



THE EFFECT OF TREATMENT ON PHYSICAL FITNESS IN BASIC SCHOOL CHILDREN WITH SOIL TRANSMITTED HELMINTHS INFECTION

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ABSTRACT

BACKGROUND: Physical fitness is the body's ability to carry out physical activities determined by the physiological and psychiatric state of the body. Physical fitness consist of cardiorespiratory, musculoskeletal and body morphology components. Infection of Soil Transmitted Helminths (STH) causes disruption of nutrition absorption, malabsorption of fat and damage to intestinal mucosa that causes a decrease in physical fitness. Treatment of STH infection with Albendazole 400 mg can inhibit glucose uptake of the parasites, aims to eradicate worms so physical fitness can be improved.

METHODS: Research with a quasi-experimental design was carried out in Pahang Village and Sei Muka Village, Talawi sub-district, Batubara district, North Sumatera from July to December 2018. Children age 9 to 12 years were included by consecutive sampling. There were 68 children who met the inclusion and exclusion criteria. Data analysis was carried out by using t-dependent test (p > 0.05).

RESULTS: From a total of 68 children infected with STH, 58 children were infected by *Trichuris trichiura*. There were effects of STH treatment with physical fitness components which are muscle strength (p = 0.001) and the flexibility of muscles (p = 0.031). However, the types of worms, nutritional status and hemoglobin levels have no effect on physical fitness after treatment.

CONCLUSION: STH treatment affects muscle strength and flexibility except the VO2 max value.

KEYWORDS : Sth; School Children; Muscle Strength; The Flexibility Of Muscles; Vo2 Max.

INTRODUCTION

Infection of Soil Transmitted Helminths (STH) is a group of nematode parasites that cause infection in human, due to contact with parasitic eggs or larvae that develop in warm and humid soils in tropical and subtropical countries in the world. Roundworms (*Ascaris lumbricoides*), whip worms (*Trichuris trichiura*), and hookworms (*Ancylostoma duodenale* and *Necator americanus*), *Strongyloides stercoralis* are called STH because they often cause chronic infections simultaneously in a child, especially in developing countries.¹

The World Health Organization (WHO) estimated in 2012 that more than 2 billions people worldwide are infected with STH, the highest prevalence occurs in inadequate sanitation areas and unclean water sources.² In Indonesia, the prevalence of STH infections in 8 provinces in 2008 ranged from 2.7% to 60.7%, with the distribution of *Ascaris lumbricoides*, *Trichuris trichiura* and Hookworm (*Necator americanus* and *Ancylostoma duodenale*) species in school children 14.5%, 13.9% and 3.6%.³ The Study conducted in villages Like the Tigapanah sub-district, Karo district, North Sumatera in 2004 showed the prevalence of helminthiasis in elementary school-aged children was 91.3%.⁴ A cross-sectional study in Belawan North Sumatera in 2015 for school-aged children in two primary schools reported that the prevalence of STH infection is 65.4%.⁵ Study conducted in villages Like the Tigapanah sub-district, Karo district, North Sumatera in 2018 the prevalence of STH infection is 55.6%.⁶ This shows that there is still high helminthiasis in school children especially elementary school children in North Sumatera Province.

Studies from several countries also show that the treatment of STH infections especially hookworms (*Ancylostoma duodenale* and *Necator americanus*) and roundworms (*Ascaris lumbricoides*) can improve work productivity, health and phy-

sical fitness.⁷ Decreased physical fitness is a manifestation of the body's inability to maintain oxygen supply enough to the body tissues. This can be caused by various causes, including chronic infections caused by STH infection.⁸ The World Health Organization recommends periodic deworming treatment of the population at risk, namely in school children with single-dose albendazole.⁷ There were two studies conducted in a randomized controlled trial in Kenya showing that physical fitness in elementary school children infected with STH improved 7 weeks to 4 months after receiving a single dose of Albendazole 400 mg using a 20 meter alternating run test.⁸

The importance of knowing that the effects of helminthiasis can cause a decrease in physical fitness in children, which in the long run can cause a decrease in learning achievement. so that the teachers can be more aware of paying attention to children's physical fitness in school. However in Indonesia, there has been no research on the effect of deworming treatment on physical fitness in primary school children with STH infection.

**METHODS
STUDY DESIGN**

This study used a quasi-experimental design, comparing physical fitness before and after treatment of worm infection in elementary school children with STH infection. The target population in this study were children aged 9 to 12 years which are infected with STH in SD Negeri 014740 Pahang and SD Negeri 010157 Sei Muka, Talawi sub-district, Batubara district, North Sumatera. The experiment was conducted in July 2018- December 2018. Data analysis was done with statistical software SPSS version 24 and the result will be presented in tables. This study was approved by the Health Research Ethical Committee, Medical School, Universitas Sumatera Utara.

SAMPLE RECRUITMENT

Samples are populations who meet the inclusion and exclusion criterias. The sample selection is based on consecutive sampling. Inclusion criteria; 1. Samples children aged 9-12 years who were infected with STH, 2. The results of Kato-Katz found one or a combination of eggs STH namely *As caris lumbricoides*, *Trichuris trichiura*, Hookworm, *Strong yloides stercoralis*. Exclusion criterias; 1. Those who do not follow the study procedures, 2. Children with chronic illnesses, such as; bronchial asthma, chronic renal failure, pulmonary tuberculosis, congenital heart disease, poor nutrition, obesity, abscess and wound on the body and limbs, 3. Children who consumed anthelmintics in the last 1 month. All study subjects had requested consent from a parent or guardian after the first explanation. Weight was measured on each sample with digital scales stand. Height was measured on each sample using microtoise. Levels of hemoglobin were examined with a portable Hb-Meter. Cardiorespiratory examination was carried out by alternating 20-meter run and then VO2 max was evaluated. Musculoskeletal function was measurement by using hand dynamometer and sit and reach box. After two months of Albendazole tablets 400 mg therapy, stool examination, hemoglobin, and musculoskeletal function measurement and cardiorespiratory function.

STATISTICAL ANALYSIS

Data management was carried out by the Statistical Package for Social Sciences for Windows (SPSS) computerized system version 24, to find out the relationship between categorical data and numerical data using the t test. To find out categorical and categorical relationships, Chi square test was used. The difference in the intensity of worm eggs with hemoglobin levels and physical fitness used ANOVA test. The confidence interval CI is 95% and the significance level is P < 0.05.

RESULTS

PREVALENCE AND DEMOGRAPHIC CHARACTERISTICS

This study was carried out in two Pahang and Sei Muka elementary schools, Talawi sub-district, Batubara district, North Sumatra, from July to December 2018. Stool examination was carried out on 196 children from 9 years old to 12 years old, there were 94 children who did not collect feces. Based on the results of fecal examination found 70 children infected with STH, but 2 children were absent from school, so only 68 children were included in the study. Anthropometry, hemoglobin examination, alternating running test, muscle strength, muscle flexibility. Then the intervention was carried out by giving a single dose of albendazole 400 mg. Furthermore, after 2 months of treatment, routine fecal examination, hemoglobin, alternating running tests, muscle strength, muscle flexibility are performed.

In this study the sample characteristics data were more men with 37 children, and women as many as 31 children. Average age of 10 years, underweight nutritional status of 20 children, 45 children with normal nutrition and 3 overweight children. Data characteristics of the study is shown in table 1.

Table 1. Characteristics of the study subjects

Characteristics	Subject (n=68)
Age, month	
Mean (SD)	10.0 (1.11)
Sex, n (%)	
Male	37 (54.4)
Female	31 (45.6)
Weight, kg	
Mean (SD)	24.3 (4.75)
Height, cm	
Mean (SD)	126.7 (7.30)

BMI, n (%)	
Underweight	19 (27.9)
Normal	48 (70.6)
Overweight	1 (1.5)
Nutritional status, n(%)	
Mild malnutritional	20 (29.4)
Normoweight	45 (66.2)
Overweight	3 (4.4)
STH, n (%)	
A. Lumbricoides	10 (14.7)
T. trichiura	58 (85.2)
Mixed infection	5 (7.3)
Hemoglobin, g/dl	
Mean (SD)	12.1 (0.84)
VO2 max, ml/KgBB/minute	
Mean (SD)	40.0 (2.36)
Muscle strength, kg	
Mean (SD)	9.2 (1.36)
Muscle flexibility, cm	
Mean (SD)	29.5 (3.17)

TYPES OF STH INFECTIONS BEFORE AND AFTER ADMINISTRATION OF ALBENDAZOLE

In this study the types of worms found were *A. lumbricoides*, *T. trichiura* and there were also mixed infections (*A. lumbricoides* and *Trichuris trichiura*). Most pre-treatment tests for STH infection were caused by *T. trichiura* worms, namely 58 children in *A. lumbricoides* 10 children, and there were mixed infections of 5 children. After 2 months of albendazole 400 mg treatment there was a decrease in STH infection to 18 infected children, with the most infections being 15 children *T. trichiura* and 3 children *A. lumbricoides*. In this study no other worm infection was found.

RELATIONSHIP TO PHYSICAL FITNESS BEFORE AND AFTER TREATMENT WITH ALBENDAZOLE

In this study two physical fitness examinations were carried out before treatment and after treatment with albendazole 400 mg. There is a significant relationship to the examination of muscle strength and muscle flexibility before and after treatment. Explanation can be seen in table 2.

Table 2. Relationship between physical fitness before and after treatment with albendazole

Physical Fitness	Before Treatment n= 68	After treatment n= 68	CI 95%	P*
Vo ₂ max, Mean (SD)	40.07 (2.36)	40.04 (2.38)	(-0.017, 0.076)	0.211
Muscle strength, Mean (SD)	9.23 (1.36)	10.08 (1.25)	(-1.055, 0.641)	0.001
Muscle flexibility, Mean (SD)	29.5 (3.17)	29.7 (3.10)	(-0.238, 0.016)	0.031

RISK FACTORS AFFECTING PHYSICAL FITNESS VALUE AFTER TREATMENT

Bivariate analysis of linear regression was carried out by the enter method, there are four independent variables and two dependent variables. Based on the results of the bivariate test, it was found that there was a significant relationship between *T. trichiura* and nutritional status on muscle flexibility. After multivariate testing, there is no effect of *T. trichiura* and nutritional status on muscle flexibility. Further explanation on the table. 3 and table 4.

Table 3. Risk factors that affect physical fitness after treatment (bivariate analysis)

Bivariate Variables	Muscle strength		Muscle flexibility	
	Coefficient	P	Coefficient	P*
<i>A. lumbricoides</i>	-0,018	0,885	-0,094	0,447

T. trichiura	-0,123	0,320	-0,165	0,179
Nutritional status	-0.038	0.756	-0.203	0.097
Hemoglobin	-0,056	0,648	0,095	0,442

Table 4. Risk factors that affect physical fitness after treatment (multivariate analysis)

Variabel Multivariat	Fleksibilitas Otot	
	Koefisien	P
T. trichiura	-0,004	0,152
Status gizi	-0.070	0.084

DISCUSSION

STH infection is one of the diseases which are common in the community and is still a public health problem in Indonesia.⁹ World Health Organization (WHO) recommend that treatment of STH infections with a single dose of Albendazole 400 mg, due to the wide spectrum that can kill certain types of worms. Number of STH infections are high in Indonesia, the highest prevalence found in Papua and North Sumatra with a prevalence of between 50% and 80%.¹⁰ Study in Bali in 2003 to 2007 showed that the prevalence of worm infection in school children is around 40%. In our study the prevalence of STH infections is around 38.5%. This rate is high when compared to the national rate of 10% worm infection. The high number of helminthiasis can be used as an indicator that the treatment of helminth infections is not maximised.¹¹

The results of our study showed high helminthiasis infection in male as much as 54.4%. This is different from the result of the study in Lombok in 2014 there were more female than male.¹² Bolivia study conducted in 2009 showed that there was no significant relationship between helminthiasis with gender and age.¹³

In our study the most nutritional status of children with good nutritional status is as much as 66.2%, malnutrition 29.4% and over nutrition 4.4%. Similar to the study conducted in Yunnan in 2013, there were 58% of children with good nutritional status.¹⁴ The results of study in Southeast Asia in 1995 declared the effect of helminthiasis on the nutritional status was more influenced by hookworm infection. Therefore recommended a programs aimed at improving the nutritional status of children, should be concentrated on the providing adequate nutrition, not just the treatment of STH infections.¹⁵

Hemoglobin level at the beginning of the study had a normal average value, after two months of treatment with a single dose of Albendazole 400 mg increased. We did not find differences in hemoglobin levels based on the type of STH infection. These results are supported by a study conducted in China in 2015.¹⁶ the study in China in 2014, there are differences in levels of hemoglobin in children with STH infections in the first, fourth and sixth month. This is due to the influence of the seasonal dietary changes or the presence of other infection.⁸

After two months of treatment with Albendazole 400 mg as many as 15 children who are infected with *T. trichiura*. The same results were obtained in studies in Lombok in 2014 also showed the presence of *T. trichiura* infection is still high after doing the treatment of single dosage of Albendazole 400 mg.¹² The study conducted in Austria in 2014, *T. trichiura* infected children who received treatment with Albendazole 400 mg for three days have better efficacy compared to the one day administration.¹⁷ However, WHO recommended to control STH infections with modern chemotherapy using a single dose Albendazole 400 mg for children aged over two years.⁷ Based on research in Ethiopia in 2013, showed that there was no significant difference between the number of worm eggs of *A. lumbricoides*, *T. trichiura* and hookworm after being given a

single dose of albendazole 400 mg. A single dose of Albendazole 400 mg is as effective in reducing the number of worm eggs.¹⁸ World Health Organization (WHO) reported rate of decline gives a fairly good number of worm eggs by 80%.¹⁹

There was a significant relationship between physical fitness after treatment with a single dose of 400 mg of Albendazole was given, visible from musculoskeletal function as assessed muscle strength and flexibility of muscles. This contrasts with research in China in 2014, that the muscle strength and flexibility of muscles increased significantly after one month of treatment with Albendazole 400 mg single dose, but after four months and six months of treatment there was no significant improvement.⁶ This study was different because rapid reinfection after successful treatment.

However in our study there was no significant relationship between physical fitness was seen from a respiratory component value VO_2 max after treatment with Albendazole 400 mg. The study in China in 2014 showed a different result in which there is a significant association with increased VO_2 max value after one month of treatment of single dose of Albendazole 400 mg. This is due to the loss of abdominal pain by eliminating *T. trichiura* can improve child endurance in physical exercise such as running back and forth 20 meters.⁸ In our study there are children who have symptoms of abdominal pain.

The results of different studies in Kenya in 1993, an increase in physical fitness after 7 weeks to 4 months of treatment albendazole 400 mg visible from the value VO_2 max increased. This study was different because there is a reduction in the number of hookworm eggs 80%, 100% *A. lumbricoides*, *T. trichiura* 75%.²⁰ While our study reduction in the number of worm eggs of *A. lumbricoides* 70%, *T. trichiura* 74%.

After multivariate analysis not found that the dominant factor *A. lumbricoides*, *T. trichiura*, nutritional status and physical fitness levels of hemoglobin against musculoskeletal related components. The study in Nigeria in 2017 their significant influence between the nutritional status of the physical components of cardiorespiratory fitness. This difference is due to the monitoring of nutritional status and cardiorespiratory component which are VO_2 max levels carried out after 6 months of treatment with Albendazole 400 mg.^{21,22}

Until now, not many study who conducted the evaluation of physical fitness in children infected with STH after doing the treatment. This study can be a valuable information as STH infection prevention to maintain a good physical fitness. Our study can be a source of information for further study. World Health Organization programs assist in the providing the appropriate antihelminth to achieve the target of 75% in school-age children globally by 2020.

The weakness of our study is that the observation time is too short to evaluate the increase in the nutritional status and physical fitness. This is because we consider the occurrence of reinfection after two months of treatment. The treatment that is recommended by WHO is a single dose of Albendazole 400 mg, while most species is *T. trichiura* infection should be given treatment Albendazole 400 mg for three days. The need for regular deworming medication, improving diet, sanitation and environmental hygiene need to be considered.

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