ORIGINAL ARTICLE

Bali Medical Journal (*Bali Med J*) 2020, Volume 9, Number 1: 271-275
P-ISSN.2089-1180, E-ISSN: 2302-2914

Published by DiscoverSys

Prevalence of giardiasis and its associated factors among livestock and rivers in Mlati, Sleman, Yogyakarta, Indonesia

Yulia Sari[1,2*], Betty Suryawati[3], Ari Natalia Probandari[4], Hartono[5], Ratih Dewi Yudhani[6]

[1]Doctoral Program of Medical Sciences, Universitas Sebelas Maret, Surakarta, Indonesia
[2]Department of Parasitology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia
[3]Department of Microbiology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia
[4]Department of Public Health, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia
[5]Department of Physiology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia
[6]Department of Pharmacology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia

*Corresponding to :
Yulia Sari; Doctoral Program of Medical Sciences, Universitas Sebelas Maret, Surakarta, Indonesia ;
Department of Parasitology, Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Indonesia; Faculty of Medicine, Universitas Sebelas Maret Jl. Ir. Sutami No.36A Kentingan Jebres Surakarta 57126; Phone : +62081392114396; Fax : 634700;
yuliasari_fk@staff.uns.ac.id

Received: 2019-10-23
Accepted: 2020-03-31
Published: 2020-04-16

ABSTRACT

Abstract: Giardiasis is a gastrointestinal disease caused by the protozoan *Giardia sp*. Recent data showed that constant contact with livestock could pose greater risk of contracting this disease, especially without any protective gears. Unfortunately, this condition is still prevalent in several areas in Indonesia. Therefore, this study was aimed to evaluate the prevalence of giardiasis and its risk factors in the community around livestock areas and rivers in Mlati, Sleman, DIY, Indonesia.

Methods: A cross-sectional study was conducted from January-August 2019 around the livestock area and rivers in Mlati, Sleman, DIY. Stool samples were obtained from subjects who have livestock and live along the rivers or its tributaries. The status of Giardiasis were determined from microscopic examination and PCR using beta-giardin as the reference conducted in Parasitology and Biomedical Laboratory, Faculty of Medicine, UNS.

Results: A total of 179 subjects were were enrolled in this study. The prevalence of giardiasis among study population was found to be at 5.02% (n=9), 19 (10.6%) of them were cattleman, and 122 (68.1%) had a history of contact with cattle. Subjects who did not own any cattle seemed to have a significantly lower risk of contracting giardiasis (AOR: 0.041, 95%CI: 0.009-0.185; p=0.000) since contact with cattle also proved to be the risk factor of giardiasis (AOR: 1.080, 95%CI: 1.027-1.135; p<0.002).

Conclusion: This study revealed that constant contact with cattle lead to significantly higher risk of giardiasis for those who live among livestock and along the rivers in Mlati, Sleman DIY.

Keywords: Prevalence, Risk Factors, Giardiasis, Livestock, Rivers
Cite this Article: Sari, Y., Suryawati, B., Probandari, A.N., Hartono., Yudhani, R.D. 2020. Prevalence of giardiasis and its associated factors among livestock and rivers in Mlati, Sleman, Yogyakarta, Indonesia. *Bali Medical Journal* 9(1): 271-275. DOI: 10.15562/bmj.v9i1.1634

INTRODUCTION

Giardiasis is one of important non-viral diarrheal diseases which is estimated to infect 280 million people worldwide with an incidence of 500,000 cases per year.[1,2] This disease is caused by enteric flagellated protozoa *Giardia duodenalis* (syn. *G. intestinalis*; G. lamblia) which is considered as worldwide parasite. The infective form of this parasite is the cyst form which can last for months in a terrestrial or water and is resistant to chlorine.[3,4] The World Health Organization (WHO) classifies giardiasis into the Neglected Diseases Initiative group because of its contagiousness, pathogenicity and has extensive socioeconomic impacts.[4]

This disease can be found in particularly anywhere in the world but tend to congregate in area with extensive river system. A parasitology test using ELISA and PCR with primers Beta-giardin Giardiasis in dairy farmers in India showed that the prevalence of giardiasis was 27.4% (14/51).[5,6] Other study in Bangladesh tested 24 water sources around the farms used by the resident and reported that 58.33% (14/24) of water sources were contaminated by *G. intenstinalis* cysts.[7] Even in arid region like Iraq, giardiasis has also been reported. The study in Al-Diwanyia Hospital, Iraq found that 54% of patients who worked as cattleman were positive for giardiasis.[8,9]

According to those evidences, it seemed that constant contact with livestock possesses significant risk of giardiasis. Locally, Most of the people who live in the area around the Livestock and along the river flow in Mlati, Sleman, Yogyakarta still have the habit of bathing livestock in the river in which the animal are also defecating in the river. However, local people sometime used river water to wash laundry and household appliances which places them at greater risk of contracting Giardiasis. Nevertheless, the socioeconomic level in the area is still relatively low which is also considered as risk factor for intestinal parasitic infections. Therefore, this research aimed to determine the prevalence of giardiasis due to the habit that was carried out in the community around the ranch and the river flow in Mlati, Sleman, DIY, Indonesia.

METHODS

Study Design

An analytic cross sectional study was carried out between January-August 2019 in the area around the Animal Husbandry and along the river flow in Mlati District, Sleman Regency, Yogyakarta. Stool examination was carried out in the Parasitology laboratory and while the molecular examination was carried out in the Biomedical Laboratory of the faculty of medicine Universitas Sebelas Maret. Subjects were selected using purposive sampling method. Socio-demographic data and attitude factors and habits of subjects were collected using a questionnaire.

Specimen collection

Stool samples were collected from individuals who have livestock and live along the rivers. A total of 179 stool samples were included in this trial. Stool was stored in stool a personalized container for each subject and labeled with their details. Containers are preserved at 4^0C with preservatives until used for analysis.

Direct microscopy and molecular analysis

The Giardiasis status was determined by direct microscopy and PCR which were performed to every stool sample. Initially, the stool was washed by PBS to remove impurities. Fecal smears and dripping using normal saline and iodine were used as fixation. The stool smear then stained using 2% eosin and the presence of trophozoites and *Giardia sp* cysts was examined under a light microscope with 100X and 400 X magnifications. DNA was extracted from *Giardia sp* positive stool samples preserved at -20^0C using the QIAamp DNA Mini Stool Kit (Qiagen, Hilden, Germany), according to manufacturer's instructions. *Gdh* gene (glutamate dehydrogenase)[10] was used as indication of positivity for Giardia.

Table 1. The baseline characteristics of the research respondent.

Variable	n	%
Gender		
▪ **Male**	90	50.2
▪ **Female**	89	49.8
Education		
▪ **Low (< Senior high school)**	160	89
▪ **High (≥ Senior high school)**	19	11
Age		
▪ **< 40 years old**	84	46.9
▪ **≥ 40 years old**	95	53.1
Occupation		
▪ **Not Cattleman**	157	89.4
▪ **Cattleman**	19	10.6
Contact with Animal		
▪ **Yes**	122	68.1
▪ **No**	57	31.9
Personal Protective Equipment		
▪ **Yes**	41	22.9
▪ **No**	138	77.1
Source of drinking water		
▪ **Yes**	61	34.0
▪ **No**	118	66.0

DATA ANALYSIS

Data was edited, cleaned, entered and analyzed using statistical package for social science (SPSS) version 21. All data were analyzed descriptively and presented as frequencies or mean. Initially, the association between each exposure and the presence of infection was assessed using the chi-square test and odds ratio was computed to measure the magnitude of the risk. Univariate and bivariate analysis were conducted which then presented as crude and adjusted odds ratio with 95 % CI. *P*-value of ≤ 0.05 was considered as significant.

RESULTS

Socio demographic characteristics

Initially, 356 people who live among livestock and in the area around the river system were assessed for eligibility. Then, 179 subjects were selected and all of them agreed to participate so that the response rate was 100 %. Overall, the gender proportion of the subjects were considered to be equal (male: 90[50.2 %] and female: 89 [49.8%]) but most of them had low educational level (160[89%]). Furthermore, only 10.6% of them were cattleman but 122 (68.1%) had a history of constant contact with cattle. Also, 138 subjects had no personal protective equipment while only 61 (34%) of them used river water as the source of drinking water. The baseline characteristics of the research subjects are summarized in Table 1.

Then, risk analysis was conducted to determine which of the aforementioned variables could act as risk factor for giardiasis. Of note, 9 subjects were tested positive for giardiasis, confirmed by microscopy and PCR. Chi-square test was used to determine the significance of the association while OR was calculate to determine the strength of the risk factors. Among all variables, age, occupation (cattleman or not), and a history of contact with animal came out as the significant factors for Giardiasis. Non-cattleman seemed to have significantly less risk of Giardiasis compared to cattleman (OR: 0.041; 95%CI: 0.009-0.185; p: 0.000). Contact with animal also possess significant risk but only slightly higher than those who had

no contact history (OR: 1.080; 95%CI: 1.027-1.135; p: 0.002). Lastly, older age also proved to have slightly higher risk (OR: 1.101; 95%CI: 1.034-1.173; p: 0.004). Table 2 summarized the result of bivariate analysis between the baseline variables and Giardiasis.

DISCUSSION

Giardiasis is one of intestinal infectious diseases which can easily transmitted by fecal-oral route especially among those who live near or around river system. The symptoms include diarrhea, flatulence, and abdominal cramping with malodorous and greasy stool. It is really contagious in the area with extensive water system and poor community hygiene especially if toilets are scarce or unavailable. Despite the widespread nature of the *Giardia sp.*, this disease is considered as neglected disease due to its infrequent outbreak.[3,4]

Despite strong association between river water consumption with Giardiasis, apparently contact with animal also increased the risk of contracting Giardia sp. Residents who live around rivers and farms, both those who work as cattleman/farmers or who have direct contact with livestock, are at risk of giardiasis. Livestock contact has been acknowledged as one of risk factors and persistent problem throughout the world for Giardiasis.[6,11] In Indonesia, this kind of condition usually found in rural area, especially in watershed area where people raise cows or buffaloes for living. In some rural area, centralized clean water supply also absent or insufficient, in which, local population depends on river water. It is in this kind of condition that Giardia sp. could infects and spread among community which could result in significant economical and health burden for local population.

Referring to the baseline characteristics, subjects in this study was dominated by respondents who come into contact with livestock, low levels of education, aged > 40 years old, and have little to no knowledge about personal protective equipment. Microscopic and molecular examination results showed positive results of infected Giardiasis were

Table 2. Bivariate analysis of Giardiasis infections and potential risk factors of those who lived around livestock and rivers in Mlati District, Sleman Regency, DIY.

Variable	Giardiasis				n	%	OR	95%CI	P
	No		Yes						
	n	%	n	%					
Gender									
▪ Male	83	92.2	7	7.8	90	100	0.273	(0.055-1.350)	0.087
▪ Female	87	97.7	2	2.3	89	100			
Education									
▪ Low (< Senior high school)	151	94.4	9	5.6	160	100	0.944	(0.909-0.980)	0.355
▪ High (≥ Senior high school)	19	100	0	0	19	100			
Age									
▪ < 40 years old	84	100	0	0	84	100	1.101	(1.034-1.173)	0.004
▪ ≥ 40 years old	86	90.5	9	9.5	95	100			
Occupation									
▪ No Cattleman	157	98.1	3	1.9	160	100	0.041	(0.009-0.185)	0.000
▪ Cattleman	13	68.4	6	31.6	19	100			
Contact with Animal									
▪ Yes	113	92.6	9	7.4	122	100	1.080	(1.027-1.135)	0.002
▪ No	57	100	0	0	57	100			
Personal Protective Equipment									
▪ Yes	39	95.1	2	4.9	41	100	0.960	(0.192-4.809)	0.661
▪ No	131	94.9	7	5.1	138	100			
Source of Drinking Water									
▪ Yes	56	91.8	5	8.2	61	100	2.545	(0.658-9.847)	0.151
▪ No	114	96.6	4	3.4	118	100			

breeders although they showed no symptoms (asymptomatic). The overall proportion of male population infected with Giardiasis (7.8%) is higher than the proportion of female population infected (2.3%). In addition, those who lived as cattleman were infected in significantly higher percentage (31.6%) although they were asymptomatic. The reason behind our findings could be that males are far more involved in work that interacts directly with animals and cleaning animal waste than females. Most of the women tend to do works related to providing food to livestock, while males are those who interact a lot with livestock including bathing livestock in rivers, cleaning feces and feeding livestock, often without personal protective equipment. Regarding the relationship between age groups and Giardiasis infection, this study revealed a relatively higher infection rate in the age group over 40 years.

This result is in concordance with several previous studies which also evaluate the significance of animal contact with Giardiasis risk. Khan et al., and Fantinatti et al., showed that the rate of Giardiasis reached 27.4% (14/51) among farmers in India using the same diagnostic method as this study (Microscopy, ELISA and PCR tests with Beta-giardin).[5,6] This findings also supported by Al-Difaie who reported that the prevalence of giardiasis in patients who were cattlemen at Al-Diwanyia Hospital at 54%.[8] However, it should be noted that Differences in prevalence reported in various studies may be due to socioeconomic status, climate conditions, poverty, as well as personal and community hygiene could contribute to the difference in Giardiasis prevalense.[12,13] These evidence and the findings in this study strengthen the fact that animal/livestock have significant contribution toward the risk of Giardiasis in the community. Surprisingly, water source was not associated with any increase in Giardiasis risk in this study although the same water source also used by the animal, thereby showing that Giardiasis infection does not pass through the same water source used by humans and animals. This study identifies Giardiasis infections which can be easily transmitted through the fecal-oral route, either directly from person to person or indirectly by eating or drinking food and water contaminated with feces.

Despite the significance of the findings, this study has several limitations such as not using blind design and lack of inspection of animal and water feces due to logistical reasons. Future community studies with a more comprehensive design and assessment of Giardia living in the river system or livestock are needed to better validate and generalize these findings.

CONCLUSION

This study revealed the presence of Giardiasis infection in watersheds and ranchers. Because most are transmitted through the fecal-oral route, work as a farmer can be risky because every day interacting with animals and cleaning livestock manure. Therefore, constant epidemiological surveillance of animal and human health through biennial routine Giardiasis tests and treatment of infected cases together with improved personal hygiene and environmental sanitation is recommended to control Giardiasis in farmers and people who care for livestock.

ACKNOWLEDGMENTS

This work was supported in part by grants from the Indonesian Directorate of Higher Education-PNBP UNS (No. 516/UN27.21/PP/2019).

CONFLICT OF INTEREST

The author reports no conflicts of interest in this work.

AUTHOR CONTRIBUTION

All authors contributed equally in conducting the study as well as writing and revising the manuscript.

REFERENCES

1. Einarsson E, Ma'ayeh S, Svärd SG. An up-date on Giardia and giardiasis. *Curr Opin Microbiol*. 2016;34:47-52. doi:10.1016/j.mib.2016.07.019
2. Ryan U, Cacciò SM. Zoonotic potential of Giardia. *Int J Parasitol*. 2013;43(12-13):943-956. doi:10.1016/j.ijpara.2013.06.001
3. Ramírez-Ocampo S, Cotte-Alzate JD, Escobedo ÁA, Rodríguez-Morales AJ. Prevalence of zoonotic and non-zoonotic genotypes of Giardia intestinalis in cats: A systematic review and meta-analysis. *Infez Med*. 2017;25(4):326-328.
4. Rodríguez-Morales AJ. AMT, Escobedo and ÁA, Escobedo JAS-D and ÁA. Introductory Chapter: Giardiasis - Still a Globally Relevant Protozoan and Zoonotic Disease. *Intech*. 2017;i(tourism):13. doi:http://dx.doi.org/10.5772/57353
5. Khan SM, Debnath C, Pramanik AK, Xiao L, Nozaki T, Ganguly S. Molecular evidence for zoonotic transmission of Giardia duodenalis among dairy farm workers in West Bengal, India. *Vet Parasitol*. 2011;178(3-4):342-345. doi:10.1016/j.vetpar.2011.01.029
6. Fantinatti M, Bello AR, Octavio Fernandes and AMD-C. Identification of Giardia lamblia Assemblage E in Humans Points to a New Anthropozoonotic Cycle.pdf. 2016.
7. Ehsan AM, Geurden T, Casaert S, et al. Assessment of zoonotic transmission of Giardia and Cryptosporidium between cattle and humans in rural villages in Bangladesh. *PLoS One*. 2015;10(2):1-11. doi:10.1371/journal.pone.0118239
8. Al-difaie RS. Molecular Study to Detect Genotyping of Giardia lamblia from Human and Cattle Feces in Al-Qadisiya. *Ibn Al-Haitham J Pure Appl Sci*. 2016;29(3):1-13.

9. Shahnazi M, Sadeghi M, Saraei M, Alipour M, Hajialilo E. Prevalence of Parasitic Intestinal Infections Among Food Handlers in Qazvin, İran. *Turkish J Parasitol*. 2019;43(1):16-20. doi:10.4274/tpd.galenos.2019.6278
10. Shin JH, Lee SE, Kim TS, Ma DW, Chai JY, Shin EH. Multiplex-touchdown pcr to simultaneously detect cryptosporidium parvum, giardia lamblia, and cyclospora cayetanensis, the major causes of traveler's diarrhea. *Korean J Parasitol*. 2016;54(5):631-636. doi:10.3347/kjp.2016.54.5.631
11. Minetti C, Taweenan W, Hogg R, et al. Occurrence and Diversity of Giardia duodenalis Assemblages in Livestock in the UK. *Transbound Emerg Dis*. 2014;61(6):e60-e67. doi:10.1111/tbed.12075
12. Hanvold TN, Kines P, Nykänen M, et al. Occupational Safety and Health Among Young Workers in the Nordic Countries : A Systematic Literature Review. *Saf Health Work*. 2019;10(1):3-20. doi:10.1016/j.shaw.2018.12.003
13. Kumma WP, Meskele W, Admasie A. Prevalence of intestinal parasitic infections and associated factors among food handlers in Wolaita Sodo University students caterings, Wolaita Sodo, Southern Ethiopia: A cross-sectional study. *Front Public Heal*. 2019;7(JUN). doi:10.3389/fpubh.2019.00140