



# The Prevalence of Soil Transmitted Helminth Among Elementary School Students in Buton, Province of South Sulawesi

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**Abstract.** Soil Transmitted Helminth (STH) is a common global helminth infection. Children have a high risk of infection with STH. Indonesia is particularly vulnerable to STH infections due to ideal environmental and socioeconomic conditions in many areas. Nearly, 200 million people across 31 provinces are estimated to be at risk of STH infection. According to clinical data, the prevalence of STH infections remains high in Buton, Indonesia and there is still a scarcity of adequate information on the prevalence of STH infection in school children as a population at risk of acquiring STH infection in Indonesia. The research had been carried out to determine the prevalence of STH among school children attending Buton Elementary school students, Southeast Sulawesi. The research sample was elementary school children in grade 2 and 3, conducted in Bonelalo Village, Lasalimu District, and Mabulugo Village, Kapontori District, October 2017. It was a cross sectional study design. The specimen was stool feces which were examined by compound microscope. A total of 153 students randomly selected on this research to participate and provide stool sample. Mostly participants were male students (59.33%). School-age proportions were about 80.66 percent for 8–9 years old student. Stool samples examined were 153 samples. The results of stool examination found that 43 positive worms on fecal specimens (28.10%). The total numbers of children affected by intestinal worms were 43 students. Based on the species of worm found, namely; 15 *Ascaris lumbricoides*, 33 *Trichuris trichiura*, 19 Hookworms, 1 *Oxiuris vermicularis*. The percentages of worm species were *Trichuris trichiura* 21,57%; hookworm 12,42%; *Ascaris lumbricoides* 9,80%; *Oxiuris vermicularis* 0,65%. The most prevalent parasites were *Trichuris trichiura*. The prevalence of soil transmitted helminth was 97.67% (42/43) for all infected children. Some students admitted that they took deworming regimen (37.25%) by an active ingredient was Pyrantel pamoate (22.22%). The students who consumed deworming regimen (14.38%), admitted that they saw worms came out in conjunction with feces after consuming deworming regimen. The result of the present study showed the high prevalence of Soil Transmitted Helminth infections among school aged children in Buton whether *T.trichiura* was the most prevalent parasite. The results imply

the need for strengthening integrated strategies for reduction of parasitic infection, including mass deworming campaign and health education to avoid the risk of helminth infection.

**Keywords:** prevalence · helminthiasis · elementary school student · Buton

## 1 Introduction

Soil transmitted helminth (STH) is a common global helminth infection. Soil is a good medium for egg development that can affect human health, although it rarely causes death [1]. Soil transmitted helminths (STHs) are among the neglected tropical diseases (NTDs) affecting more than 2 billion people worldwide. [2]. Infection with STH occur in tropical and subtropical regions of sub-Saharan Africa, Americas and Asia where warm moist environments favour worm egg and larvae survival, poor hygiene and sanitation prevail, and limited access to safe water sources facilitates transmission [3].

Ingestion of infective parasite eggs from the environment are principle routes for transmitting roundworms (e.g. *Ascaris lumbricoides*) and whipworms (e.g. *Trichuris trichiura*). Skin penetration of infective larvae is the most common route of transmission for hookworms (e.g. *Ancylostoma duodenale* and *Necator americanus*) and threadworms (e.g. *Strongyloides stercoralis*). These four types of nematodes comprise the majority of STH infections; however, other parasites such as cestodes, trematodes, and protozoa may also be present and cause disease [4].

Around 438,9 million people have been infected by hookworm, 819 million by *Ascaris lumbricoides* and 464,6 million by *Trichuris trichiura* [5]. Many reports illustrated that *Ascaris lumbricoides* is the most prevalent intestinal parasite in different communities usually occurring together with *Trichuris* infections [6]. Hookworm infection, is also public health problem though the magnitude is lesser compare to Ascariasis [7, 8]. Infection intensity is a key factor in understanding the morbidity of STH; although light infections are often asymptomatic, heavy infections cause an array of morbidities, including dietary deficiencies and delayed physical and cognitive development [9].

Children have a high risk of infection and more than 270 million preschool-aged and 550 million school-aged children are infected with STH [10]. Infection in children can lead to physical, nutritional and cognitive impairment affecting their schooling and perpetuating the cycle of poverty [11], also the growth of children are caused by changes in appetite, digestion, absorption of nutrients, and iron deficiency. The impact of STH infection leads to poor school performance and attendance so that when they reach their adulthood their productivity tends to decrease and their pregnancy tends to be harmful [12, 13].

Indonesia is vulnerable to STH infections due to ideal environmental and socio-economic conditions in many areas [14, 15]. Nearly, 200 million people across 31 provinces are estimated to be at risk of STH infection [14]. According to The Ministry of Health of The Republic of Indonesia, in year 2014, the prevalence of helminthiasis in Indonesia was about 30 percent, then in 2015, reached 28 percent. The prevalence of STH infection in children in Indonesia is generally very high [16]. Meanwhile, based on parasitological survey, the prevalence of helminthiasis in children throughout Indonesia at the age

1–6 years and ages 7–12 years is still quite high, from 30 percent to 90 percent [17]. According to the Ministry of Health, the target of helminthiasis prevalence in Indonesia is less than 10 percent [18].

In the study area, the prevalence of STH infections remains high in Buton, according to clinical data generated from the health offices. There is still a scarcity of adequate information on the prevalence of STH infection in Indonesia, and there are only a few research studies related to STH infection in school children as a population at risk of acquiring STH infection, and indispensable for controlling the morbidity of STH infection is a strategy recommended by WHO and the Indonesian government conducted [19, 16]. Therefore, the present study attempted to determine the prevalence of STH among school children attending Buton Elementary school students, Southeast Sulawesi.

## **2 Materials and Methods**

### **2.1 Study Design**

The study utilized a cross-sectional study design.

### **2.2 Study Setting/Study Area**

The study was conducted in Bonelalo Village, Lasalimu District, and in Mabulugo Village, Kapontori District, Buton Regency, Southeast Sulawesi Province [20], in October 2017.

### **2.3 Study Population**

All school children attending Elementary school students of Buton were the source population. All, 153 school children in grade 2 and 3, with aged 7–10 years old, who were not terminally ill (diarrhea) were included in the study.

### **2.4 Sample Size and Sampling Technique**

The sample size for the study was determined using single population proportion formula;  $n = z^2 p (1-p) / d^2$  at 90% confidence of interval (CI) where,  $z = 1,645$  and  $d = 5\%$  precision (0,05). The prevalence of STH was 18%,  $p = 0,18$  among school children in the study area. Thus, the sample size of the study participants estimated  $n = 147$  children; with  $N = 1476$  children. Five schools equivalently admitted to the total school children attended the elementary school was selected purposively and systematic simple random sampling technique was employed to select sampling unit.

### **2.5 Questionnaire**

The instrument used in the study is a questionnaire to obtained data about consuming, effect and brand of anti-helminthic drug. The questionnaire was answered by each participant. Participants were confidentially of their answers, and nothing will harm of participant of moral and material. A questionnaire was given to participants prior to sampling stool.

## 2.6 Parasitological Stool Testing

In this study, the team was consisting of a leader, specimen examiner, registration officers.

Activity: (1) The day before, stool pot containing 10% formaldehyde ( $\pm 2$  cc) distributed and explained sampling purpose to parents of students. (2) After giving explanation, stool pot given according to students name and code (3) Doing in the morning, before students go to school (4) Stool is taken with a spoon that is attached to the pot (5) Must be fresh stools inserted into stool pot (6) Not contaminated with urine (7) Stool pots are tightly closed (8) Give it to the officer 1–2 h after defecating (9) The specimen stool should be checked immediately on the same day, because the helminth eggs will be damaged or hatch into larvae. If examination on the same day can't be done, stool specimen will be given 10% formaldehyde until submerged.

Procedure: Stool samples were collected from study participants/school children at the schools by teacher supervision using labeled, stool pots, cool box, and transported to field laboratory. The stool was examined directly and microscopically. Double check to smear slides were worked on from each stool specimen and examined by another laboratory expert.

## 2.7 Ethics Approval

The study was carried out after having an ethical clearance endorsement from National Institute of Health Research and Development Ethical Review Committee and all methods were carried out in accordance with relevant guidelines and regulations. Positive children for STH were informed to the Health Offices for free treatment using standard dose of the respective drugs.

# 3 Results

## 3.1 Characteristics of the Study Participants

A total of 153 school children randomly selected were volunteer to participate in the study and provide stool sample. More than half of the study participants were males (59.33%,  $n = 90$ ). Larger proportions of age of the children was 80.66%, ranging from 8 to 9 years (Table 1).

## 3.2 Prevalence of Soil Transmitted Helminth Infections and Associated Factors

The study was conducted on elementary school children grades 2–3. The results of stool examination showed that 43 elementary school children positively contain worm eggs on fecal specimens. A total of 153 study participants were found positive for one or more soil transmitted helminth infections. The overall prevalence of STHs was 27.45% ( $n = 42$ ) of which *Trichuris trichiura* was the most common parasite, 21.57% ( $n = 33$ ) identified among specimen stool school children (Fig. 2). *Ascaris lumbricoides* and hookworms were detected in 9.80% ( $n = 15$ ) and 12.42% ( $n = 19$ ) of children, respectively. Four species of intestinal parasites were identified, including *Oxyuris vermicularis* 0.65% ( $n = 1$ ) was also detected among school children, and 28.1% ( $n = 43$ ) of school

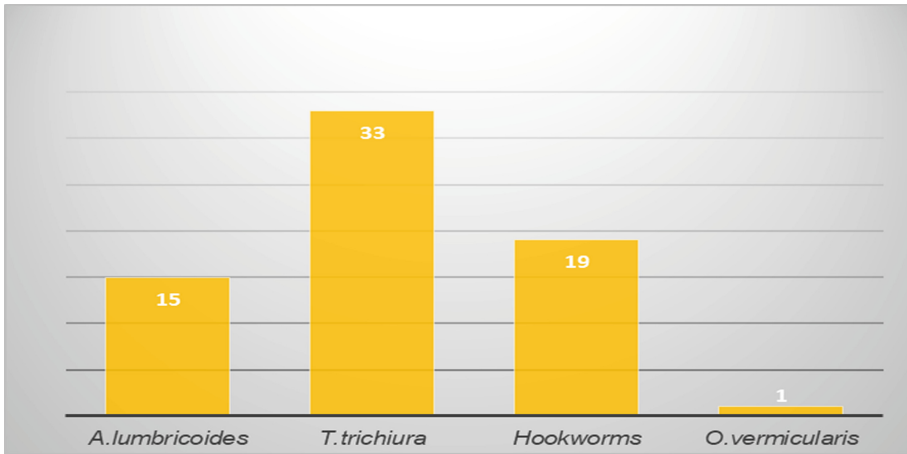
**Table 1.** Characteristic of School Children, Buton

	Characteritics	Frequency, n	%
<b>Sex</b>	Male	90	59.33
	Female	63	40.66
<b>Age</b>	6 yr.	1	0.60
	7 yr.	19	12.66
	8 yr.	45	28.66
	9 yr.	79	52.00
	10 yr.	8	5.30

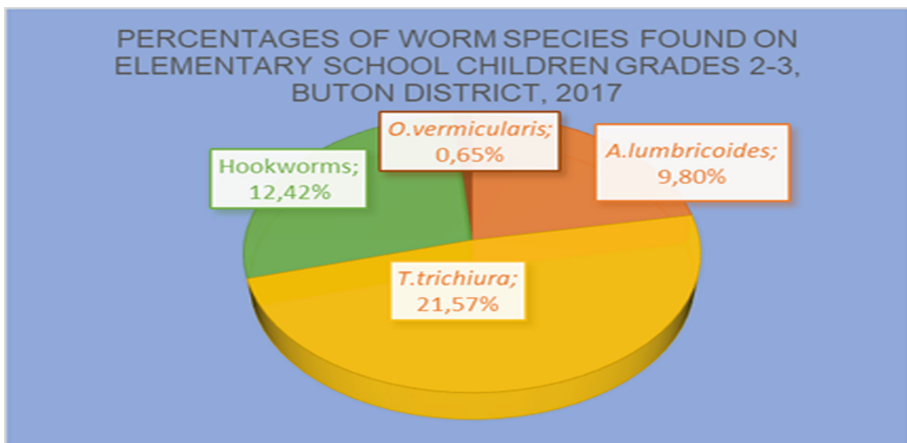
**Table 2.** Frequency of helminthiasis of school children in Buton District

Species	Sex	Result of examination		P-value
		Positive (N/%)	Negative (N/%)	
<i>Ascaris lumbricoides</i>	Male	5/ 5.6%	84/ 94.4%	0.222
	Female	1/ 1.6%	60/ 98.4%	
	Total	6/ 4%	144/ 96%	
<b>Hookworms</b>	Male	10/ 11.23%	79/ 88.76%	0.430
	Female	3/ 4.92%	58/ 95.08%	
	Total	13/ 8.66%	137/ 91.33%	
<i>Trichuris trichiura</i>	Male	5/ 5.56%	84/ 94.4%	0.221
	Female	6/ 9.84%	55/ 90.16%	
	Total	11/7.33%	139/92.66%	
<b>Mix infection</b>	Male	10/ 11.23%	79/ 88.76%	0.460
	Female	2/ 3.28%	59/ 96.72%	
	Total	12/ 8%	138/ 92%	

children were infected with these intestinal parasites. The prevalence of the STHs was relatively higher among male children, as compared to female, although not statistically significant. Table 2 showed that there was no significant differences between the sexes of school children infected with worms, although numerically, male students tend to be more susceptible to *Ascaris lumbricoides*, hookworm and mixed infections than female students. Figure 1 showed a number of worm species found in stool specimens, were 15 *Ascaris lumbricoides*, 33 *Trichuris trichiura*, 19 Hookworms, 1 *Oxyuris vermicularis*.



**Fig. 1.** A number of worm species found in Elementary School Children Grades 2–3, Buton District, 2017



**Fig. 2.** Percentages of worm species found on Elementary School Children Grades 2–3, Buton District, 2017

School children experience of consuming anti-helminthic drug was presented in Table 3. Some students admitted that they had taken anti-helminthic drug (37.25%) and 16.99% of them had taken anti-helminthic drug a year before (2016). Most of the active ingredients for anti-helminthic drug consumed were pyrantel pamoate (22.22%) with a brand which was already popular in Indonesia. According to confession of school children who consumed anti-helminthic drug (14.38%), admitted that they saw worms came out through feces after consuming anti-helminthic drug.

**Table 3.** School children experience of consuming anti-helminthic drug

No	Variables	Frequency,n	%
1	Have ever consuming anti-helminthic drug		
	-Yes	57	37.25
	-No	95	62.09
	-Forgot	2	1.31
2	The last time consuming anti-helminthic drug		
	-2014	6	3.92
	-2015	9	5.88
	-2016	26	16.99
	-2017	12	7.84
	-Forgot	3	1.96
3	Kind of medicine active prescription		
	-Pyrantel pamoate	34	22.22
	-Forgot	23	15.03
4	Presence of worm in feces after consuming anti- helminthic drug		
	-Yes	22	14.38
	-No	35	22.87

## 4 Discussion

STH infections is primarily affecting children living in rural and semi urban areas of developing countries [21, 22]. In Indonesia, STH infection is still a major health problem especially in rural areas [23], where population of school aged and preschool children experience the most morbidity [19], [24].

Given this, the present study attempted to determine the prevalence of STH infection among school children in Buton, Southeast Sulawesi. The results then revealed the high prevalence of STH infections (27,45%) which is higher than the findings from Tegal (12,3%) and West-central border area of Thailand (15,6%) (25,26) and a bit higher than the study conducted in China in 2010 by Wang et al. which reported that was 21,2% of STH infection prevalence in preschool children [27]. As with previous study, Ethiopian studies in 2014 by Shumbej et al. showed STH infection prevalence of 23,3% in preschool children [12]. These differences could be explained by variations in altitude, hygienic conditions, awareness level towards STH and playing habits and facilities of children in and outside the school [28]. Environmental factors have been associated with STH prevalence and intensity of infection. High precipitation, sandy-loam soil, high vegetation index and higher temperatures associated with increased hookworm prevalence and infection intensity [29, 30, 31]. In contrast, *A.lumbricoides* and *T.trichiura* infection negatively associated with higher rainfall and temperatures [32]. Most infections with intestinal parasites are more severe in children than adults [33].

As a result, *T.trichiura* (21,57%), Hookworms (12,42%), and *A.lumbricoides* (9,80%), shown in this study were much higher than the national prevalence of STH infection report (under 10% of indicator development programme) (18). In this study, reported a high prevalence of *T.trichiura* infection of 21,57% in school children. Nonetheless, there were no clear identifiable differences between villages that might provide a plausible explanation for the comparatively high levels of *T.trichiura* in Buton or vastly differing prevalences. There was a significant association between *T.trichiura* infections and stunting. Due to chronic inflammation that parasites lead to, the gut suffers from environmental enteropathy leading to leaky gut and poor absorption of nutrients and vaccines [34, 35]. *T.trichiura* in particular may cause gastrointestinal bleeding leading to life-threatening anaemia [36]. However no measurement was taken for under-nutrition on this study. While the impact of STHs on nutritional status of children has long been established [37].

In this study, there is any school children which have no wear shoes and with dirt under finger nails. This is in accordance with previous study which is some studies found that the number of infection is higher among school children with dirt under their finger nails. Similarly, children who reported to walk barefoot had higher risk of being infected with the hookworms than children who wore shoes. This could be justified as children playing in the contaminated outdoor environment and experience frequent contact with soil. According to the Paige et al.(2017) study the use of footwear can reduce the risk of helminth infections [38]. The use of footwear will protect the feet from helminth infections that can penetrate the skin. According to Bird et al. (2014) although the use of footwear is not always effective in preventing infection of helminth, the use of footwear can protect a person from helminth [39]. Inconsistent use of footwear will also increase the prevalence of helminth infections [28, 40].

Prevalence for STH infections often exhibit age-dependent patterns. It is a case for *A. lumbricoides* and *T. trichiura*, where peak prevalence is seen in children under the age of five years [11]. In contrast, hookworm infection exhibits peak prevalence in adulthood [41].

Transmission of *A. lumbricoides* and *T. trichiura* occurs via faecal-oral routine, meaning that infection typically results from an ingestion of infective eggs through contaminated food, water, eating utensils or sucking fingers or biting fingernails of improperly washed hands. Transmission of *Oxyuris vermicularis* usually occurs among families and groups in the same environment. The transmission could happen through hand to mouth, and also influenced by environment humidity condition [29].

This study is still small study done in Indonesia which to know the incidence of STH infection in school children, especially in Buton, Southeast Sulawesi, and it is useful to give input to the local health office that the prevalence of the incidence of STH in children still above of indicator development programme of helminthiasis disease, so that anthelmintic can be administered to children as much as once a year in accordance with Indonesia Ministry of Health and support WHO de-worming program [16, 19] The present study used only few measurements to collect data in the field. Hence, this finding should be interpreted by taking into account these limitations.



## 5 Conclusion

The result of present study shows that *T. trichiura* is the most prevalent parasite among school-aged children in Buton. It implies the need for strengthening integrated strategies and reduction of parasitic infection, including mass deworming campaign and health education to avoid the risk of helminth infection.

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