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Research Article

Intestinal Helminth Infections among Children with Disabilities in Bantul Regency, Special Region of Yogyakarta

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Abstract

Due to physical, intellectual, mental, and/or sensory limitations, person with disabilities tend to experience obstacles and limitations in their ability to care for themselves, knowledge of health, and access to health services. As a result, people with disabilities are more at risk of experiencing health problems, one of which is intestinal helminth infection. The aim of this study was to assess the prevalence of intestinal helminth infections and associated risk factors among children with disabilities at school age in Bantul Regency, Special Region of Yogyakarta. A school-based cross-sectional study design was conducted from October until December 2019. A total of 130 stool samples were collected and examined by the flotation, Kato-Katz, Harada-Mori, and Baermann methods to detect the presence of helminth eggs and/or larvae. An interview with parents/guardians of the subject based on a questionnaire was conducted to obtain information regarding the associated risk factor. The overall prevalence of intestinal helminth infections among subjects was 1.5% (CI=95%). Of these, 0,07% (1/130) was positive for hookworm infection, and the remaining 0,07% (1/130) was positive for Trichuris trichiura. Analysis for all risk factors showed no statistically significant association between all risk factors and the intestinal helminths infections in the study subjects (p>0.05).

Keywords: intestinal helminth infections, knowledge of health, risk factors, access to health service

Introduction

Disability was a term that encompasses one or all of the weaknesses in the structure or function of the body, limitations in activity, or barriers to participation in life in society (World Health Organization, 2011a). More than 1 billion people worldwide, around 15% of the total population, lived as children with disabilities (World Health Organization, 2011a). The prevalence of children with disabilities aged 5-17 years in Indonesia was 3.3%, while in the Special Region of Yogyakarta was 4.8% (National Institute of Health Research and Development, 2019). In terms of the economic level, it was estimated that 25.1% of all of people with disabilities in Bantul Regency, Special Region of Yogyakarta have a low economic level (Health Department of Special Region of Yogyakarta, 2019).

Based on The Laws of the Republic of Indonesia Number 8 of 2016, children with disabilities experienced barriers and difficulty in doing activities due to physical, intellectual, mental, and/or sensory limitations, including adequate self-care activities; so they tended to have difficulty maintaining good personal hygiene (Fentahun *et al.*, 2019). Children with disabilities also tended to have limited knowledge about health, both due to lack of information received and their limited ability to understand it (Grut *et al.*, 2015; The United Nations, 2018). Interactions of various factors

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including poverty, poor housing conditions, and social isolation and discrimination among children with disabilities (Chiluba & Muke, 2019) also cause obstacles in accessing health services (Stillman *et al.*, 2017; Vergunst *et al.*, 2017). As a result, people with disabilities were more at risk of experiencing serious health problems (Kuper *et al.*, 2014; Vergunst *et al.*, 2019).

One infectious disease that was susceptible experienced by children with disabilities was intestinal helminth infection, especially some species of helminths commonly known as soil-transmitted helminths or STH (Shehata & Hassanein, 2015; Fentahun *et al.*, 2019). These helminths caused intestinal infections in around 2 billion world population (World Health Organization, 2018), an estimated 610 million cases came from Southeast Asia (Pullan *et al.*, 2014). In Indonesia, the prevalence of intestinal helminth infections ranges from 20-86% with an average of 30% (Ministry of Health of the Republic of Indonesia, 2015). Around 610 million children of school age in the world were at risk of getting intestinal helminths (World Health Organization, 2011b). Chronic intestinal helminth infection in children will cause malabsorption and malnutrition (Papier *et al.*, 2014; El-Sayed & Ramadan, 2017), which will have an impact on growth and development disorders (Forrer *et al.*, 2017; Pabalan *et al.*, 2018).

Until now there was no data on the prevalence of intestinal helminth infections in children with disabilities in Indonesia. This was likely due to the low number of contacts between people with disabilities and health services. Children with disabilities tended to encounter obstacles in accessing health services (Sakellariou & Rotarou, 2017; Vergunst *et al.*, 2017). Those problems related to the availability of services, lack of transport, difficulties in the use of services, inadequate drugs or equipment, and high cost of health services (Eide *et al.*, 2015). Children with disabilities also complained that their wishes were often not understood and treated as a low priority group by health workers, causing them to often refuse to be invited by their parents/guardians to visit health services (Vergunst *et al.*, 2017).

At the 67th World Health Assembly in 2014, WHO launched a draft in the form of action for people with disabilities globally with the theme of "better health for all people with disabilities", aimed at improving the quality of health in these populations around the world (World Health Organization, 2015). In order to achieve this goal, adequate understanding and analysis of the quality of health of children with disabilities was required. One of them is by knowing the prevalence and the risk factors of infectious disease in this population, including intestinal helminth infections. Through that information, efforts to control and eliminate the incidence of disease can be planned, so that the quality of their health will improve.

Methods

A school-based cross-sectional study design was conducted from October until December 2019. Survey was carried out on children with disabilities of all types and degrees aged 5-18 years who registered as students in 20 special schools in Bantul Regency and did not treated with any anthelmintic for 3 months before and during the study. The ethical clearance for this research was obtained from Medical and Health Research Ethics Committee Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada in November 2019. Informed consent was sought from parents/guardians of subjects and subjects aged ≥ 12 years who were not mentally disabled. Data on risk factors related to the incidence of intestinal helminth infections were obtained through interviews with parents/guardians of the subjects with the guidance of the standardize questionnaire. Regarding data concerning the degree of disability related to subject's ability to do self-care activities, questionnaires were prepared based on the International Classification of Functioning, Disability, and Health Children & Youth Version 2007.

Stool sampling was carried out independently by the parents/guardians of the subjects in their respective homes after received an explanation and equipments, then the stool samples were collected at each school. A total of 150 parents

were interviewed, but in the end only 130 subjects returned the pot containing the stool sample. Stool samples collected came from those produced during defecation in the morning of the same day. Stool samples collected were examined by the flotation, Kato-Katz, Baermann, and Harada Mori method to identify the presence of eggs and/or larvae of intestinal helminths at Laboratory of Parasitology, Faculty of Medicine, Public Health, and Nursing Universitas Gadjah Mada. Descriptive analysis was used to calculate frequencies, percentages, means, and standard deviation. The relationship between factors thought to be risk factors and intestinal helminth infections was analyzed using Mann-Whitney and Fisher's test.

Results

The sociodemographic characteristics observed in this study include age, gender, parent's occupation, parental education, parental income, and family size. The mean age of the study subjects was 9.76 ± 3.04 years. In accordance with the data contained in Table 1, based on the results of the examination, the prevalence of intestinal helminth infections in subjects was 1.5% (n = 2); the prevalence of hookworm infection and *Trichuris trichiura* were 0.77%, respectively. Both subjects who were infected with intestinal helminths experienced a single infection with mild intensity. Neither *Ascaris lumbricoides* egg, hookworm larvae, nor *Strongyloides stercoralis* larvae were found in all stool samples.

Table 1. Prevalence of intestinal helminth infections in children with disabilities in Bantul Regency, Special Region of Yogyakarta (N=130)

Characteristics	n	%
Intestinal Helminth Infections		
Negative	128	98.5
Positive	2	1.5
Intestinal Helminth Species		
Ascaris lumbricoides	0	0
Hookworm	1	50
Trichuris trichiura	1	50
Strongyloides stercoralis	0	0
Classification of Intestinal Helminth Infections		
Single infections	2	100
Mixed infections	0	0

The Mann-Whitney test was carried out to identify the association between age and the intestinal helminth infections, the result was p=0,761 (CI=95%). Age was not related to the incidence of intestinal helminth infections, statistically. The Fisher's test was used to identify the association between other risk factors with intestinal helminth infections, include parental occupation, parental income, parental level of education, family size, type of disability, degree of disability, behavior, household water sources, and sites of defecation. Statistical analysis with Fisher's test gave the result that the p value for all risk factors > 0.05 (CI=95%). Having habit of biting fingers/inserting objects into the mouth and habit of using footwear when leaving the house gave results of p value <0.25, therefore these two variables were included in multivariate logistic regression analysis to determine the strength and significance of the relationship between variables. The p value for each of these habits was 0.996 (Prevalence Ratio = 0,000). No risk factor in study subjects was significantly associated with intestinal helminth infections.

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Table 2. Risk factors associated with intestinal helminth infections in children with disabilities in Bantul Regency, Special Region of Yogyakarta (CI=95%)

Characteristics	Category	Infected		Not Infected		Total Subject		*p-value*
		n	%	n	%	N	%	
Gender	Male	1	1.4	73	98.6	74	56.9	1.0
	Female	1	1.8	55	98.2	56	43.1	
Father's occupation	Contact with soil	1	1.3	74	98.7	75	57.7	
	No contact with soil	1	1.8	54	98.2	55	42.3	1.0
Mother's occupation	Contact with soil	2	1.7	114	98.3	116	89.2	1.0
	No contact with soil	0	0	14	10.9	14	10.8	
Parental income	Low	2	2.5	78	97.5	80	61.5	0.523
	Standard	*0*	0	50	100	50	38.5	
Father's education level	Low	1	1.7	57	98.3	58	44.6	1.0
	High	1	1.4	71	98.6	72	55.4	
Mother's education level	Low	1	1.9	53	98.1	54	41.5	1.0
	High	1	1.3	75	98.7	76	58.5	
Familiy size	Small (< 4 persons)	1	2.6	37	97.4	38	29.2	0.501
	Big (≥ 4 persons)	1	1.1	91	98.9	92	70.8	
Type of Disability	Physical disability	0	0	35	27.3	35	26.9	1.0
	Mental disability	2	2.1	93	97.9	95	73.1	
Degree of disability	No disability – mild disability	0	0	64	50	64	49.2	
	Moderate to total disability	2	3.0	64	50	66	50.8	0.496
Eating raw vegetables	Yes	0	0	15	100	15	11.5	1.0
	No	2	1.7	113	98.3	113	88.5	
Sucking fingers/putting objects in the mouth	Yes	2	5	38	95	40	30.8	0.093
	No	0	0	90	100	90	69.2	
Washing and peeling fruit before eating	Yes	*2*	1.8	109	98.2	111	85.4	1.0
	No	0	0	19	100	19	14.6	
Washing hand with water and soap before eating and after defecating	Yes	1	1.1	94	989	95	73.1	0.468
	No	1	2.9	34	97.1	35	26.9	
Wearing footwear when step on the ground	Yes	0	0	80	100	80	61.5	0.146
	No	2	4	48	96	50	38.5	
Routinely cutting nails	Yes	1	1	101	99	102	78.5	0.386
	No	*1*	3.6	27	96.4	28	21.5	

Household water supply	Well and/or regional water supply company	2	1.6	127	98.4	129	99.2	1.0
	Sungai	0	0	1	100	1	0.8	
Defecating site	Latrine	2	1.6	127	98.4	129	99.2	
	River	0	0	1	100	1	0.8	1.0

Discussion

This study indicated that the prevalence of intestinal helminth infections in children with disabilities who attend school in Bantul Regency, Special Region of Yogyakarta Province, was much lower when compared with other studies in several countries. Some study in Nigeria showed that the prevalence of intestinal helminth infections in children with chronic neurological disorders was 31% (Nwaneri *et al.,* 2013) and 8.5% (Uzodimma *et al.*, 2016). Another study of students with mental disabilities in Ethiopia stated that the prevalence of intestinal helminth infections was 20.19% (Fentahun *et al.*, 2019). Our study was the first study of the prevalence of intestinal helminth infections in children with disabilities at special school in Indonesia.

Hookworm and *Trichuris trichiura* eggs were found from two out of 130 children with low intensity, while *Ascaris lumbricoides* and *Strongyloides stercoralis* eggs and larvae were not found. The prevalence of infection for each hookworm and *Trichuris trichiura* species in this study was 0.77%. This figure was lower than the results of study in Nigeria which mentioned that the prevalence of hookwormand *Trichuris trichiura* infections was 7.7%, while for *Ascaris lumbricoides* was 20% as mild intensity (Nwaneri *et al.*, 2013). Higher prevalence rate was also found in studies conducted in Ethiopia, which were 6.20% for hookworm and 7.90% for *Ascaris lumbricoides*, all classified as mild-intensity infections (Fentahun *et al.*, 2019). Slightly different results were shown in the results of other studies in Nigeria, the prevalence of *Ascaris lumbricoides* helminth infection by 7.7% and *Trichuris trichiura* by 0.8%, infection of both helminths also in low intensity (Uzodimma *et al.*, 2016).

Very low prevalence of intestinal helminth infections at the study site was probably related to the implementation of the Distribution of Mass Preventive Chemotherapy (PC) Program based on the Regulation from Republic Indonesia Ministry of Health (2017) which concerning prevention of intestinal helminths. The target of this program was all children aged 1-12 years in regencies/cities with moderate (20-25%) and high (>50%) prevalence, whereas in low prevalence areas, PC were carried out selectively. Drugs given at this program are Albendazole 200 and 400 mg single dose. Although Bantul Regency was not considered as an area for PC implementation, PC was distributed at Bantul Regency due to Ministry of Health of the Republic of Indonesia instruction in 2019 which set Bantul Regency as one of 160 districts/cities included in the stunting intervention (Directorate General of Disease Prevention and Control, 2019). Reducing the helminth infection was one of the specific nutrition intervention frameworks in stunting management efforts. For Bantul Regency, the drugs given twice a year at 6-month intervals, began in April 2019. This program coverage for school-aged children 5-12 years in Bantul Regency in April 2019 ranged from 89-100%.

In this study, age and gender were not significantly related to intestinal helminth infections. This is in line with previous studies in children with no disabilities at elementary school in Ethiopia (Samuel *et al.*, 2017), but different with the results of studies in children with no disabilities in Surabaya (Rosyidah & Prasetyo, 2018) and children with disabilities in Ethiopia (Fentahun *et al.*, 2019). Both subjects who were positive for intestinal helminth infections in this study were 9 years old. Based on previous research, intestinal helminth infections occur most in the 5-9 years age group (Damen *et al.*, 2011). This was related to the habits of children in this age group who had the habit of playing on the

ground which was known to be one of the transmission media for intestinal helminth infections. Besides, children in that age group also still had immature immune systems compared to children with older age thus increasing the risk for intestinal helminths infections. Intestinal helminth infections were more common in boys than girls (Uzodimma *et al.*, 2016). This was also related to the habits of boys who played more often and contacted with the ground compared to girls who tended to prefer to play in the house.

The type of work of the parents of the research subjects was also known to be unrelated to the incidence of intestinal helminth infections in children, this was in line with the results of research on children in North Sumatra (Pasaribu *et al.*, 2019). The education level of the parents of the study subjects was also not related to the incidence of intestinal helminth infections in children, in line with the results of the study in North Sumatra (Pasaribu *et al.*, 2019), but different from some of the results of other studies (Hailegebriel, 2018; Teshale *et al.*, 2018; Fentahun *et al.*, 2019). Mothers with low levels of education were considered to lack understanding and mastering the concept of 'clean and healthy life behavior', so it would be difficult to practice it in the family environment (Doni *et al.*, 2015; Ross *et al.*, 2017; Torres de Freitas *et al.*, 2017). On the subject of this study, although half of the parents of the subjects had a low level of education, their awareness of implementing 'clean and healthy life behavior' practices for their children was quite good. The positive effect could be seen from the low prevalence of intestinal helminth infections in study subjects.

In this study, parent's income which had implications for the economic level of the family did not have a significant relationship with the incidence of intestinal helminth infections in children, in contrast to the results of previous studies in Nigeria (Uzodimma *et al.*, 2016). Poverty was considered influential in preventing access to health services that are both preventive and curative in nature, so that the poor would be more at risk of being infected with intestinal helminths, then if they were infected they tended not to get treatment (Houweling *et al.*, 2016). In this study, although most of the research subjects came from families with low economic levels, this did not affect the incidence of intestinal helminth infections in their children. Guaranteed free health services by the government, both preventive and curative in the form of free treatment in health facilities, might be able to eliminate the gap in opportunities to access health services between upper, middle and lower economic groups (World Health Organization, 2015).

Family size that represents the density of house occupants was not related to the incidence of intestinal helminth infections in this study, different from the results of previous studies (Samuel *et al.*, 2017; Fentahun *et al.*, 2019). If one family member was infected with intestinal helminths, then the risk of another family member could become infected will increase if the density of the occupants of the house was higher. This was related to higher contact rates between occupants of houses with high density. There was no significant association between the type and degree of disability with the incidence of intestinal helminth infections. Both subjects who were positively infected by intestinal helminth were children with mental disabilities with a moderate degree of disability. Several previous studies conducted on children with mental disabilities indicate an increased risk of intestinal parasitic infections that occured due to the inability to properly maintain personal hygiene and a lack of understanding of personal hygiene (Shehata & Hassanein, 2015). In contrast to children with physical disabilities who tended not to experience limited understanding of something, even though they had obstacles in their activities but still had awareness about personal hygiene so they could ask for help from others in carrying out activities related to maintaining personal hygiene that they could not do themselves.

The degree of disability was describing the limited ability of the subject in self-care activities so that it required quite a lot of help from others. The increasing degree of disability was in line with the increasing limitations of activities, including the ability to maintain personal hygiene which was one of the factors that most influences the occurrence of intestinal helminth infections in

children with disabilities (Teshale *et al.*, 2018; Fentahun *et al.*, 2019). However, the condition of disability in this study subject would be a reason for parents to give them special attention and treatment, including in terms of hygiene and health, which had implications for the low prevalence of intestinal helminth infections in the group.

Children's behavior was related to personal hygiene, such as cutting nails, washing hands with soap and water before eating and after defecating, washing and peeling fruit before eating, eating raw vegetables, sucking fingers or putting objects in the mouth, and habit of not wearing footwear had no association with the intestinal helminth infections in children with disabilities in Bantul Regency. The habit of consuming raw vegetables was estimated to be a risk factor for intestinal helminth infections (Huat *et al.*, 2012; Fentahun *et al.*, 2019), because helminth egg were often found in vegetables that are naturally grown on the ground. Cooking vegetables first before consumption would reduce the risk of being infected with intestinal helminths, because most helminth eggs would be damaged at high temperatures. Helminth eggs which were infective stages could also be ingested through contaminated fruit skin. In line with previous habits, the habit of washing and peeling the skin of the fruit before eating would reduce the risk of intestinal helminth infections (Vos *et al.*, 2015; Teshale *et al.*, 2018). The only 1.5% prevalence of helminth infections in this study was probably related to the small number of subjects who had habit of eating raw vegetables (11.5%) and not washing and peeling fruit before eating (14.6%), although statistically not related to the incidence of intestinal helminth infections.

Nails that were not routinely cut could be filled with various types of dirt material that were very likely to cause stool-oral transmission of intestinal helminths, or could instead be used by helminths as habitat to complete their life cycle. Therefore, the habit of routinely cutting nails would reduce the risk of intestinal helminth infection (Nwaneri *et al.*, 2013; Mirisho *et al.*, 2017; Hailegebriel, 2018; Novianty *et al.*, 2018; Fentahun *et al.*, 2019). The results of this study indicated that statistically there was no association between the habit of cutting nails with the intestinal helminth infections, similar to previous studies (Anwar *et al.*, 2013; Uzodimma *et al.*, 2016; Sofiana & Kelen, 2018). The majority of subjects (78.5%) were accustomed to cutting or cutting their nails at least once a week. This might explain the low prevalence of intestinal helminth infections in this group, although the habit was not related to the intestinal helminth infections.

Washing hands with soap and water before eating and after defecating was considered to reduce the risk of intestinal helminth infections (Nwaneri *et al.*, 2013; Omitola *et al.*, 2016; Mirisho *et al.*, 2017; Teshale *et al.*, 2018; Fentahun *et al.*, 2019). Hands are the most vulnerable part of the body to be contaminated with infective material, as well as the most frequent contact with the mouth which is one of the most common routes of entry for intestinal helminth infections. Washing hands with soap and water could get rid of the infective stage of helminths and other infective material from the hands (Fentahun *et al.*, 2019). The results of this study indicated that there was no relationship between these habits with the incidence of intestinal helminth infections in line with previous studies in West Sumatra (Anwar *et al.*, 2013). Because the habit of washing hands with soap and water was owned by the majority of research subjects (73.1%), it was likely that this affects the low prevalence of intestinal helminth infections in research subjects.

One of the bad habits that were often found in children with disabilities was the habit of biting fingers or putting objects in the mouth. These habits could be a way for the entry of helminth eggs into our bodies, so children who had these habits would be at greater risk for intestinal helminth infections (Nwaneri *et al.*, 2013). In this study it was concluded that there was no relationship between these habits with the intestinal helminth infections, the same result as the results of previous studies (Uzodimma *et al.*, 2016). However, one of the subjects who was positively infected by *Trichuris trichiura* species had this habit. Associated with their life cycle, the possibility of infection obtained by the subject

was related to his habit of biting a finger or inserting objects into the mouth.

Another habit that could reduce the risk of being infected with intestinal helminths was to wear footwear when step on the ground (Tomczyk *et al.*, 2014). The method of transmission of several species of helminths, including hookworm and *Strongyloides stercoralis* was through the larvae that penetrate the skin. The presence of helminth larvae in the ground was very likely to penetrate the skin of the foot, especially if it was not protected by footwear. In this study, there was no relationship between the habit of using footwear and the incidence of intestinal helminth infections, similar to the results of previous studies in Nigeria (Fentahun *et al.*, 2019). Most subjects in this study had a habit of using footwear, but 2 children. Among those 2 children who have a habit of not using footwear when leaving the house, only 1 child who was positive for hookworm infection. This fact suggests that the subject got an infection due to bad habits that often did not use footwear when step on the ground.

Efforts to eliminate intestinal helminth infections, especially soil-transmitted helminths, required increased access of fresh water, quality of sanitation, and hygiene (Strunz *et al.*, 2014). Poor environmental sanitation was one of the risk factors for intestinal helminth infections (Bakarman *et al.*, 2019; Ercumen *et al.*, 2019; Pickering *et al.*, 2019). In this study, it was known that there was no statistical relationship between the type of household water source and the place of defecation with the incidence of intestinal helminth infections, this result was in line with the results of previous studies (Uzodimma *et al.*, 2016), but different from some other studies (Rosyidah & Prasetyo, 2018; Fentahun *et al.*, 2019). The majority of study subjects used dug wells and/or the regional water supply company as household water sources (99.2%) and used latrine as a place for defecation (99.2%), including two subjects who were known to be positively infected with intestinal helminths. Statistically, there was no significant relationship between the incidence of intestinal helminth infections in children with disabilities and all of the risk factors mentioned above. This may be due to very low number and uneven distribution of cases of intestinal helminth infections in this population.

Conclusion

The prevalence of intestinal helminth infections among children with disability in special school at Bantul Regency, Special Region of Yogyakarta was low; and there was no statistically significant association between all risk factors and the intestinal helminth infections in this study subject.

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