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Research Report

PREVALENCE OF SOIL TRANSMITTED HELMINTHIASIS AMONG ELEMENTARY CHILDREN IN SORONG DISTRICT, WEST PAPUA

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ABSTRACT

Soil transmitted helminthiasis are common in the world and cause illness, especially in developing countries. It can cause infection in humans by contact with parasitic eggs or larvae that live in moist and warm soil. Soil-transmitted helminthiasis is often caused by Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duodenale, and Necator americanus. In Indonesia, Soil transmitted helminthiasis prevalence is still high in some places. The tropical climate and high humidity support for the development of worms like in Sorong District, but there was no data. The purpose of this study is to identify the presece of Soil transmitted helminthiasis in primary school children in Sorong District. A cross-sectional study was conducted in two elementary schools located in Sorong District, West Papua, Indonesia. The two elementary schools are SDN 22 in Klain village and SD Inpres 24 in sub-district Mayamuk. Once collected, the pot that has contained stool is given formalin 10%. Stool examinattion using direct smear method to determine the presence of soil transmitted helminthiasis. Researchers get the subject as many as 147 children. The proportion of elementary school children by sex consists of 72 boys (49%) and 75 girls (51%). The prevalence of Soil transmitted helminthiasis as a whole was 30.6% (45/147) with 40.1% (18/45) single infections and 59.9% (27/45) mixed infections. The single infection that most frequent is Trichuris trichiura, then followed by Ascaris lumbricoides. Soil-transmitted helminthiasis mostly found in girl than boy and mostly found in 6-9 years age group. The worm species that infect elementary school children in the district is Ascaris lumbricoides, Trichuris trichiura, Hookworm, and Strongyloides stercoralis. This is probably related with the climate and low sanitation level. To eliminate soil transmitted helminthiasis among elementary school children, in addition to routine treatment also needs intensive counseling about the importance of maintaining personal hygiene and the environment.

Keywords: *prevalence, soil transmitted helminthiasis, direct smear method, elementary school, Sorong District*

ABSTRAK

Soil-transmitted helminthiasis sering terjadi di dunia dan penyebab kesakitan khususnya di negara berkembang. Hal ini dapat menyebabkan infeksi pada manusia melalui kontak dengan telur parasit atau larva yang tinggal di tanah lembab dan hangat. Soil-transmitted helminthiasis sering disebabkan oleh Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duodenale dan Necator americanus. Di Indonesia, prevalensi soil transmitted helminthiasis masih tinggi di beberapa tempat. Iklim tropis dan kelembaban yang tinggi mendukung untuk perkembangan cacing seperti di Kabupaten Sorong, tetapi belum ada data. Tujuan dari studi ini adalah untuk mengidentifikasi keberadaan Soil-transmitted helminthiasis pada anak sekolah dasar di Kabupaten Sorong. Studi cross-sectional dilakukan di dua sekolah dasar yang terletak di kabupaten Sorong, Papua Barat, Indonesia. Dua sekolah dasar tersebut adalah SDN 22 berada di desa Klain dan dan SD Inpress 24 berada di sub-distrik Mayamuk. Setelah terkumpul, pot yang berisi tinja kemudian diberi formalin 10%. Pemeriksaan feses menggunakan metode pemeriksaan langsung direct smear untuk mengetahui adanya soil transmitted helminthiasis Peneliti mendapatkan subjek penelitian sebanyak 147 anak. Proporsi anak-anak sekolah dasar berdasarkan jenis kelamin terdiri dari 72 laki-laki (49%) dan 75 perempuan (51%). Prevalensi soil transmitted helminthiasis secara keseluruhan adalah 30,6%

(45/147) dengan infeksi tunggal 40,1% (18/45) dan 59,9% (27/45) infeksi campuran. Infeksi tunggal yang sering ditemukan adalah Trichuris trichiura diikuti dengan Ascaris lumbricoides. Soil-transmitted helminthiasis sebagian besar ditemukan pada perempuan daripada laki-laki dan lebih banyak ditemukan pada kelompok usia 6-9 tahun. Spesies cacing yang menginfeksi anak sekolah dasar di kabupaten tersebut adalah Ascaris lumbricoides, Trichuris trichiura, cacing tambang dan Strongyloides stercoralis. Hal ini mungkin terkait dengan iklim dan tingkat sanitasi yang rendah. Untuk mencegah kejadian soil transmitted helminthiasis, selain perawatan rutin juga perlu dilakukan konseling intensif tentang pentingnya menjaga kebersihan diri dan lingkungan.

Kata kunci: *prevalensi, soil-transmitted helminthiasis, pemeriksaan tinja mikroskopis cara langsung, Kabupaten Sorong*

INTRODUCTION

The worms parasite have infected humans in the world more than 1 billion. WHO estimates that more than 1.5 billion people worldwide or 24% of the world's population are infected with worms and widely distributed in tropical and sub-tropical areas, mostly in sub-Saharan Africa, the Americas, China and East Asia. More than 270 million pre-school children and over 600 million school-aged children live in endemic areas and require preventive therapy and intervention[1]. In 2011, Indonesian Health ministers said about 195 million Indonesians live in worms endemic areas, including 13 million pre-school children and 37 million school-aged children[2]. Soil transmitted helminthiasis is often caused by *Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duodenale* and *Necator americanus*(1).

Soil transmitted helminthiasis is transmitted through eggs collected with the patient's stool. Female worms live in the human intestine and produce thousands of eggs daily. In areas with low sanitation levels, the eggs will contaminate the soil. Things that may cause Ascaris and Trichuris eggs to be swallowed human beings include eating egg contaminated vegetables, while the vegetables are not cooked and washed properly, eggs contaminate drinking water and eggs are swallowed by children who play the soil and do not wash their hands thoroughly. Hookworm and Strongyloides stercoralis hatch in the soil, releasing filariform larvae that can infect humans through penetration of the larvae on human skin. Penetration usually occurs through the skin of the foot that is not covered by footwear(3).

Worms produce eggs or larvae in very large quantities and have high reproductive capacity, which can lead to high incidence of infection in humans when the condition of the host is conducive to infections such as in the marginal areas in tropical countries(4).

MATERIAL AND METHOD

Subject of Research

The research is conducted by cross sectional study on two elementary schools in Sorong District, West Papua, Indonesia. The two elementary schools are SDN 22 in Klain village, and SD Inpres 24 in sub-district Mayamuk (see Figure 1).

Sorong district lies in the coordinates of 000 33 '42' '- 010 35' 29 '' South Latitude and 1300 40 '49' '- 1320 13' 48 '' East Longitude with an area of 12,159.42 km^2, which consists of land area of width 11,644.77 km^2 and the sea area of 514.65 km^2. Sorong district consists of 19 sub-districts with 18 urban villages and 135 villages. One of the sub-districts is Mayamuk. The research conducted in sub-district Mayamuk.

Large sample calculations using Lemeshow formula with unknown population. From the calculation, the sample size is at least 96, but to anticipate the error result, the researcher adds 10% of the minimum sample size.

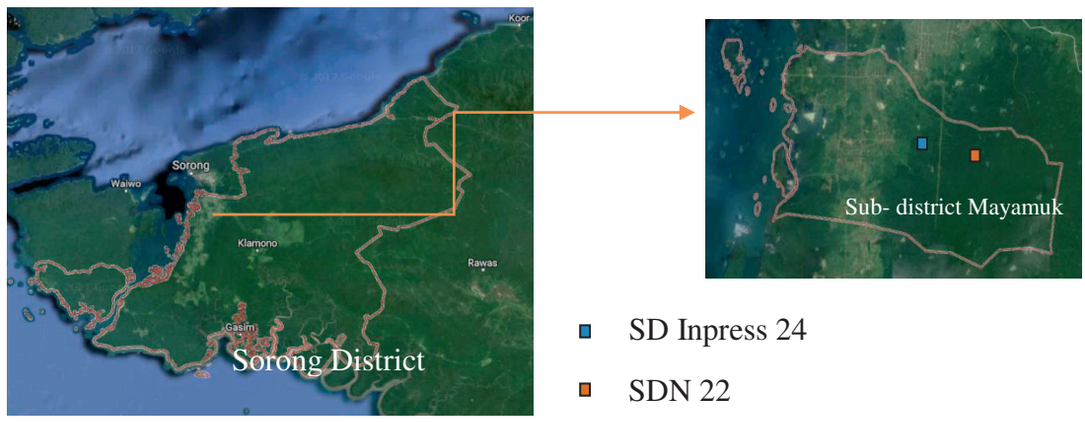

Figure 1. Map of Sub-District Mayamuk and Klain Village in Sorong District, Showing The Location of SDN 22 and SD Inpres 24.

Data Collection

Samples are collected on August 2017. Students are given an explanation of how to collect and store stool samples. Once collected, the pot that has contained stool is given formalin 10%. Stool samples were taken by researchers to be examined at the Department of Parasitology Faculty of Medicine, Universitas Airlangga, Surabaya.

Stool examination using direct smear/wet mounting method to determine the presence of soil transmitted helminthiasis. Pots containing stools, stirred using sticks to be homogeneous, then stool taken and mixed on a object glass that has been given a drop of lugol 1% and then leveled. The rest of the food and crude fiber are removed with a stick and then closed with a cover glass and check under microscope systematically. The preparations are examined under a microscope with magnification 10x then 40x.

Data Analysis

Results of direct-smear data then analyzed descriptively to determine the prevalence of infection and the type of worm infection.

RESULT AND DISCUSSION

Researchers get the subject of research as many as 147 children. The distribution of male and female students in both primary schools is almost the same, with the total of male students being 72 students while the total female students are 75 students. By age group, the highest group was age 6–7 years (44.9%) while the lowest was 11-12 years old (2.7%) (see Table 1).

The results of microscopic examination showed 45 (30.6%) students from 147 students infected, with soil transmitted helminthiasis. Prevalence in girls is higher than boys (see Table 2). The highest prevalence is in level grade 1 (see Figure 2).

Mixed soil transmitted helminthiasis was more common than single infection with 62.2% (28/45) prevalence compared to 37.8% (17/45). The single infection that most frequent is *Trichuris trichiura* infection, followed by *Ascaris lumbricoides*. The most common mixed infection are *Ascaris lumbricoides* and *Trichuris trichiura* also *Ascaris lumbricoides, Trichuris trichiura* and Hookworm.

In one microscopic stool examination sample found many mature *Ascaris lumbricoides* eggs and *Ascaris*

Table 1. Demographic Characteristics of Research Subjects at SDN 22 and SD Inpres 24 in Sorong District.

	SDN 22 (n=55) n (%)	SD Inpres 24 (n=92) n (%)	N=147 N (%)
Age (years)			
6-7*	23 (41,8)	43 (46,7)	66 (44,9)
8-9*	22 (40)	43 (46,7)	65 (44,2)
10-11*	8 (14,5)	4 (4,4)	12 (8,2)
11-12	2 (3,7)	2 (2,2)	4 (2,7)
Grade Level			
I	16 (29,1)	40 (43,5)	56 (38,1)
II	13 (23,6)	23 (25)	36 (24,5)
III	6 (10,9)	27 (29,3)	33 (22,4)
IV	14 (25,5)	2 (2,2)	16 (10,9)
V	6 (10,9)	0	6 (4,1)
Sex			
Boy	29 (40,3)	43 (59,7)	72 (49)
Girl	26 (34,7)	49 (65,3)	75 (51)

* Some subjects are unknown of date of birth so the age of the subject is classified according to grade level.

Table 2. Characteristic of Soil Transmitted Helminthiasis Cases by Sex in Children of SDN 22 and SD Inpres 24 in Sorong District.

	SDN 22 (n=24) n(%)	SD Inpres 24 (n=21) n (%)	N (45) N (%)
Sex			
Boy	13 (59,1)	9 (40,9)	22 (48,9)
Girl	11 (47,8)	12 (52,2)	23 (51,1)

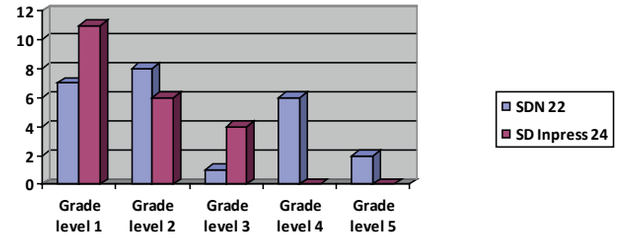

Figure 2. Soil-Transmitted Helminthiasis Based on Grade Level.

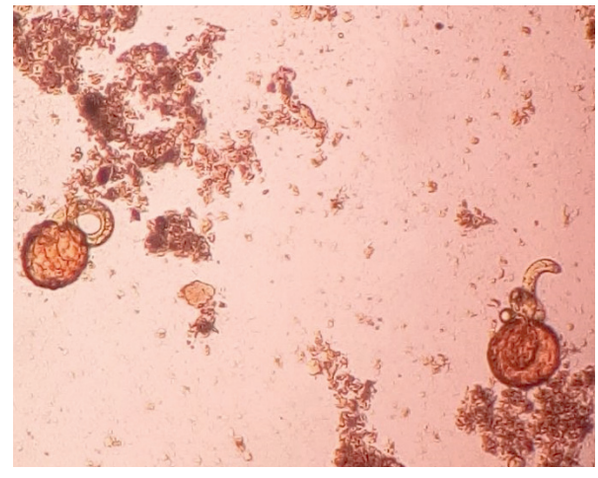

Figure 3. *Ascaris Lumbricodes* Larvae Goes Out The Egg (Arrow), 40 x obj

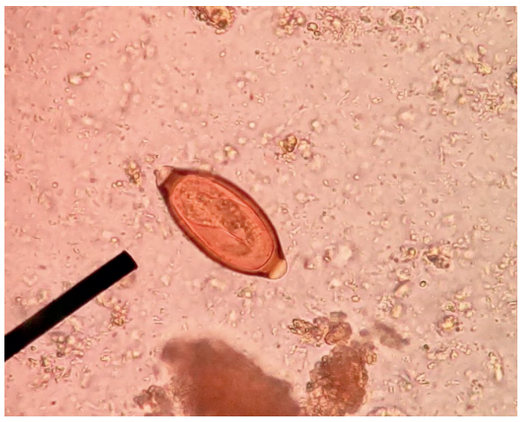

Figure 4. *Trichuris Trichiura* Egg, 40x Obj

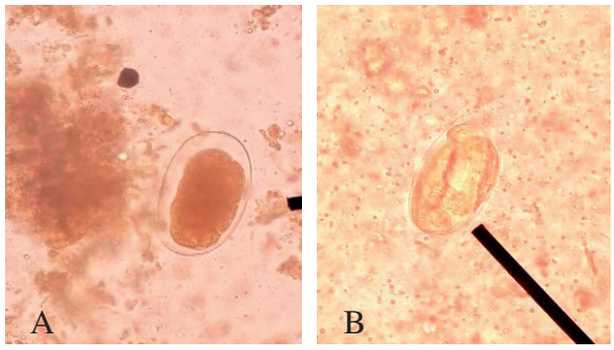

Figure 5. (A) Hookworm Egg. (B) an Advance Stage of Hookworm Egg, 40 X Obj.

lumbricoides larvae that came out of the egg (see Figure 3). In this sample also found *Trichuris trichiura* eggs containing embryos or in an infective stage (see Figure 4).

In this study hookworm eggs mostly found in stadium that containing 2-8 cell embryos, but there are also an advanced stage that containing larvae (see Figure 5).

Figure 6. *Strongyloides Stercoralis* Rhabditiform Larvae, 40 X Obj.

Strongyloides stercoralis infection is not found in a single infection but there was in mixed infection (see Figure 6). Students with mixed infection of *Strongiloides*

Table 3. Results of Stool Examination of Children of SDN 22 and SD Inpres 24 in Sorong District.

STH Infection	SDN 22 (n=55) n (%)	SD Inpres 24 (n=92) n (%)	N = 147 N (%)
Single infection			
Ascaris lumbricoides (**AL**)	0	5 (5,4)	5 (3,4)
Trichuris trichiura (**TT**)	6 (10,9)	2 (2,2)	8 (5,4)
Hookworm (**HW**)	4 (7,3)	0	4 (2,7)
Strongyloides stercoralis (**SS**)	0	0	0
Mixed Infection			
AL – TT	1 (1,8)	6 (6,5)	7 (4,8)
AL – HW	1 (1,8)	0	1 (0,7)
AL – TT – HW	3 (5,5)	4 (4,3)	7 (4,8)
AL – TT – SS	1 (1,8)	0	1 (0,7)
AL – TT – HW – SS	1 (1,8)	0	1 (0,7)
TT – HW	5 (9,1)	2 (2,2)	7 (4,8)
TT – HW – SS	2 (3,6)	2 (2,2)	4 (2,7)
Not Infected	31 (56,4)	71 (77,2)	102 (69,3)

stercoralis were 6 students, 4 of whom were from SDN 22. The description of stool examination result of the sample was explained on Table 3.

From Table 2 it can be concluded that the prevalence of soil transmitted helminthiasis is more common in girls than in boys. This may be due to female hygiene in this area is less good compared with male. Bestari(5) in 2015 doing research in Surakarta city also found the same results.

Most of the infected subjects were 6-9 years old. The prevalence of high soil transmitted helminthiasis at 6-10 years of age can be attributed to habit factors of play. Generally children at that age play more outside home and contact with the ground which is a medium of worm transmissions. Transmission can occur among school students through holding hands while playing with students who often play outside the house and contact with the ground(6).

The types of worms found in stool examinations vary, from *Ascaris lumbricoides*, *Trichuris trichiura*, Hookworm to *Strongyloides stercoralis*. Several surveys in Indonesia show that often high prevalence of *Ascaris* is accompanied by a high prevalence of *Trichuris* as well(6,7). In this study, it was found similar but the prevalence of *Trichuris trichiura* was higher than *Ascaris lumbricoides*. Sorong district areas include tropical areas that have a hot and humid climate(8). This becomes one of the risk factors because *Trichuris trichiura* spread mainly in hot and humid areas(9,10). Tropical climate with high air humidity as well as fertile soil are the optimal environtment for worm life. These two types of worms often lead to mixed infection because their habitats and life cycles equally require soil media(9,11). The number of found mixed infection indicates the level of

hygiene and sanitation in the children's environment is very bad(6). The main factors that cause the occurence of soil transmitted helminthiasis is a behaviour factor that reflects low personal hygiene such as not washing hands with soap before eating and after defecation, cleanliness of the nails that are not maintained, eating foods which cleanliness is questioned, fingernail biting, not wearing footwear during outdoor activities, defecate in the open area[12–14]. The spread of soil transmitted helminthiasis is strongly influenced by the occurence of faeces contamination on the soil and water, so the defecation habits will be very decisive.

In this study, hookworm infection is also commonly found. Generally, the prevalence of hookworm is more common in adults. Hookworm infections often occur in areas where human faeces are used as fertilizer or where defecation onto soil happens[15]. This may explained higher prevalence is found in plantation areas as well as in mining[16,17]. Most of the Sorong district community has major jobs in agriculture, plantation and forestry[18]. There was possibility of an infected adult defecating outside (near bush, in a garden, or field) then a mature hookworm egg and hatch, releasing larvae (immature worms)[15]. The larvae became mature into a form that can penetrate childern's skin. Many elementary school children do not wear footwear. This can increase the risk of getting infected with hookworm and *Strongyloides stercoralis*[19–21].

Strongyloides stercoralis infection was found in 6 students with mixed infection. This is probably related with the climate[22,23]. Sorong's climate is humid, the himidity ranges between 81-87%[8]. This tropical climate and high humidity support the development of *Strongyloides stercoralis*.

Knowing the prevalence of worms can be useful for worm management strategies and can be used for basic data on allergic correlation research with worm infection. The prevalence of allergies is increasing dramatically in the world, both in developing and developed countries, especially in low- and middle-income countries. It is estimated that 30-40% of the world's population is exposed to one or more allergic conditions. This increase is especially true in children.

There is much debate about the interaction between helminths and allergic disease. Some epidemiologic studies suggest that helminth infections induce or increase the severity of atopic diseases. Other studies report children with soil transmitted helminthiasis have lower prevalence and milder atopic symptoms. Although there have been many recent studies, the relationships between allergic and helminth infections remains controversial. The "Hygiene Hypothesis" is a very popular concept among scientists. The so-called "hygiene hypothesis" which posits that allergic phenomena arise from the sanitized living conditions of the developed world has been one of the major theories to account for this remarkable difference in prevalence of allergy. Multiple mechanisms may account for the hygiene hypothesis, but there is considerable evidence to suggest that helminth infection plays a central role[24].

To eliminate soil-transmitted helminthiasis among elementary school children, in addition to routine treatment or deworming through mass drug administration also needs intensive counseling about the importance of maintaining personal hygiene and the environment. Interventions Water, sanitation and hygiene (WASH) and health education could sustain the benefits of antihelmintic therapy[25,26]. They play an extremely important role in breaking the cylce of transmission and preventing infection. There was a study in Sri Lanka showed that even after 10 years of antihelmintic therapy, prevalence can be restored after discontinuation of preventive deworming, if the initial force of transmission is strong and other long-term control measures are not concurrently implemented[25].

CONCLUSION

Prevalence of Soil-transmitted helminthiasis among elementary school children in Sorong district is 30,6% (45/147) with 40.1% (18/45) single infections and 59.9% (27/45) mixed infections. The single infection that most frequent is *Trichuris trichiura*, then followed by *Ascaris lumbricoides.* The worm species that infect elementary school children in the Sorong district is *Ascaris lumbricoides, Trichuris trichiura,* Hookworm and *Strongyloides stercoralis*. Soil-transmitted helminthiasis mostly found in girl than boy and mostly found in 6-9 years age group.

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