

## Hygiene Related Risk Factors for Giardia Infection in Sukowono District, Jember, Indonesia

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### Abstract

*Giardia spp.* is a common cause of diarrhoeal disease in humans and is also known as a zoonotic agent in humans and animals. There are three risk factors of zoonotic *Giardia*, the first is individual characteristics, the second is hygiene, and the last is environmental. This study aimed to analyze the hygiene related risk factors for *Giardia* infection in Sukowono District, Jember. The research design was a cross-sectional study with 52 subjects from Sukowono District, Jember. The study was carried out from December 2020 to April 2021. The sampling method used purposive sampling is a non-probability sample and chi-square test for data analysis. Data was analyzed using SPSS statistics programme. P value < 0,05 was considered statistically significant. The result of microscopic examination of 52 fecal samples found 1.9% of the subjects were infected with *Giardia spp.* There was no association between hygiene behavior factors with *Giardia spp.* in Sukowono District, Jember (p>0.05). Data suggest that risk factors may not contribute to *Giardia spp.* infection. Based on these findings, need to do further research about hygiene related risk factors for *Giardia spp.* infection in Jember especially Sukowono District.

**Keywords:** hygiene factor, *Giardia* infection, zoonosis

### Introduction

*Giardia spp.* is a common intestinal protozoan that infects humans, as well as animals and is considered a zoonotic disease. The highest incidence of cases was found in developing countries ranging from 20-30% compared to developed countries which rang from 3-7% (Nengsih et al., 2020). Giardiasis is transmitted by either direct or indirect mechanisms (Yaoyu Feng, 2011). The direct deployment can be through the fecal-oral and ano-oral route, while indirectly through water or food that has been contaminated with *Giardia spp.* (Artika et al., 2017). Clinical manifestations of *Giardia spp.* range from the absence of symptoms to acute symptoms, chronic diarrhea, abdominal pain, nausea, vomiting and weight loss to nutrients malabsorption (Vivancos et al., 2018).

The World Health Organization (WHO) data in 2013 states that the second largest deaths in the world mainly in children are caused by diarrhea, inflicting 370,000 cases in 2019 (WHO, 2013). Three factors influence the incident of diarrhea, the first is characteristics originating from individuals such as the level of caregivers' education for children or toddlers, and nutritional status. The second is preventive behavior in a person such as hygiene habits which include boiling drinking water, washing hands before eating, after defecation or contact with livestock. Then the last factor is the environment, which includes availability and quality of clean water as well as density in the area of residence occupied (Al-Mekhlafi et al., 2016 ; Campbell et al., 2016).

*Giardia spp.* infection will cause productivity disturbances that can have an impact on the economy, while in children who are infected for a long time, will cause developmental disorders such



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as growth failure or stunting (Marie CM Halliez, 2013). Thus, this study aimed to determine the risk factors of hygiene behavior towards *Giardia* infection in Sukowono District, Jember.

## Methods

This was a cross sectional study conducted from December 2020 to April 2021, using a self-reported questionnaire. The sampling method of this study was purposive sampling is a non-probability sample with a total of 52 people in Sukowono District, Jember agreed to participate in the study. Sampling using the Gpower application with type of strength or determination of the sample based on the value of  $\alpha$  0,05,  $\beta$  0,95, and a medium 0,5 of effect size, Inclusion criteria were subjects who can communicate well, using well water in the daily life which were associated with the source of infection with *Giardia spp.*, wells that met health requirements, namely >15 m deep and have cattle located around 10 m from their house. Cattle cages that are close to the house can affect the incidence of someone being infected with giardia, so the farther the house is from the cage, the less a person is infected with *Giardia spp.*. The subjects who did not collect their feces sample will be excluded. This study was approved by the Ethics Committee of the Faculty of Medicine, University of Jember No. 1.523/H25.1.11/KE/2021.

The questions in the questionnaire consist of 20 points about hygiene-related factors such as food and beverages handling, hand washing with soap, nail hygiene, and latrine habits. There were three assessments of hygiene behavior factors: good, moderate, and poor using the percentile formula. Good if the score was >14, moderate if the score was 13-14, and poor if it had a score <13.

Fecal samples were taken from subjects and examined for *Giardia spp.* by a microscope examination with 1000x

magnification. For microscopic observation, concentration technique was the sedimentation and modification of Ziehl-Neelsen (ZN) method done at the Parasitology Laboratory, Faculty of Medicine, University of Jember. Data were analyzed by *chi-square* test using using SPSS statistics programme. P value < 0,05 was considered statistically significant.

## Results

Characteristics of subjects based on gender, age, education level, and occupation were presented in Table 1. More than half of the subjects in this study were female (59.6%). Most of the subjects were adults aged 18-45 years (42.3%), elementary school as last educational background (44.2%) and works as farmers and ranchers (34.6%).

The hygiene risk factor in this study were food and beverage handling, hand washing with soap, nail hygiene, and latrine habits (Table 2). Subjects who had food handling habit as much as 88.5%, while 50% had drink handling habit, those washed their hands with soap were 75%, whereas 13,5% had the habit of cleaning their nails 38.5% had latrine habits in the toilets Table 2.

The subjects, who had good hygiene behavior this research were 30.8% or 16 people, while 50% or 26 people were moderate, and 19.2% or 10 people were poor. Based on the *chi-square test*, there was no relationship between hygiene factors and *Giardia spp.* ( $p$ -value= 0.601) (Table 4).

Microscopy to be the primary method for detection of the protozoa *Giardia* cyst. In detection require a stool sample to be examination with concentration technique was the sedimentation and staining modification of ZN method (See Fig.1).

**Table 1.** The subjects characteristics

No	Characteristics	Frequency	(%)	Infected by <i>Giardia spp.</i>	
				Positive n (%)	Negative n(%)
1.	<b>Gender</b>				
	Female	31	59.6	0.0	31.0
	Male	21	40.4	1.0	20.0
	<b>Total</b>	<b>52</b>	<b>100</b>	<b>1.0</b>	<b>51.0</b>
2.	<b>Age</b>				
	0-1 year old	2	3.8	0.0	2.0
	1-6 year old	6	11.5	1.0	5.0
	6-18 year old	7	13.5	0.0	7.0
	18-45 year old	22	42.3	0.0	22.0
	45-59 year old	11	21.2	0.0	11.0
	≥60 year old	4	7.7	0.0	4.0
	<b>Total</b>	<b>52</b>	<b>100</b>	<b>1.0</b>	<b>51.0</b>
3.	<b>Education Level</b>				
	Pre-school	7	13.5	1.0	6.0
	No education or Elementary school	23	44.2	0.0	23.0
	Junior high school and senior high school				
	College	19	36.5	0.0	19.0
	<b>Total</b>	<b>3</b>	<b>5.8</b>	<b>0.0</b>	<b>3.0</b>
	<b>Total</b>	<b>52</b>	<b>100</b>	<b>1.0</b>	<b>51.0</b>
4.	<b>Occupation</b>				
	Farmer/ranchers	18	34,6	0.0	18.0
	Housewife	9	17,3	0.0	9.0
	Student/not school yet	14	26,9	1.0	13.0
	Other	11	21,2	0.0	11.0
	<b>Total</b>	<b>52</b>	<b>100</b>	<b>1.0</b>	<b>51.0</b>

**Table 2.** Hygiene behavior risk factors of subjects

No.	Hygiene Behavior	Frequency	Percentage (%)
1.	<b>Handling Food</b>		
	Yes	46	88.5
	No	6	11.5
	<b>Total</b>	<b>52</b>	<b>100</b>
2.	<b>Handling Beverage</b>		
	Yes	26	50
	No	26	50
	<b>Total</b>	<b>52</b>	<b>100</b>
3.	<b>Washing hands with soap</b>		
	Yes	39	75
	No	13	25
	<b>Total</b>	<b>52</b>	<b>100</b>
4.	<b>Nail hygiene</b>		
	Yes	7	13.5
	No	45	86.5
	<b>Total</b>	<b>52</b>	<b>100</b>
5.	<b>Bowel habits</b>		
	Yes	20	38.5
	No	32	61.5
	<b>Total</b>	<b>52</b>	<b>100</b>

**Table 3.** Hygiene behavior risk factors with infections of *Giardia spp.*

	<i>Giardia spp.</i>				Total	<i>p-value</i>
	Positive	%	Negative	%		
<b>Personal hygiene</b>						
Good	0	0.0	16	100.0	100.0	0.601
Moderate	1	3.8	25	96.2	100.0	
Poor	0	0.0	10	100.0	100.0	
<b>Total</b>	<b>1</b>	<b>1.9</b>	<b>51</b>	<b>98.1</b>	<b>100.0</b>	

Significant if  $p < 0.05$ 

## Discussion

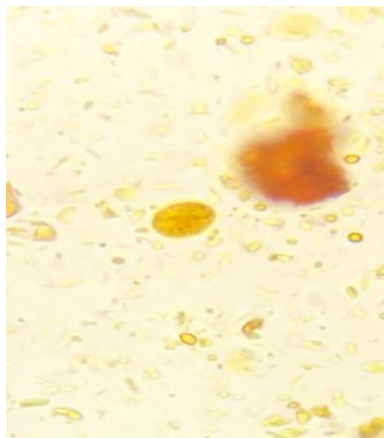
This research results indicate that the majority of the subjects are female 31 person, but among 21 male subject there were 1.0% of them infected with *Giardia spp.*, compared to none among the females. This finding is in line with research by (Nurhayati, 2015) and (Samie et al., 2020), where the infection of *Giardia spp.* was higher in male than that of female. This might be related to male's higher activity and more contact with the external environment. According to (Joseph, 2020), reported more female infected with *Giardia spp.*. Differences in results in this study could be caused by other factors such as personal hygiene, environmental sanitation, socioeconomic status, nutritional status, and the quantity of *Giardia spp.* to cause infection (Samie et al., 2020). The majority of the subjects were aged 18-45 years, but 1.0% of people infected with *Giardia spp.* were aged 1-6 years, this is probably caused by immature immune system, poor personal hygiene habits, and frequent activities outside the environment, such as playing (Al-Jawabreh et al., 2019).

The subjects of this study generally have a low level of education (elementary school graduates or no school), 1.0% of people who have not entered school are infected with

*Giardia spp.*. The level of education is an effort made by the community to improve health status. The low level of education will affect a person's awareness of the importance of personal and environmental hygiene. Someone with a low level of education will experience obstacles in receiving various information both in the health sector and others (Dwi et al., 2020).

The majority of subjects worked as farmers or ranchers, but 1.0% of the subject who did not go to school were actually infected with *Giardia spp.*. The same study was reported by research in (Zajackowski et al., 2019) and (Maryanti et al., 2019) which stated that the risk factors for being infected with *Giardia spp.* could occur in students or not yet in school, but most likely exposed to *Giardia spp.*, while at school or on a playground.

The results of this study indicate that there is no significant relationship between hygiene behavior factors and *Giardia spp.* infection. This is in line with study by (Maryanti et al., 2019) that reported there was no significant difference between the hygiene behavior and *Giardia spp.* infection. That is due to immunity, low socioeconomic status, and a history of traveling outside the region or country of origin.



**Figure 1.** The cyst of *Giardia spp.* in fecal sample and identified on wet mount in microscopic analysis of fecal material with lugol's iodine using 1000x magnification

There is no significant relationship between hygiene behavior factors and infection of *Giardia spp.*. The majority of subjects have the habit of handling food before consumption. This finding is consistent with a study conducted (Sinambela, 2015) which revealed there was no significant relationship between food handling and *Giardia spp.*.

Another indicator that cause insignificant results is the handling of beverage. The subjects have a balanced habit of handling beverage before consumption with those that are not. The source of water used by the subjects comes from well water which still does not meet the requirements of good well water, so itthe water requires further process. This can reduce the risk of being infected with *Giardia spp.*. The results of this study are in line with study by (Lia Tri Hardiyanti, 2017) which reported that there was no significant relationship between handling of beverage and *Giardia spp.* infection with drinking water consumed daily, closure of municipal water District and used well water, as well as handling water before consumption (Saputra et al., 2016).

In addition to handling beverage, another indicator is washing hands with soap. The subjects have a habit of washing their hands with soap before eating, contact with soil, animals, and after defecating. The results of this study are in line with research by (Maryanti et al., 2019) which stated that there was no significant relationship between hand washing with soap and *Giardia spp.* infection, while the results study by (Artika et al., 2017) indicated that hand washing with soap was associated with *Giardia spp.*. The difference in the results is caused by differences in knowledge in proper hands washing and can be influenced by other factors such as the level of awareness of the importance washing hands with soap.

The insignificant results may also be due to other factors, including nail hygiene. The same study was reported by research by (Artika et al., 2017), that there was no significant relationship between nail hygiene, such as not having the a habit of biting nails with *Giardia spp.*. A different study by (Al-Mekhlafi et al., 2016) reported the results which stated that there was significant because the subjects had the habit of

cutting their nails more than once a week, so that it could cause a high risk of being infected with *Giardia spp.*

Another factor that is not significant other than cleanliness of the nails is the habit of defecation. Only a few of all subjects have the habit of defecating in the toilets. The habit of defecating in the toilet, can reduce *Giardia spp.* infection. This finding is in line with the research that conducted by (Maryanti et al., 2019) The study revealed that there was no significant relationship between latrine habits and *Giardia spp.* infection. The finding is in contrast to study conducted by (Nengsih et al., 2020) which stated the habit of defecating 5.73 times could increase the risk of *Giardia spp.* infection.

### Conclusion

This study provides important data on risk factors for *Giardia spp.*. The data suggest that risk factors may not contribute to *Giardia spp.* infection. Based on these findings, further research needs to be done by adding a more comprehensive sample regarding about hygiene related risk factors for *Giardia spp.* infection in Jember especially Sukowono District.

### Conflict of Interest

The authors declare no conflict of interest.

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### Author Contribution

The all author contributed in preparing the manuscript, drafting concepts, compiling research designs, collecting data, data analysis, revise the final manuscript for publication, and approve final version to be published.

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