53.3%) pupils were positive in Manbaul hikma school as follows; 6(20.0%), 1(3.3%), 1(3.3%), 2(6.7%), 1(3.3%), and 5(16.7%) for *Ascaris lumbricoides, Strongyloides stercoralis, Enterobius vermicularis, Necator americanus, Ancylostoma duodenale and Trichuris trichuria* respectively (Table 4).

Table 4. Distribution of gastrointestinal helminthes species in the study area.

	No. examined	no. infected (%)	A.l	S.s	E.v	N.a	A.d	T.t	*p-value*
Location									
Kab	40	12(30.0)	3(7.5)	3(7.5)	(0.0)	1(2.5)	3(7.5)	2(5.0)	
Al-ameen	30	16(53.3)	6(20.0)	3(10.0)	(0.0)	2(6.7)	(0.0)	5(16.7)	*.14*
An-nur	50	21(42.0)	6(12.0)	6(12.0)	1(2.0)	3(6.0)	3(6.0)	2(4.0)	
Manbaul hikma	30	16(53.3)	6(20.0)	1(3.3)	1(3.3)	2(6.7)	1(3.3)	5(16.7)	
Total	150	65(43.3)	21(14.0)	13(8.7)	2(1.3)	8(5.3)	7(4.7)	14(9.3)	

Key:

A.l *Ascaris lumbricoides* N.a *Necator americanus*

A.d *Ancylostoma duodenale* E.v *Enterobium vermicularis*

T.t *Trichuris trichuria.* S.s *Strongyloides stercoralis*

Thirty-seven (24.7%) pupils had co-infection of malaria and gastrointestinal parasites in the study area as follows; 12(8.0%), 8(5.3%), 6(4.0%), 7(4.7%) and 5(3.3%) for malaria and *Ascaris lumbricoides, Strongyloides stercoralis, Necator americanus, Ancylostoma duodenale* and *Trichuris trichuria* respectively. Kab model school had co-infection of malaria and gastrointestinal parasites of 9 (22.0%) as follows; 2(5.0%), 2(5.0%), 1(2.5%), 2(5.0%), and 2(5.0%) for *Ascaris lumbricoides, Strongyloides stercoralis, Necator americanus, Ancylostoma duodenale* and *Trichuris trichuria* respectively. Al-ameen school had co-infection of malaria and gastrointestinal parasites of 6 (20.0%) as follows; 2(6.7%), 2(6.7%), 1(3.3%) and 1(3.3%) for *Ascaris lumbricoides, Strongyloides stercoralis, Necator americanus and Ancylostoma duodenale* respectively.

An-nur school had co-infection of malaria and gastrointestinal parasites of 16(32.0%), as follows; 3(6.0%), 4(8.0%), 3(6.0%), 4(8.0%) and 2(4.0%) for malaria and *Ascaris lumbricoides, Strongyloides stercoralis, Necator americanus, Ancylostoma duodenale* and *Trichuris trichuria* respectively. Manbaul hikma school had co-infection of malaria and gastrointestinal parasites of 7(23.3%), as follows; 5(16.7%), 1(3.3%) and 1(3.3%) for malaria and *Ascaris lumbricoides, Necator americanus* and *Trichuris trichuria* respectively.

Table 5. Distribution of co-infection of malaria and intestinal parasites in the study area.

Location	No.examined	No.infected (%)	MP+A.l	MP+S.s	MP+N.a	MP+A.d	MP+T.t	*p-value*
Kab model	40	9(22.5)	2(5.0)	2(5.0)	1(2.5)	2(5.0)	2(5.0)	
Al-ameen	30	6(20.0)	2(6.7)	2(6.7)	1(3.3)	1(3.3)	0(0)	*.45*
An-nur	50	16(32.0)	3(6.0)	4(8.0)	3(6.0)	4(8.0)	2(4.0)	
Manbaul hikma	30	7(23.3)	5(16.7)	0(0)	1(3.3)	0(0)	1(3.3)	
Total	150	37(24.7)	12(8.0)	8(5.3)	6(4.0)	7(4.7)	5(3.3)	

A.l *Ascaris lumbricoides.* N.a *Necator americanus*

A.d *Ancylostoma duodenale* E.v *Enterobium vermicularis*

T.t *Trichuris trichuria* S.s *Strongyloides stercoralis*

Thirty-seven (24.7%) pupils had co-infection of malaria and gastrointestinal parasites in the study area as follows; 12(8.0%), 8(5.3%), 6(4.0%), 7(4.7%) and 4(2.7%) for malaria and *Ascaris lumbricoides, Strongyloides stercoralis, Necator americanus, Ancylostoma duodenale* and *Trichuris trichuria* respectively. Twelve (17.1%) males had co-infection as follows; 4(5.7%), 2(2.9%), 2(2.9), 3(4.3), 1(1.4) for malaria and *Ascaris lumbricoides, Strongyloides stecoralis, Necator americanus, Ancylostoma duodenale* and *Trichuris trichuria* respectively. While females had 25(31.3%) had co-infection as follows; 8(10.0), 6(7.5), 4(5.0), 4(5.0) and 3(3.8) for malaria and *Ascaris lumbricoides, Strongyloides stecoralis, Necator americanus, Ancylostoma duodenale* and *Trichuris trichuria* respectively (Table 6).

Table 6. Sex related distribution of co-infection of malaria and intestinal parasites.

Sex	No.examined	No.infected (%)	MP+A.l	MP+S.s	MP+N.a	MP+A.d	MP+T.t	p-value
Male	70	12(17.1)	4(5.7)	2(2.9)	2(2.9)	3(4.3)	1(1.4)	0.04
Female	80	25(31.3)	8(10.0)	6(7.5)	4(5.0)	4(5.0)	3(3.8)	
Total	150	37(24.7)	12(8.0)	8(5.3)	6(4.0)	7(4.7)	4(2.7)	

A.l *Ascaris lumbricoides.* N.a *Necator americanus*

A.d *Ancylostoma duodenale* E.v *Enterobium vermicularis*

T.t *Trichuris trichuria* S.s *Strongyloides stercoralis*

3. Discussion

The prevalence of malaria and gastrointestinal helminthes among pupils of four Muslim schools in Port Harcourt Rivers State was 50.7% and 43.3% respectively. This finding on malaria is higher when compared to [15] who recorded a prevalence of (43.1%) malaria parasitemia in school children from two districts of Ghana but lower than the findings of [7] who recorded a prevalence of 63.3%. The 43.3% prevalence of gastrointestinal helminthes in line with [16, 8 and 17], But lower when compared to 72.2% finding by [18].

Manbaul hikma School had the highest prevalence of (63.0%) and (53.8%) for malaria and gastrointestinal helminthes respectively, this might be as a result of the surrounding

bushes and water puddles which aid the proliferation of the vector agent mosquito. The high occurrence of intestinal helminthes infection in Manbaul hikma was not unusual because the area is rural. Parasitic diseases are known to be common in rural areas due to poverty, ignorance and low sanitary conditions [19, 20]. This is similar to the reports of [21] that carried out research to determine Risk factors and Socio-Demographic determinants of intestinal helminthes among children in school.

The least prevalence was recorded in Kab model school, the low prevalence may be attributed to high level of hygienic practices and regular deworming among the pupils which reduced transmission.

This is also in agreement with the works of [16, 15 and 17].

Males had higher prevalence of (33.3%) to females who had (27.8%) in gastrointestinal helminthes. This might be as a result of male children getting involved in activities of such as playing in contaminated soils most times bare footed and could have exposed them to infections. This finding is in line with [22, 23 and 24]. Females had a higher malaria parasite infection prevalence of (51.2%) than the males (50.0%). This might be as a result of hormones and other intrinsic factors such as menstruation in some of the females, which might affect the body's immune system due to loss of blood and also the involvement of females in more outdoor activities like washing, cleaning and cooking.

This is in contrast to the works of [25] where the prevalence of male to female is higher in a proportion of (59.8%:40.2%).

Age groups 9-10 and 5-6 had same infection rate of (42.9%) in helminthes infection followed by 7-8 (30.0%) [24]. While age group, 9-10 has the highest infection rate of

(54.2%) of malaria parasite, followed by ages 5-6 with prevalence of (50.9%). (*P= .87).* These findings are not strange as the age ranges fall within susceptible groups.

Six species of intestinal helminthes was recovered from the study area. These includes; *Strongyloides stercoralis*, *Ascaris lumbricoides*, *Enterobius vermicularis*, *Necator americanus*, *Ancylostoma duodenale* and *Trichuris trichura*. The prevalence of *Strongyloides stercoralis* in this study was (8.7%) which is in contrast with [26] who had a higher prevalence of (17.0%) in his study. The low prevalence of *S*. *stecoralis* might be as a result of improving hygiene practices in the various schools. *Ascaris lumbricoides* had a prevalence of (14.0%). This is similar to the result obtained from the works of [27] who also encountered *Ascaris lumbricoides* in his research. *Enterobium vermicularis*, *Necator americanus*, *Ancylostoma duodenale* and *Trichuris trichuria* had prevelences of (1.3%), (5.3%), (4.7%), and (9.3%) respectively, which is in line with [28].

Co-infection of malaria and intestinal parasites was recorded during the study with 32% occurring in An-nur. Males had a lower co-infection than female 31.3% as this might be as a result of their biology. Co-infection in this study is in line with the study of [29].

4.1 Conclusion

Having observed the high prevalence of gastrointestinal helminthes and malaria parasites in the study area and the danger it portends for the school children most of whom are ignorant and fall within the vulnerable age brackets, lacking access good toilet facilities, clean environment and good health care, regular medical checks and treatment of malaria should be done for the children as routine de-worming of the pupils

and health education which are necessary to keep the prevalence of gastrointestinal helminthes in check are often carried out in school by health authorities.

Consent

Survey visits were made to identify the school and interact with the management and obtain their consent to participate in the study.

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