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The Role of Health Education in the Prevalence of Intestinal Parasitic Infections and Salmonella among Primary School Children in Douala, Littoral Region, Cameroon

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Abstract Mass drug administration is the cornerstone for the control of infection with intestinal parasites, but it does not prevent reinfection and is unlikely to interrupt transmission as a stand-alone intervention. The study, therefore, aimed to determine the role of health education in the prevalence of intestinal parasitic infections (IPI) among primary school children in Douala, Cameroon. The study was intervention case-control, and prospective longitudinal, conducted in two primary schools in Douala, Littoral Region, Cameroon. The study population consisted of 300 students for both sexes, enrolled from the 1st and 6th grade. For comparison, we used the independent sample t-test. The data were analyzed using SPSS version 22 software. The prevalence of IPI has increased significantly (t=-2.606; P=0.01) in GBPS Ndobo (Control) 6 months after the first phase. The prevalence of intestinal parasites decreased significantly (t =4.093; P<0.0001) in GS Nkonjibe (Experimental) after the intervention. A significant difference in the prevalence of salmonella was found in GS Nkonjibe (Experimental arm) after the intervention (t=2.787; P=0.006). *Ascaris lumbricoides* was found to be predominant parasites to cause parasitic infection in both schools. The decrease in the prevalence of *Ascaris lumbricoides* was observed to be associated (P=0.021) with the intervention in GS Nkonjibe (Experimental). Health education intervention increased school children knowledge of IPI that resulted in the reduction of the prevalence of IPI.

Keywords: *GBPS Ndobo (Control), GS Nkonjibe (Experimental arm), prevalence intervention, intestinal, parasites, infections, Douala, Cameroon*

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1. Introduction

Intestinal parasitic infections (IPI) remain a public health concern in most sub-Saharan African countries and school children being more at risk [1]. It is estimated that more than 10.5 million new cases of diseases caused by intestinal helminths (*Ascaris lumbricoides*, *Trichuris trichiura*, hookworms, and *Hymenolepis nana*) and intestinal protozoan (*Balantidium coli*, *Giardia lamblia*, *cryptosporidium parvum*, and *Entamoeba histolytica*) are reported annually [2]. These parasites can be transmitted directly (hand-to-hand contact) or indirectly (contact with contaminated food, water and environmental surfaces) [3]. The global epidemiological data indicate that approximately 50% of the world population is infected with one or more IPI, resulting in 450 million cases of diseases yearly [4]. Estimates of the worldwide burden of infection with soil-transmitted helminths range from 4.7 million to 39.0 million disability-adjusted life-years [5], while IPIs are responsible for more than 58 million diarrheal cases detected each year [6]. Almost half of the global disease burden due to worm infections is borne by children aged 5 to 14 years [7]. A recent study has shown that this age group can contribute up to 50% of the *Ascaris lumbricoides* burden in the community [8]. According to the World Health Organization (WHO) fact sheet on STHs, globally, over 568 million school-age children live in intestinal helminth prevalent area [9]. The WHO strategy for STH control is to treat all preschool- and school-age children and women of childbearing age living in endemic areas. Treatment frequency depends on the STH prevalence in a particular community. When the prevalence of intestinal worm infection exceeds 20%, mass treatment should be given to major risk groups once a year; two treatments per year are recommended when the prevalence is greater than 50% [1]. IPI has been associated with several pathologies including anaemia, nutrient deficiency, cellular and tissues damage leading to intestinal bleeding or obstruction [10]. The combination of the symptoms result in delayed growth, decreased mental development, school absenteeism, low academic achievement, prone to malnutrition and infection [11]. The school can provide the ideal framework for health-promoting activities aimed at disease prevention and strengthening of health protection factors and thus, providing an ideal environment for effective actions for health education [12]. The school platform is of great importance since children are more receptive to educational stimuli and are disseminators of information received on arrival at the family environment. School children are the most commonly affected groups due to their poor handwashing practice, unhygienic feacal activity, consumption of non-potable water and there are at the formative phase of their immature immune system [13]. Children tend to be more active in the infected environment and rarely employ good sanitary behaviours.

Bieri (14) reported the development and testing of a health education package that included a 12-minute animated narrative cartoon video entitled “The Magic Glasses” to prevent STH infections in Chinese primary school students. They found out that the health education package resulted in a 50% efficacy in preventing STH infections and established proof of principle that the video-based health educational package increases student knowledge and improves hygiene practice, resulting in fewer worm infections [14] Researchers in People Republic of China have developed and successfully tested in Hunan province, a health education package to prevent STH infections in Han Chinese primary school students [15] This renewed attention in children is particularly concerning since the population structure of Cameroon shows a predominance of children under the age of 15 which stands at 43.6 %. [16]. Recent epidemiological data in Cameroon showed a declining pattern in the occurrence of intestinal parasitic infection. A prevalence rate of 50.0% was reported in Yaounde [17], 28.1% in the Buea Sub Division [18] and 9.6% in Douala metropolis [19]. A recent study conducted on school children aged 3-15 years in the Health District of Lolodorf, South Region of Cameroon indicated an overall prevalence of infection rate of 46.8% of IPI. The authors found out that the global egg load varied from 24 to 30.000 eggs per gram of stool, 24 to 56400 eggs per gram of stool and 24 to 14520 eggs per gram of stool for *Ascaris lumbricoïdes*, *Trichuris richiura* and hookworms respectively [20] (Nkengazong *et al*., 2018). According to [21] (WHO-Cameroon, 2017), the deworming campaign of school-age children took place in 24 000 primary schools in the country and nearly 9 000 000 school children were administered chemo-preventive drugs. The keystone of IPI control adopted by the Ministry of Public Health through the National Programme for the Control of Schistosomiasis and Soil-Transmitted Helminthiasis (NPCS/STH) is Bi-annual administration of chemotherapy curtail the disease burden [22] (Tchuem Tchuenté *et al*., 2009).

Bi-annual administration of chemotherapy as a sole intervention for the control of intestinal parasitic infections may not be enough to achieve elimination [15]. The burden of intestinal parasitic infections in school-age children in different settings is still poorly defined in Cameroon because there are several locations for which epidemiological data are lacking. Moreso, few studies have been carried out to determine the role of education on the prevalence of intestinal parasitic infection in school-going children. The study, therefore, aimed to determine the role of health education in the prevalence of IPI among primary school children in Douala, Cameroon. Our findings will provide a complementary interventions strategy for prevention and control, to curb the burden of IPI in school children in Douala metropolis.

2. Materials and Method

2.1. Study Area

The study was conducted in two primary schools from December 2015 to May 2016 in the city of Douala, the economical capital and the main seaport of Cameroon. The city is situated near the Atlantic coast and 1 m above sea level. Douala is located on the coast of Atlantic Ocean, at the bottom of Guinea Gulf region of Cameroon with a land area of 20 248 square kilometres and a total population of 3,623,770 inhabitants [23]. Douala has an equatorial climate, and the average annual temperature is 26.6°C with total annual rainfall ranging from 0.00 mm to 585.5 mm [24]. Water supply by national water supply company through the distribution system is inadequate and erratic.

2.2. Study Design, Sample Size and Sampling Technique

The study was intervention case-control, and a prospective longitudinal study conducted among school children attending Government Bilingual Primary School (GBPS) Ndobo and Government School (GS) Nkonjibe in Douala, Littoral Region, Cameroon. A single population proportion formula was used to estimate the sample size (n). $n=Z^2xP\ (1-P)/d^2$. Taking 24.1% prevalence (p) of intestinal parasites from study by Tchuem [25], 95% confidence level (Z = 1.96) and 5% margin of error (d = 0.05), the initial sample size was 214. By considering a 15% (32) non-response rate, the target sample size was 245. Schools were randomly allocated to either the control or intervention arm.

The total sample size was equally allocated to the schools. Participant children were selected using multistage random sampling technique based on their educational level consisting of junior school children (grade 1 to grade 3) and senior school children (grade 4 to grade 6). School children were selected based on a quota that was allocated to each grade level based on the total number of students.

2.3. Inclusion/Exclusion Criteria

The inclusion criteria were: being within the age group of 5-14 years old, attending the selected schools, volunteer to participate in the study. Children who took antihelminthic or anti-protozoal drugs within the last 3 months and those who were not willing to give stool samples were excluded from the study.

2.4. Intervention Program

Following sample collection, the health educational package that informed children about the transmission and prevention of IPI was given to the pupils of GS Nkonjibe (experimental arm), with emphasis on the aspects of personal hygiene relevant to the control of faeco-orally transmitted parasitic infections and salmonellosis. The study was conducted in two phases.

2.4.1. Phase I

Data were obtained included questionnaires and stool samples for laboratory analysis. School children were administered a questionnaire to provide information on personal biodata (name, age, sex, grade) and their awareness toward faecao-orally transmitted parasites and salmonellosis. Children questionnaires were prepared and distributed through the headmasters of the schools and the teachers. Questionnaires were returned through the same channel.

2.4.2. Phase II

The second phase was conducted 6 months after the end of the first intervention. The same questionnaire was administered to assess children's perception of IPI, then stool samples were collected. However, pupils in the GBPS Ndobo (control school) received health education only at the end of the sample collection.

2.5. Stool Collection and Examination

For stool collection, a single well labelled, clean, dry, disinfectant free, wide-mouthed plastic container were distributed to each study participant with instruction requesting them to return stool sample immediately. Stool samples were collected from each student along with a questionnaire. After receiving about 10-g single stool specimen, trained microscopists prepared two slides from each stool specimen for wet mount in saline and formal ether concentration technique. Each slide was microscopically examined initially under low power (10X) bright-field, then under high power (40X) bright-field on the field. Simultaneously, samples were emulsified in a 10% formalin solution and transported to the Laboratoire Sainte Anne (New-Bell, Douala), within 2 hours of collection. For the emulsified sample, 1 g (pea size) of faeces was added in about 4 mL of 10% formal water and then mixed and sieved into another tube. Then, 3-4 mL of ether was added and centrifuged immediately at 750-1000 g (~3000 rpm) for 1 min. Finally, the supernatant was discarded, and then a small portion of the sediment was transferred to a slide and covered with a cover-slip and examined first with 10X and then 40 X objectives and examined microscopically. Both saline wet mount and formal ether concentration techniques were used for examination of intestinal parasites as described by [26] (Cheesbrough, 2006). For the culture of *Salmonella species*, a pea-size of the stool sample was added into 10 mls of Selenite F broth and incubated at 37°C for 24hrs. Then sub-cultured onto Salmonella Shegella (SS) agar and incubated for 24 hours 37°C. *Salmonellae species* produced raised black colonies on SS agar [27].

2.6. Statistical Analysis

Data were entered into Microsoft Excel and exported to SPSS version 21 software for analysis. The study population characteristics were calculated using descriptive statistics. The chi-square test was used to compare the prevalence of parasites with sex, age groups and grade level. The student's t-test was used for comparison before and after the health education intervention at a significant level of 0.05.

2.7. Ethical Considerations

The study was approved by the Institutional Review Board of the University of Douala, Douala (No CEI-UD/377/01/2015/M). Study subjects were provided information about the purposes and objectives of the study and the possible discomforts that their participation in the study might cause to them. Sensitization meetings were held with Headmasters and teachers, members of the school' Parents and Teachers Association (PTA) on the justification, procedures, risks and benefits of the study. Prior to the commencement of the study, written informed consent was obtained from the parents or legal guardians of all school children. Parents and students were informed of their right to withdraw from the study at any time. Every parasitized individual in this survey was sent for treatment at the Bonassama District Hospital. The treatment protocol was as follows: pupils parasitized by STHs were given, under medical supervision, 2 oral 100 mg doses per day of mebendazole for 3 days, repeated after 10 days, whereas individuals with protozoan infections (giardiasis and amoebiasis) were given 3×250 mg doses per day of metronidazole for 7 days. Individuals with mixed infections were first treated with mebendazole and later with metronidazole as recommended by Cameroon' Ministry of Public Health efforts through the National Program for the Control of Schistosomiasis and Soil-transmitted helminthiasis (NPCS/STH).

3. Results

3.1. Characteristics of Study Participants

A total of 300 school children with an aged range of 4-14 years participated in this study. They were from two government primary schools in Douala namely; GBPS Ndobo (control arm) and GS Nkonjibe (Experimental arm). In GBPS Ndobo (control arm), 55(36.7%) male and 95 (63.3%) female were recruited, while in GS Nkonjibe (Experimental) children less than 9 years were 51(34.0%) and those between 9-12 years were 66(44.0%) (Table 1).

Table 1. Characteristics of Study Participants

Variables	Schools n(%)		Total n(%)
Gender	GBPS Ndobo (Control)	GS Nkonjibe (Experimental)	
Male	55(36.7)	50(33.3)	105(35)
Female	95 (63.3)	100(66.7)	195(65)
Total	150	150	300
Age group			
<9	42(28.0)	51(34.0)	92(30.7)
9-12	87(58.0)	66(44.0)	153(51)
>12	21(14.0)	33(22.0)	54(18)
Total	150	150	300
Grade			
Junior	71(47.3)	70(46.7)	141(47)
Senior	79(52.7)	80(53.3)	159(53)
Total	150	150	300

Prevalence of intestinal parasites

Before health education intervention (phase1) parasites were present in 50(33.3%) stool specimens collected in GBPS Ndobo (Control) and 78(52.0%) in GS Nkonjibe, the experimental school (Table 2). Our findings indicated a significant association between age group (P =0.008) and grade level (P= 0.001) and prevalence of intestinal parasites (IP) in GS Nkonjibe (Experimental) before health education intervention. There was a significant decrease in the prevalence of IP after health education in GS Nkonjibe (Experimental) (t =4.093; P<0.0001).

Prevalence of Parasite species

Seven different types of IP (*Ascaris lumbricoides*, *Trichuris trichiura*, Hookworm, *Hymenolepis nana*, *Entamoeba histolytica*, *Giardia lamblia*, *Balantidium coli*) were found in stool samples collected from school children. In GBPS Ndobo (Control), the change in the prevalence of parasites was significant for *Ascaris lumbricoides* (P=0.022) six months later. In GS Nkonjibe (Experimental), a significant decrease in the occurrence of *Ascaris lumbricoides* (P=0.021) occurred after health education package was implemented. We also observed a decreasing trend (P=0.054) in the prevalence of *Trichuris trichuira* in GS Nkonjibe (Experimental) after the intervention.

Predisposing factors for the prevalence of intestinal parasites

In GS Nkonjibe (Experimental arm) school, the knowledge of diseases transmitted by dirty hands resulted in a decrease in the prevalence of IP from 61.5% to 35.2%. The prevalence of IP among school children that gave the correct answer on how intestinal worm is transmitted contracted from 46.6% to 22.6% when health education was held (Table 4) in GS Nkonjibe (Experimental arm).

Table 2. Prevalence of IPI Before and After Health Education Intervention According to Gender Age Group, and Grade Level

Schools		Number (%) of samples infected with parasites			
		Before health education intervention		After health education intervention	
GS Nkonjibe (Experimental)	Gender		P-value		P-value
	Male	24(48.0)	0.495	17(30.4)	0.854
	Female	54(54.0)		27(28.7)	
	Total	78(52.0)		44(29.3)	
	Age group				
	<9	35(68.6)	0.008	22(33.3)	0.376
	9-12	31(47.0)		11(22.0)	
	>12	12(36.4)		11(32.4)	
	Total	78(52.0)		44 (29.3)	
	Grade		0.001		0.715
	Junior	47(67.1)		19(31.7)	
	Senior	31(38.7)		25(27.9)	
	Total	78(52.0)		44 (29.3)	
GBPS Ndobo (Control)	Gender		0.477		0.092
	Male	15(29.1)		22(38.6)	
	Female	34(35.8)		50(53.8)	
	Total	50 (33.3)		72(48.0)	
	Age group				
	<9	17(40.5)	0.392	30(71.4)	0.001
	9-12	28(32.2)		36(41.4)	
	>12	5(23.8)		6(28.6)	
	Total	50 (33.3)		72(48.0)	
	Grade		0.083		0.0001
	Junior	29(40.8)		43(70.5)	
	Senior	21(26.6)		29(32.6)	
	Total	50 (33.3)		72(48.0)	

Table 3. Comparison of the Frequencies of IPI Before and After the Health Educational Intervention

Parasite species	Number (%) of infected samples in GBPS Ndobo (Control arm)			Number (%) of infected samples in GS Nkonjibe (Experimental arm)		
	Before intervention	After intervention	P- value	Before intervention	After intervention	P- value
Ascaris lumbricoides	15 (9.9)	29 (19.3)	0.02	21(14.0)	9 (6.0)	0.02
Trichuris trichuira	4 (2.6)	6 (4.0)	0.52	8 (5.3)	2 (4,5)	0.05
Hookworm	7 (4.6)	14(9.3)	0.11	13 (8.5)	10 (6.7)	0.51
Hymenolepsis nana	1 (0.7)	5(3.3)	0.1	4(2.7)	4(2.7)	1.00
Entamoeba histolytica	13 (8.8)	7 (4.7)	0.16	22 (14.7)	13 (8.5)	0.10
Giardia lamblia	6(4.0)	8 (5.3)	0.58	8 (5.3)	4(2.7)	0.24
Balantidium coli	4(4.6)	3 (2.0)	0.70	2 (1.3)	2 (1.3)	1.00
Total	50 (33.3)	72(48.0)		78(52.0)	44 (29.3)	

Prevalence of *Salmonella*

There was no significant difference between the prevalence of Salmonella in both schools and gender, age group and grade level before the health education package was delivered. The prevalence of Salmonella in age group and grade level varied significantly in both schools after the intervention. In GBPS Ndobo (control) the prevalence of Salmonella increase after 6 months, but no significant difference (t = -1.506; P=0.133) was observed. In the present study, a significant decrease on the prevalence of salmonella was found in GS Nkonjibe (Experimental arm) after the intervention (t = 2.787; P=0.006).

4. Discussion

Children are at major risk for infection with soil-transmitted helminths, and programs at schools are a cost-effective means of delivering interventions, a feature that was recognized by the WHO through the launch of the Global School Health Initiative [28]. Mass drug administration is the cornerstone for the control of infection with soil-transmitted helminths, but it does not prevent re-infection and is unlikely to interrupt transmission as a stand-alone intervention [29].

Supplementary intervention, such as health education to complement existing strategies, for integrated control of the infection is a key element in achieving several of the United Nations Millennium Development Goals [7]. The prevalence of intestinal parasites in GBPS Ndobo (Control arm) and GS Nkonjibe (Experimental arm) schools before health education intervention were 33.3% and 78.0% respectively, were contradictory to findings by Kamga (50.9%vs 51.5%) [30], and Eldessouki (57.5% and 52.5%) [31]**.** In GBPS Ndobo (Control arm), in which no health education was given, our findings indicated a significant increase in intestinal parasites. The increase in the rate of intestinal parasite in the GBPS Ndobo (Control arm) could be attributed to the deplorable state of a school toilet, poor water supply and unhygienic. Moreso, erratic water supply by the State-run Water Utility Company might have aggravated the condition. GBPS Ndobo lacks a borehole or a dug shallow well water to supply water to the school-children in the absence of pipe borne water. In the present study, the high prevalence of IPI in the GS Nkonjibe (Experimental arm) was inconsistent with studies conducted in other regions of the country. For instance, a study conducted among school children in the Health District of Lolodorf [20] showed lower prevalence (46.8 %) of IPI. Furthermore, lower prevalence (48.3%) of IPI was reported from a study conducted in the population of Bamboutos locality (West Region, Cameroon) [32]. Access to safe drinking water, absence of hands washing habits and environmental conditions might bring about such differences.

Table 4. Predisposing factors for prevalence of intestinal parasites among primary school children

S.no	Parameters	Frequency of intestinal parasites in GBPS Ndobo (control)		Frequency of intestinal parasites in GS Nkonjibe (Experimental)	
1		Do you know of diseases transmitted by no washing the hands			
		Before	After	Before	After
	Yes	9(25.5)	11(40.7)	16(61.5)	25(35.2)
	No	41(37.5)	65(52.8)	62(50.0)	19(24.1)
2		Have you ever seen worms in your stool			
	Yes	13(27.1)	24(57.1)	32(60.4)	15(15.0)
	No	37(36.3)	53(54.7)	46(47.3)	29(29.0)
3		Do you know how people contact intestinal worms			
	Yes	6(31.6)	12(57.1)	13(46.6)	14(22.6)
	No	44(33.6)	64(49.6)	65(53.3)	30(34.1)
4		Have you ever heard about typhoid			
	Yes	21(42.9)	22(47.8)	39(62.9)	26(30.2)
	No	42(41.6)	54(51.9)	39(44.3)	18(28.1)
5		Do you know how people contact typhoid fever			
	Yes	9(33.3)	13(56.5)	14(43.8)	20(22.2)
	No	54(43.9)	63(49.6)	52(44.1)	23(38.3)

Table 5. Prevalence of Salmonellosis before and after health education intervention according to gender and age group

Schools		Number (%) of samples infected with *Salmonella*			
		Before health education intervention		After health education intervention	
GS Nkonjibe (Experimental)	Sex		P- value		P -value
	Male	21(42.0)	0.862	19(33.9)	0.35
	Female	45(45.0)		24(25.5)	
	Total	66(44.0)		43(28.7)	
	Age group		0.196		0.02
	<9	27(52.9)		26(39.4)	
	9-12	28(42.4)		8(16.0)	
	>12	11(33.3)		9(26.5)	
	Total	66(44.0)		43(28.7)	
	Grade		0.101		0.04
	Junior	36 (51.4)		23(38.3)	
	Senior	30 (37.5)		20(22.2)	
	Total	66(44.0)		43(28.7)	
GBPS Ndobo (Control)	Gender		0734		0.40
	Male	22(23.1)		26(45.6)	
	Female	41(43.2)		50(53.8)	
	Total	63(42.0)		76(50.0)	
	Age group		0.620		0.004
	<9	14(33.3)		30(71.4)	
	9-12	39(44.8)		39(44.8)	
	>12	10(8.8)		7(33.3)	
	Total	63(43.0)		76(50.0)	
	Grade		0.546		0.001
	Junior	28(39.4)		41(57.2)	
	Senior	35(44.3)		35(39.3)	
	Total	63(42.0)		76(50.0)	

The prevalence of IPI did not vary with sex in both schools, which is similar to the observation made in previous works [20,33]. However, the present study found a significant association between the age group, grade level and occurrence of IP in GS Nkonjibe (Experimental arm) school before health education.

The prevalence of IP in school children attending GBPS Ndobo (Control) before health education package intervention was lower than that of Tchapda [34] who found a prevalence of 26.6% for intestinal parasites among public primary schools the city of Douala.

In the present study, health education intervention resulted in the reduction in the prevalence of IPI from 78% to 44 % among schoolchildren attending GS Nkonjibe (Experimental). A similar decrease was observed in Salmonella prevalence after health education intervention.

The decrease in the rate of IPI could have been as a result of the increase in knowledge of school-children about intestinal parasites ipso facto lead to improved personal hygiene practice. Consequently, awareness about transmission of the intestinal parasite might have led to behaviour change, resulting in fewer infections. This is consistent with other studies [15,29]. The significant change in prevalence in the experimental school cannot be attributed to seasonal variation; a significant increase of IPI was observed in GBPS Ndobo (Control) 6 months after the first collection. Similarly, a study in Brazil on IPI by Pereira [35] found out that playful educational interventions are an excellent didactical resource in the teaching-learning process of schoolchildren and resulted in a significant decrease of IPI prevalence among children. Reports by Bieri [15] describes successful prevention of soil-transmitted helminth (STH) infections in Chinese school children through the use of a health education package that includes a 12-minute video cartoon, ''The Magic Glasses,'. Similar, the decrease of the prevalence of Salmonella was observed in GS Nkonjibe (Experimental) after the intervention. The present findings suggest that proper hand washing system by the school children could result in the overall reduction of IPI in the study population.

Our data indicated an association between respondent's correct answers and the prevalence of IPI. Basic knowledge of intestinal parasites transmission could be the key factor influencing personal hygiene practice. In Brazil, Bragagnollo [12] found out that, the playful educational interventions offered help to the students, to efficiently identify the mode of transmission of parasites, which is fundamental to establish actions for preventing intestinal parasites.

An interesting finding is that knowledge of intestinal parasites is translated into action, thus reducing the burden of the infection. On the contrary, [35] Pereira (2012) observed that though 50% of local residents of Campos dos Goytacazes, Rio de Janeiro, Brazil, were parasitized and had some knowledge of intestinal parasitic infections but did not apply this knowledge in improving their personal hygiene.

Our analysis showed that *Ascaris lumbricoides* was the most prevalent IPI in both schools. This is supported by other studies in the same city [34] and elsewhere [36].

Comparing the prevalence of different parasites in the GS Nkonjibe (Experimental arm) school before and after health education, there was a drop in *Ascaris lumbricoides* (14% vs. 9.0%), *Entamoeba histolytica* (22% vs. 13%) which are similar from findings by Kamga [30] for *Entamoeba histolytica* (20% vs. 10%), *Ascaris lumbricoides* (10% vs. 5%). The occurrence of *Ascaris lumbricoides* could have been attributed to poor hand washing of school children, frequent contact with contaminated soil and insufficient provision of potable water in the selected schools.

5. Conclusion

The work indicated a high prevalence of IPI among school-going children attending GBPS Ndobo (Control arm) and GS Nkonjibe (Experimental) in Douala. Health education intervention increased school children knowledge of IPI that resulted in the reduction in the prevalence of IPI. These findings highlighted the need to supplement mass drug administration with health education among school children for sustainable IPI control.

6. Study Limitations

As limitations of the study, we highlight the short period for implementation of the health education package intervention, the restriction of the study to two primary schools in Douala. The use of molecular techniques could have helped to improve the diagnosis of intestinal parasites and take appropriate prevention and control measures

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Authors' Contributions

FK, conceived the study, wrote the proposal, participated in data collection, analyzed the data and drafted the manuscript. BT, conceived the study, analyzed the data and drafted the manuscript. HLFK Conceived the study, wrote the proposal, and drafted the manuscript. SA analyzed the data. All authors read and approved the final manuscript

Competing Interests

The authors declare that they have no competing interests.

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