International Journal of TROPICAL DISEASE & Health

Volume 44, Issue 23, Page 29-44, 2023; Article no.IJTDH.110021
ISSN: 2278–1005, NLM ID: 101632866

Knowledge, Attitude and Practice of Children (5 to 14 Years) in Relation to Predisposing Factors and Prevention of Soil-transmitted Helminth Infections in South West Region, Cameroon

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJTDH/2023/v44i231502

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/110021

Original Research Article

Received: 01/10/2023
Accepted: 03/12/2023
Published: 16/12/2023

ABSTRACT

Soil-transmitted helminths (STHs) diseases are among the group of Neglected Tropical Diseases (NTD). STHs infections are a significant public health problem globally with children being the most affected group. This study aimed to assess the knowledge, attitude and practice in relation to

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predisposing factors and preventive measures for STHs among children 4 to 15 years in Mutegene community.
It was a cross-sectional study, involving 250 school children of both sexes. A systematic random sampling method was used to collect data. Basic demographic data was obtained from the class registers. A structured questionnaire was used to collect information on personal bio-data, characteristics of their home and school environment in relation to helminthes transmission and prevention. Data was analysed using SPSS version 21 and Chi-square test.
The results showed that 44.4 % (n=109) of the participants had good knowledge of parasitic worms, and 62.0 % (n=155) of the participants knew how to avoid getting infected with worms. Soil-transmitted helminth infection was present in Mutengene community with an overall prevalence of 3.6% and the species present included *A. lumbricoides, T. trichiura,* and *hookworms*. Participants who indicated that they played out-doors had the highest prevalence (2.8%, n=7) closely followed by those who usually played in water (2.4%, n=6) and thirdly, by those who always put dirt in their mouth (2.0%, n=5).
At the end of the study, the researchers ecommended that health education should be given through community radios and televisions as a means of making the people understand the mode of transmission and methods of prevention of STH infection in order to eliminate STHs.

Keywords: Soil-transmitted helminths; knowledge; attitude; practice; transmission; prevalence; prevention and control.

1. INTRODUCTION

Soil-transmitted helminthiasis (STH) refers to a group of parasitic diseases caused by nematode worms that are transmitted to humans through faecally contaminated soil. The soil-transmitted helminths of major concern to humans are *Ascaris lumbricoides, Trichuris trichiura, Necator americanus and Ancylostoma duodenale* [1]. The highest prevalence occurs in areas where sanitation is inadequate and water supplies are unsafe. It is estimated that approximately 2 billion people are infected with STHs globally [2]. The burden of disease from STH is mainly attributed to their chronic and insidious impact on the health and quality of life of those infected rather than to the mortality they cause. Infections of heavy intensity impair physical growth and cognitive development and are a cause of micronutrient deficiencies including iron deficiency anaemia leading to poor school performance and absenteeism in children, reduced work productivity in adults and adverse pregnancy outcomes [3, 4]. The transmission of STH is determined by many factors, such as hygiene and sanitation [5] human awareness, poverty behavior [6], environment, health system and socioeconomic status [7 and 8]. Understanding the factors that influence disease transmission in a particular area is key to effective STH control. Morbidity and mortality due to STH infections are related to the number of worms in an infected person, as well as age and immunity. School children are the most vulnerable group of people affected by the disease [8]. Infection of these parasites in children may result in malnutrition, poor school performance, delayed physical growth and impaired cognitive function [9].

In the Mutengene Health Area, little is done on education of the population about personal and environmental hygiene especially in relation to transmission and preventive measures against soil helminths. A prevalence of STHs as low as 6% could lead to rapid spread of STHs especially in conditions of poor hygiene and overcrowding [10]. There has been an impact on the environmental and social factors because the Anglophone crisis. Rapid influx of so many internally displace persons into Mutengene can contribute to a change in disease dynamics. There is the need to assess the knowledge, attitude and practice of children in relation to malaria and soil transmitted helminthes so that control measures and proper education can be given. In addition, there has been the interruption of the school base de-worming campaign and health talks which used to be periodically carried out by the government on school age children with the goal of complete eradication of STHs and sanitization on malaria and other tropical diseases. Therefore, the study was designed to assess the knowledge, attitude and practice in relation to predisposing factors and preventive measures for STHs among children 4 to 15 years in Mutegene. The research could provide useful information that may help policy makers, particularly those under the ministry of public

health, plan effective and sustainable control program in school age children.

2. MATERIALS AND METHODS

2.1 Study Area, Scope and Study Design

Mutengene has a total surface area of 484 km^2 and is located between Longitude 8.6°10'E and Latitude 4°5.2'N [11]. Mutengene has a coastal equatorial climate with daily temperatures ranging from 28°C to 33°C. Soil types include the sandy alluvial and volcanic soils, which encourages agriculture. The main activity of the population is petite trading, pig raring specifically for local consumption. It has a total population of 147,423 and 12.02% (17,722) of this population are primary school children [11].

The study was limited to Mutengene inTiko Health District and involved school age children (5 to 14 years). A total of 250 children whose parents consented were eventually sampled. The data collection took place from the April to July, 2021.

The study designed employed was cross-sectional study. Five primary schools including both Government and private schools were randomly selected in the study area taken into consideration distance from each other and location. The five selected schools were Divine Faith Bilingual Primary and Nursery school, Saint Joseph Catholic school Buea road, Saint Alexender Primary and Nursery school quarter 10, CBC Primary and Nursery school Limbe road, and Government school Tiko Road. At each selected schools about forty percent of pupils in each class were included in the study by a random sampling technique.

2.2 Study Population, Inclusion and Exclusion Criteria

The study included pupils of both sexes aged 4 - 15 years. The schools included in the study were chosen by random sampling. Pupils were enrolled into the study only if they fulfilled the inclusion criteria and were pupils in one of the chosen schools selected for the studies also by randomization. Children, who gave their assent, answered the questionnaire and their parents/legal guardians gave their consent by signing the informed consent forms were included in the study. Also, children who were neither sick nor suffering from severe medical conditions were included. All sick children or those with severe medical conditions, or who did have signed consent forms or gave their assent were excluded.

2.3 Data Collection Tools

Tools used for the research include a clinical laboratory analyses form, simple structured questionnaire administered in English and exceptionally in Pidgin English, consent and assent forms.

2.4 Sample Size

The sample size for this study was calculated using the Lorentz formula, which states that

$$n = Z^2 P(1-P)/e^2$$

Where:

- n - Maximum Sample size of the study population.
- Z – a constant corresponding to the confidence level for example (1.65 for 90% confidence, 1.95 for 95% confidence, and 2.575 for 99% confidence). In this study, 2.575 for 99% confidence interval was used).
- P – Estimated value or percentage of a sample that has similar condition of interest, and
- e – The margin of error or precision of the event of interest (0.05). With P = 6.5% (Ndamukong-Nyanga *et al*., 2014, for intestinal helminths prevalence in Tole, SW Cameroon) [12].
- Z =2.575, e = 0.05 It implies that n = $\{(2.575)^2 (0.065) (1-0.065)\}/ (0.05)^2 = 162$.

The minimum calculated sample size was 162. However, four hundred and twenty-two (422) participants were issued consent/assent forms and only 250 pupils responded positively and succumbed to the stool collection procedures.

2.5 Sampling Techniques

In order to reduce cost and improve sampling efficiency, random sampling technique was used to recruit the study participants, 5 primary schools were randomly selected out of 17 primary schools. Random selection was done by writing the name of each school on a separate piece of paper, which was then placed in a box and thoroughly mixed before selection. A simple

random sampling technique was applied by blindly picking 5 of the papers and the name of the selected school(s) written in a field note book. A total of 5 schools were selected. This was closely followed by visit to the schools. First visits were made to each school in the month of May to explain the purpose and methodology of the survey and potential benefits of the study to the head teachers/teachers of the schools', parents/guardians during parent and teachers' association (PTA) meetings. A second visit was made to talk to the pupil about the studies and check the proportion of pupils who had returned the signed consent form.

Third visit was made and this time we ensured that within each selected school, pupils whose assent were sort and they accepted were selected as follows: for small class sizes (less than 30 pupils), the entire class was selected. For classes with more than 60 pupils the systematic random sampling approach was used. From the class list of each class, every third or fourth [13] pupil was sampled depending on the number of pupils in the class.

Only those children whose parents already signed the consent form were qualified to respond to the questionnaire with the help of the research team and their class teachers. After Completion of the questionnaires, children were given specimen container and instructed on how to collect the stool specimen. The stool samples were put in mobile cooler containing ice packs to preserve the eggs. Stool samples were then be transported to the laboratory and processed within 12 hours after collection. Microscopically examination will be performed within 1 hour of preparation to avoid missing hookworm ova.

2.6 Questionnaire

Each child was questioned separately on his/her socio-demographic and behavioral factors. This was done to avoid influence from friends. Qualitatively, a structured questionnaire was used to collect information on demographic characteristics and risk factors such as age, sex and parental occupation, hand washing practices, walking barefoot, presence of toilets and its usage and types of water sources available for domestic purposes.

2.7 Sample Processing

2.7.1 Macroscopic examination and microscopic examination of stool

After reception of the specimen on the date of collection, samples were examined macroscopically for colour, consistency (such as formed, unformed) and the presence of constituent such as blood and mucus). Microscopic examination was done to check for the presence of adult worms, worm segment, ova (eggs).

Iodine saline wet mount was done within hours on the fecal specimen for identification of ova, larvae, yeast cells, intestinal flagellates, etc while iodine wet mount was carried out followed by Formals- Saline ether sedimentation method to identify most types of worm eggs (round worms, tapeworms, schistosomes, and other fluke eggs, larvae, and protozoan [13].

2.8 Data Analysis

Data obtained were entered into the computer using Microsoft excel 2007 version, entry errors were checked and analysis was carried out using SPSS for windows version 21 (SPSS Inc., Chicago, IL, USA). Categorical variables like the demographic characteristics of the respondents were presented as frequencies and percentages, and analyzed in relation to risk parameters using the Chi-square test. The significant associations were identified based on $p < 0.05$ [14]. Cross tabulations of important variables of the questionnaire were done and the statistical significance of variables was estimated using Chi-square test.

3. RESULTS

3.1 Demographic Characteristics of the Study Population

The field implementation of the study took place during May and July 2021. According to school records, the total number of potential participants from primary 1-6 from all the five schools that were enrolled in the study, 250 pupils took part in the study. The ages of the children ranged from 5 to 14 year with a mean of 11.18 ± 1.83years. In term of gender, 48% were boys and 52% were girls. The children were grouped into three age groups 5 – 8, 9 – 12 and 13 – 15 as shown in Table 1.

Table 1. Gender, age of participants

SN	Characteristics	Variable	Frequency (n)	Percentage (%)
1.	Gender	Male	120	48
		Female	130	52
2.	Age range (years)	5 – 8	18	7.2
		9 – 12	170	68
		13 – 16	62	24.8

Majority of the children, 75.5% (n=189) lived in cemented houses while the rest lived in tiled houses (21.6%, n=34) and earth (2.7%, n=7) houses respectively. The study also indicated that majority of the participants 72.8% (n=101) got their water from the public taps and very few 1.6% (n=4) got their water from rivers. As concern cooking, a greater portion of the participants (n = 187, 74.8%) used fire wood, seconded by gas (21.6%, n=54) and smaller proportion used charcoal. Statistics from the survey also showed that majority of the participants (76.4%, n=191) used pit latrine and 141 used flushable toilets. For other social amenities such as television, electricity and refrigerator, many used television (92.2%, n=232), electricity (90.4%, n=226) and refrigerators (64.4%, n=161). The study also revealed that 37.6 % (n=94) had one or more domestic animals in their homes. Details can be obtained from Table 2.

3.2 Knowledge, Attitude and Practice of Children in Relation to Risk Factors and Preventive Measures Associated with Soil-transmitted Helminthes

Concerning the knowledge, attitude and practices of preventive measures of Soil-Transmitted Helminths by school age children. Tables 3, 4, 5 and 6 show the level of awareness of the respondents in the prevention and the control of STH among school age children in Mutengene community. The study also proved that 44.4 % (n=109) of the participants had good knowledge of parasitic worms, however 42.8 % (n=103) did not actually know about worms and 62.0 % (n=155) of the participants knew how to avoid getting infected with worms (Table 3).

A large proportion of the respondents 44.4%, (n=109) refused putting dirt in the mouth, or walking bare feet. Those who treat drinking water were 42.7, (n=107). Some (50%. n=125) of the participants never knew that animals are sources of worm infection (See Table 4 for details).

Based on the analysis majority of the 63.2%, (n=152) participants indicated that they did not defecate in bushes but used toilets. Those who always covered their pit latrine around their houses were 44.4% (n=111), and 48.89% (n=122) of the participants always boil their drinking water (Table 5).

The study showed that (76.8 %. n=192) of the participants always washed vegetable and fruit before eating as a way of preventing the transmission of soil helminths as compared to only (0.1%. n=1) that does not wash fruit before eating (Table 7).

Concerning hand washing after using the toilet, 68.8% (n=172) of the participants indicated that they always washed their hands after toilet use. Hence, preventing the transmission of helminthic infections (See Table 6 for details).

3.3 Risk Factors Associated With Soil-transmitted Helminthes, Knowledge, Attitude and Practice of Children in Relation to Risk Factors

This study revealed that soil-transmitted helminth infection was present in Mutengene community with an overall prevalence of 3.6%. The Soil-Transmitted Helminths parasite species found in our study area included *A. lumbricoides, T. trichiura,* and *hookworms*.

Concerning prevalence of STH in relation to perception and knowledge of the participants about STH, data analysis proved that from all the participants investigated in the study, 161 had known about worms before with prevalence of (2.8, n=7). Those who knew how worms are transmitted had a prevalence of (1.2%, n=3). It was shown that no significant association (p-value>0.05%) existed between perception and knowledge of the STH with the prevalence of STH. The survey also indicated that those who had never known how to get infected with STH were 71 with worm prevalence of 2.4% (n=6) as shown in Table 8.

Table 2. Socio-demographic characteristics of study population II (type of houses, water availability, cooking utensils, toilets, refrigerators, electricity, televisions, presence of animals around the houses)

SN	Characteristics	Variable	Frequency (n)	Percentage (%)
1	Floor type	Cemented	189	75.6
		Earth	7	2.8
		Tiles	54	21.6
		Total		
2	Water for house for domestic use	Public tap	101	72.8
		Well without pump	22	8.8
		Well with pumps	88	12.2
		Water truck	13	5.2
		River	4	1.6
		Total		
3	Source of fuel for cooking	Fire wood	187	74.8
		gas	54	
		charcoal	1	0.4
		kerosine	8	3.2
		Total		
4	Toilet	Flushable toilet	141	65.4
		Pit latrine	191	76.4
		Total		
5	Television	Yes	232	92.2
		No		
		Total		
6	Refrigerators	Yes	161	64.4
		No		
		Total		
7	Electricity	Yes	226	90.4
		No		
		Total		
8	Presence of Animals	Yes	94	37.6
		No		
		Total		

Chi square test was used to compare between water sources and the type of toilets facilities of participant and the prevalence of STHs at 0.05 significant level. The type of toilets and water sources were found to be insignificantly associated with the prevalence of STHs in the study (P- Value > 0.05%). Pupils who used of pit latrines had higher prevalence (2.0%, n=5) of STHs infection as compared to those using flush toilets (1.6 %, n=4).

In terms of water sources, majority of the children (n=130) that uses water from the tape had only (1.2%, n=3) of the children infected as compared to those that used well water with prevalence of (1.6%, n=4). The study shows that participants who uses water from the river had prevalence of (1.2%, n=3) as compared to (0.4%, n=1) participants that uses sachet water and water trucks (See Table 9 for details).

Chi square analysis, showing the relation between hygienic practices such as hand washing, sucking of finger, biting of nails and cleaning of toilets and the prevalence of STH, proved that a significant association (P< 0.05) between hand washing before eating and the prevalence of STH, and the rest of the hygienic practices show no significant association (See Table 10 for more information).

The survey analysis using Chi square test showed no association between the prevalence of STH and factors such as always putting dirt in the mouth, playing door in the soil and playing in water (P- value >0.05). Making a comparison of all participants that took part in the study, those who indicated that they played out-doors always had the highest prevalence (2.8%, n=7) closely followed by those who usually played in water (2.4%, n=6) and thirdly, by those who always put dirt in their mouth (2.0%, n=5) (See Table11 for more information).

Table 3. Knowledge of respondent towards STH infection

variables	frequency	Percentage (%)	Chi square(χ2)	p-value
Know about parasitic worms				
no	109	44.4	Chi square(χ2)	p-value
yes	103	42.8		.248
I Do not know	29	12.8	4.125	
Total	241	100		
had worms before				
Yes	161	64.4	Chi square(χ2)	p-value
no	44	17.6	1.574	
I do not know	36	14.4		.455
Total	241	100		
Know any types of worms				
yes	3	1.2	Chi square(χ2)	p-value
no	107	42.7	2.054	.561
I do not know	128	51.2		
Total	241	100		
Know how to get worms			Chi square(χ2) .418	p-value .957
yes	155	62.0		
no	40	16.0		
I do not kow	45	18.0		
Total	241	100		

Table 4. Knowledge, alttitude and practice of respondent towards STH infection in relation to dirts, animals and water treatement

Variables	Frequency	percent. (%)	Chi square(χ2)	p-value
Putting dirt into the mouth				
Always	29	12.8	Chi square(χ2)	p-value
Never	109	44.4		
Sometime	103	42.8	.5179	.159
Do not know	9	3.6		
Total	250	100		
Walking barefeet			Chi square(χ2)	
Aiways	25	10		p-value
Never	109	43.6	3.568	.468
Sometime	113	45.2		
Do not know	3	1.2		
Total	250	100		
Play with animals				
Sometimes	66	26.4	Chi square(χ2)	
Never	44	17.6		p-value
Always	125	50	2.0541	
Do not know	15	6.0		
Total	250	100		.561
Treat water before drinking				
Yes	107	42.7	Chi square(χ2)	
No	70	28.4		p-value
Do not know	73	29.2	3.656	.301
Not applicable	00	00		

Table 5. Knowledge, attitude and practice of respondents towards STH infection in relation to water, toilets and feces

Boiled drinking water				
Always	122	48.89	Chi square(χ2)	p-value
Sometime	22	8.8		
Never	100	40.0	2.015	.733
I do not know	3	1.2		
Total	250	100		
Covered pit latrine				
Always	111	44.4	Chi square(χ2)	p-value
Never	32	12.8	3.462	
Sometime	107	42.8		.326
Do not know				
Total				
Defecate in open bush				
Always	17	7.6	Chi square(χ2) **=.**477	p-value=.976
Sometimes	68	28.2		
Never	152	63.2		
Do not know	3	1.2		
Total	250	100		

Table 6. Knowledge, altitude and practice of respondent towards STH infection in relation to hand washing and care of the finger and nails

Hand washing after toilet				
Always	172	68.8	Chi square(χ2)	p-value=.723
Sometime	56	22.4		
Never	17	7.6		
Do not know	5	6.8	1.326	
Total	250	100		
Wash hands before eating				
Always	198	78.8	Chi square(χ2) =.642	p-value=.887
Used soap when washing hands				
Always	75	29.2	Chi square(χ2)	p-value
Sometime	93	37.2		
Never	74	30	29.633	.000
Do not know	5	1.6		
Total	250	100		
Nail's biting				
Always	60	23.2	Chi square(χ2)	p-value
Never	44	17.6		
Sometime	145	58.0	.460	.977
Do not know	1	0.4		
Total	250	100		
Finger sucking habits				
Always	7	2.8	Chi square(χ2)	
Never	196	78.4		p-value
Sometime	41	16.4	.679	.878
Do not know	6	2.4		
Total	250	100		

Table 7. Washing fruits and vegetables before eating as a preventive measure against STHs

Washing fruits and vegetables before eating				
Always	192	76.8	Chi square(χ2)	
Never	1	0.4		p-value =.910
sometime	1	0.4	1.0001	
Do not know	55	22.0		
Total	250	100		

Table 8. Perception and knowledge of risk factors of STHs in relation to the worms Prevalences

SN	Risk factors	variables	Total examined	No infected	Prevalence	Chi square(χ2)	p-value
	Know about parasitic worms	no	109	4	1.6	Chi square(χ2)	
		yes	103	2	0.8		p-value
		I do not know	29	3	1.2	4.125	.248
		Total	241	9	3.6		
	had worms before	Yes	161	7	2.8	Chi square(χ2)	p-value
		no	44	2	0.8	1.574	
		I do not know	36	0	0.0		.455
		Total	241	9	3.6		
	Know any types of worms	yes	3	0	0.0	Chi square(χ2)	p-value
		no	107	2	0.8	2.054	.561
		I do not know	128	6	2.4		
		Total	241	9	3.6		
	Know how to get worms	yes	160	3	1.2	Chi square(χ2)	p-value
		no	71	6	2.4	.418	.957
		I do not know	10	0	0.0		
		Total	241	9	3.6		

Table 9. Water source and toilet type in relation to STHs infection

SN	Variable		Total examined	No infected	prevalence	Chi square	p-value
1	Sources of water supply					Chi square(χ2)	p-value
		taps	130	0	0.0	.174	.372
		rivers	1o	3	1.2		
		well	62	4	1.6		
		tank	36	0	0.0		
		Water trucks	10	1	0.4		
		Sachet water	3	1	0.4		
2	Type of toilet	Total	241	9	3.6	Chi square(χ2)	p-value
		Flushable toilet	170	4	1.6	4.053	
		Pit latrine	71	5	2.0		.421
		Totals	241	9	3.6		

Table 10. Personal hygiene practices in relation to STHs infection

SN	Variable		Total examined	Number infected	Prevalence	Chi square(χ2)	p-value
	Washing of hands before eating	always	133	5	2.0	Chi square(χ2)	p-value
		never	44	0	0.0	29.633	.000
		Some time	64	4	1.6		
		Total	241	9	2.6		
	Finger sucking	always	13	0	0.0		
		never	189	7	2.8	Chi square(χ2)	p-value
		sometimes	39	2	0.8	.679	.878
		Total	241	9	3.6		
	Biting finger nails	always	59	3	1.2	Chi square(χ2)	p-value
		never	43	1	0.4	.460	.977
		sometimes	139	6	2.4		
		Total	241	9	3.6		
	Clean toilet	always	108	0		Chi square(χ2)	p-value
		never	18	1	0.4	5.179	.159
		sometimes	77	6	2.4		
		Total	241	9	3.6		

Table 11. Activities/practices that predisposes pupils to STH

SN	Variables		Total examined	No infected	Prevalence	Chi square(χ2)	p-value
	Putting dirt in the mouth	always	86	5	2.0	Chi square(χ2)	.940
		never	100	1	0.4	.693	
		sometimes	56	3	1.2		
		Total	241	9	3.6		
	Play outside on the soil	Always	155	7	2.8	Chi square(χ2) 1.462	p-value .734
		never	20	0	0.0		
		Sometimes	66	2	0.8		
		Total	241	9	3.6		
	Play in water	always	10	6	2.4	Chi square(χ2)	p-value .947
		never	160	1	0.4	.456	
		sometimes	71	2	0.8		
		Total	241	9	3.6		

Comparing water source, uses and the prevalence of STH, analysis revealed that those who got their water from the well had a higher prevalence (1.6%, n=4) indicating that well water is a predisposing factor to transmission of STH as compared to other sources of water. Water from the tap, water tank or rivers had a prevalence of 1.2%, 0.0% and 0.8% respectively (See Table 12). There was no association between water sources, their uses and the prevalence of STH, (p-Value > 0.05).

Testing the association between Prevalence of STH with prevention and control Measures using the Chi square test, showed no association between moving without shoes, boiling drinking water, washing vegetable and fruits with the prevalence of STH (P-Value >0.05). Those

participants who never washed fruit and vegetables were 2.8 % (n=7) compared to 0.8% (n=2) of those who washed vegetables and fruit (Table 13).

Table 12. Knowledge, attitude and practice on water sources and treatment in relation to STHs infection

SN	Variables		Total	Number infected	Prevalence	Chi square(χ2)	p-value
1	Use same water for drinking and washing dishes	yes	100	3	1.2	Chi square(χ2) .597	p-value=.897
		no	134	6	2.4		
		I Do not know	7	0	0.0		
		Total	241	9	3.6		
2	Water treated with chlorine	yes	105	2	0.8	Chi square(χ2) 3.656	p-value=.301
		no	65	2	0.8		
		Do not know	71	5	2.0		
		Total	241	9	3.6		
3	Source of school water	tap	120	0	0.0	Chi square(χ2) 7.566	p-value=.372
		well	62	4	1.6		
		river	10	3	3		
		Water tank	49	2	0.8		
		Total	241	9	3.6		

Table 13. Knowledge, attitude and practice on moving without shoes, handling of drinking water, vegetables and fruits in relation to STHs infection

SN	Variables		Total examined	Number infected	prevalence	Chi square(χ2)	p-value
1	Moving with shoes	always	27	1	0.4	Chi square(χ2) 2.054	p-value=.561
		never	107	2	0.8		
		Sometime	107	6	2.4		
		Total	241	9	3.6		
2	Boils drinking water	always	24	1	0.4	Chi square(χ2) 3.292	p-value=.510
		never	97	6	2.4		
		sometimes	120	2	0.8		
		Total	241	9	3.6		
3	Washes vegetables	always	215	0	0.0	Chi square(χ2) 1.084	p-value=.897
		never	7	4	1.6		
		Sometimes	19	5	2.0		
		Total	241	9	3.6		
4	Washes fruits	always	180	0	0.0	Chi square(χ2) .793	p-value .939
		never	7	7	2.8		
		sometime	54	2	0.8		
		Total	241	9	3.6		

4.DISCUSSION

Our study revealed, an overall prevalence of 3.6%. Similar studies carried out in Tiko Health District, South West Region of Cameroon, indicated the prevalence of STH to be 1%, which is lower than that of our studies. The reason for this increase in prevalence in our study as compared to that of similar studies in Tiko Subdivision can be attributed to a number of factors, including the Anglophone crises which has taken more than four years. Some studies showed that transmission of STHs occurred more in countries where poverty, poor nutrition, inadequate sanitation, overcrowding, poor housing, failure to put on footwears, poor socioeconomic status, lack of clean drinking water, and minimal health care prevailed [15]. This similar condition has been experienced in our study area due to influx of internally displaced persons (IDP) into Mutegene leading to overcrowding in houses, poor environmental and personal hygiene, limited toilet facilities lack of knowledge of waste management and lack of health education. These risk factors have contributed to the observed prevalence of STH in our study area. STHs present a major public health challenge by virtue of their, widespread distribution and consequences on health [16].

The low prevalence recorded in this study when compared with previous studies is probably an indication of improved hygienic conditions. The evidence of this improved hygiene can be attributed to the fact that 109 (43.6 %) of the participants had good knowledge about parasitic worms, while 155 (62 0 %) of the participants knew how to avoid getting infected with worms. Some (63.2 %) of the participants avoided defecating in the bushes. Some (44.4%) of participants always covered their pit latrine around the houses hence preventing the risk of transmission of STH. A large proportion of the respondents, (78.8%) always washed their hands with clean water and soap. In addition, (22%) knew that not washing fruit and vegetable before cooking or eating could predispose them to STH. Some (50%) of the respondents avoided playing with pet/ animals. All these are enough reasons to justify the low prevalence of STH as compared to that of similar studies carried out in Muyuka, Southwest Region Cameroon (showing the prevalence of STH, in school age children to be 33.9% [17]. In other parts of the world other authors have also recorded higher prevalence' of STH than that of this study [18].

Government further re-inforced this policy by enhancing, the subsidization of drugs in pro-pharmacies and health centres all over the country and by education on television and radio [19]. These are evident in our study by the fact 226 (90.4) of our respondents indicated the present of electricity in their homes and 232 (92.2%) of them had televisions which can help them gain some knowledge about prevention and control of STH through health education program. This control strategy is in line with WHO's control intervention which is based on the periodic administration of anthelminthics to groups of people at risk, supported by the need for improvement in sanitation and health education [20].

Our study also investigated behavioral risk factors such as washing of vegetables and fruit before eating, treating of drinking water by boiling or chlorination, washing of hands before eating and visiting the toilet, use of clean water, biting or sucking of finger nails. Some of the reasons for high prevalence can be attributed to the fact that 35% of our study population used the well and 22% used water from rivers which are all unclean sources of water. In addition, 38.8% of the participant never boiled their water before drinking and 76.4% of the participants used pit latrine while 94(37.6%) played with animals. All these risk factors justify the 3.6 % prevalence of soil transmitted helminths we had in our analysis. Occupations with high soil contact such as farming also increase the risk of STHs infection [21] Children with long/untrimmed nails are found to have a higher risk of STH infection. Also, previous studies showed that children who habitually picked up and ate food from the ground had a higher risk of STH infection. The association of all this risk factors were tested in our study and were all insignificant.

In terms of classes, pupils in primary 5 and 6 had the highest prevalence. This could be attributed to the increased tendency to play out-door among the pupils compared to their younger counterparts in lower classes. Several other factors such as lack of environmental sanitation, low level of education, lack of access to safe drinking water, good toilet facilities and proper personal hygiene conditions, poverty and ignorance [22].

The risk factors assessed in this study were selected based on the fact that transmission of intestinal parasites is related to poor sources of

drinking water, hygienic practices, fecal disposal systems, socioeconomic status and existence of wide variations of parasites within human communities. In this study, the only risk factor which statistically showed an association with STH infection was the use of soap in hand - washing and the delay in the de-worming process. The prevalence of STH infection within populations has previously been linked to different factors most importantly socioeconomic, environmental, parasitic and host factors [23].

Comparing attitude and practice of respondent towards STH infection with prevalence, it was observed that those whose water sources are rivers recorded a prevalence of 3 (1.2%). This may be attributed to free moving animals that also defecate all around particularly at dumpsite as they go to feed. These evidences, however, suggest a high level of environmental risk of parasites transmission. From the study, Children who walk barefooted and play on the ground, had a prevalence of 8(3.2) This because during recreation at the playground children who play bare-feet are easily exposed to continuous infection (especially while playing). From the survey it was noted that children who picked up dropped foods from the ground, and sucked or bite their nails or record a high prevalence. According to WHO, children are the most vulnerable population to STH infection [1].

Our study revealed that out of 77 participants who never clean their toilets regularly, 6 (2.4%) of them were infected with STH. Contamination with STH at the toilet areas could be attributed to the fact that most of the inhabitants with pit latrines even when housed in small buildings, still preferred to defecate around toilet areas or they used the toilet but never clean the floors. This was in accordance with a study carried out by Ziegelbauer et al. in 2012 [22]. Many studies have shown that good sanitation facilities protect against Soil-transmitted helminth infections. From our results, children from home and schools with toilet facilities had lower prevalence of STH compared to children from schools without toilets. Another risk factor is the type of floor. in the home from our study, most of the study participants that had Cemented floors had a very low rate of infection with STH because this type of floors reduces the prevalence of STH infection. Our study equally proved that toilet habits had influence on infection rate as very few of those participants that used flushable toilets were infected [23]. Combining adequate sanitation facilities with preventive chemotherapy and health education are the recommended sure ways in preventing and controlling helminthiasis [12].

5. CONCLUSIONS

- In relation to attitudes and practices of respondents towards STH infection, it was found that high proportion of the respondents have adequate knowledge of how to prevent transmission of STH.
- The study also enabled allowed to identify risk factors associated with STHs infections in the study area. Thus, factors such as hand washing with soap after toilet used and hand washing before eating were significantly associated with STHs infections and play a great role in affecting the prevalence. This indicates that re-infection is common even after de-worming if proper hand hygiene is not done.
- This study revealed that soil-transmitted helminth infection was present in Mutengene community with an overall prevalence of 3.6% and the species present included *A. lumbricoides, T. trichiura,* and *hookworms*.
- Participants who indicated that they played out-doors had the highest prevalence (2.8%, n=7) closely followed by those who usually played in water (2.4%, n=6) and thirdly, by those who always put dirt in their mouth (2.0%, n=5).
- Considering that STHs are associated to hygiene practices and the availability of portable water supply, interventions to improve on these factors can prevent transmission. This can be done through change in government policy to improve on water supply, educate the population and provide anti-helminthic treatment to population.

6. RECOMMENDATIONS

- Health education could be given through community radios and televisions as a means of making the people understand the mode of transmission and methods of prevention of STH infection better.
- People could be encouraged to be boil their drinking water if the source is doubtful.

- Government could provide a good waste management system to the Mutengene community and also teach them lesson on good waste management via meeting houses, churches, television and the radio.
- Finally, policymakers should advocate for ways to improve the hand washing facilities and community water systems and also ensure that lessons on environmental, personal hygiene and sanitation, are taught in schools around Mutengene community.

CONSENT AND ETHICAL APPROVAL

All pupils were issued consent/assent forms to seek for their parents' approval. Pupils were accepted to participate in the studies when they brought back signed informed consent/assent forms following the approval of their parents/guardians.

Authorization letters were obtained from the Regional Delegation of Public Health (R11/MINSANTE/SWR/RDPH/PS/710/920), Regional Delegation of Basic Education (G379/374/MINEDUB/RDSW/SDGA/SHS), the Institutional Review Board of the Faculty of Health Science, University of Buea, Cameroon (Recu No. 1476-05 of 2021) and Head Teachers of the five randomly selected primary Schools in Mutengene area. A brief talk was given to the participants on the objectives, protocol and benefits of the study**.**

ACKNOWLEDGEMENT

The researchers are grateful to the following

- The Cameroon Baptist Convention Health Services for providing the laboratories for the study.
- Regional Delegation of Public Health (RDPH) Buea, Biaka university institute and all relevant institutions who granted administrative permission.
- The parents and pupils who gave consent/assent and participated in the study.
- The different School authorities, head teachers and class teachers who collaborated in this study.
- The Ethical Review Board of the University of Buea, for providing the ethical authorization for this work.
- The inspectorate of Basic Education in Buea for authorization this work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/110021