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RISK FACTORS FOR SCHISTOSOMIASIS INCIDENCE IN COMMUNITIES IN LINDU SUB-DISTRICT, SIGI DISTRICT, CENTRAL SULAWESI PROVINCE, INDONESIA

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Abstract

Schistosomiasis is a disease that has been experienced for generations by a community, and until now it is still a public health problem and local government. This is because behavioural factors and ways to control this tropical disease have not been considered. Objectives: This study aims to determine the risk factors for schistosomiasis in the community in Lindu sub-district. Methodology: The type of research used was analytical observational with case-control design. The population in this study were all people who did laboratory stool tests with positive and negative results in the Lindu Health Centre working area. The sample in this study was 110 (22 cases, 88 controls). Cases were patients who suffering from schistosomiasis with positive faecal results from 2020-2023. The controls were neighbours of patients who did not suffer from schistosomiasis. The case sampling technique was exhaustive sampling, while the control used simple random sampling method. Bivariate analysis using chi-square test and multivariate using logistic regression test. Results: The results showed that significant risk factors for schistosomiasis were the use of water sources (OR=7.809; 95%CI=1.979-31.158), use of personal protective equipment (OR=9.066; 95%CI=2.834-31.468), taking deworming drugs (OR=4.5; 95%CI=1.463-13.613), and use of latrines (OR=12.647; 95%CI=1.821-138.206). On multivariate analysis, the use of personal protective equipment resulted (OR=7.89, p=0.000, coefficients=2.06) and latrine use (OR=8.55 with p=0.028, coefficients=2.14) in a probability of 15.89%. Conclusions: Respondents who did not use personal protective equipment and did not use latrines had a 15.89 times risk of suffering from schistosomiasis disease.

Keywords: Case-Control Study, Risk factors, Schistosomiasis, Lindu Community.

1. INTRODUCTION

Schistosomiasis is a disease caused by a type of worm belonging to the genus Schistosoma. These worms live in the blood vessels of humans and vertebrate animals, especially mammals in some tropical regions and the disease is zoonotic so that the source of transmission is not only humans with schistosomiasis but also all infected mammals [1].

Globally, deaths from schistosomiasis are reported to be 200,000 per year. So far, four Schistosoma species can cause schistosomiasis in humans, namely Schistosoma haematobium, Schistosoma mansoni, Schistosoma japonicum, and Schistosoma mekongi.

Schistosoma japonicum is considered the most dangerous worm compared to other species because it produces the largest number of eggs, the small size of the eggs makes it easy to wash back, has many reservoir hosts, is difficult to treat, and can

result in death. This parasite is widely distributed in the continents of Africa, the Middle East, South America and Southeast Asia [2].

Schistosomiasis in Indonesia is only found in Central Sulawesi in the Lindu, Napu and Bada Highlands. Central Sulawesi is the only province in Indonesia that is endemic for schistosomiasis. The disease is found in two districts/cities, namely in Lindu Valley, Lindu District, Sigi Regency, Napu Valley, Lore District, Besoa Valley, Central Lore District, Bada Valley, West Lore District, and Poso Regency. Schistosomiasis in Indonesia is caused by the worm S. japonicum with the intermediate host was Oncomelania hupensis lindoensis snail, which is endemic to Central Sulawesi [3].

The climate in Napu and Lindu with 0-99% humidity, 70-900 rainfall is very favourable for the proliferation of the intermediate host of Schistosomiasis, Oncomelania hupensis Lindoensis (OHL) [4].

The results of OHL distribution surveys conducted in 2016-2017 in all endemic areas compared to the 2004 and 2008 surveys showed that significant changes occurred in the distribution of infectious snail foci [5]. This is inseparable from the human population and reservoir animals that have typical behaviour and become one of the risk factors for Schistosomiasis [6].

The national target for schistosomiasis eradication refers to the WHO recommendation for a declaration of eradication (0% prevalence in humans, animals and snails) by 2025. Lindu sub-district, which has 5 villages, is one of the schistosomiasis endemic areas in Central Sulawesi. Based on the results of fecal surveys by the Sigi District Health Office, the prevalence of schistosomiasis in the Lindu plain for the last 4 years (2020-2023) is still fluctuating, namely in 2020 as many as 1 case (0.16%), in 2021 as many as 1 case (0.16%), in 2022 as many as 12 cases (1.97%) and in 2023 as many as 8 cases (1.14%).

There are fluctuations in infection even though treatment programmes and control measures continue to be carried out which indicates that there are factors that cause re-infection to still occur.

Fluctuations in schistosomiasis prevalence may also be caused by re-infection. People who have schistosomiasis and have received treatment return to their daily activities in the focus area, i.e. in rice fields, cocoa farms, vegetable gardens, or throughout the focus area. Fluctuations in schistosomiasis prevalence occur due to schistosomiasis reinfection [7].

Schistosomiasis control efforts in Sigi District through Lindu Health Centre are divided into three categories, namely focus areas located in community settlements (housing and roads), focus on agricultural sites (rice fields and plantations), and focus on forests. Priority focus areas are located close to settlements or roads.

People who live very close to the OHL focus area have a high risk of being infected with Schistosomiasis because in their activities, sometimes people often unwittingly contact the focal water in the area [8].

Epidemiologically, schistosomiasis transmission is inseparable from behavioural factors or human habits. In general, schistosomiasis patients are those who have habits that are inseparable from water. Frequent contact with water or entering waters infected with Schistosoma parasites causes an increase in schistosomiasis patients in the community [9].

2. METHODS

Type of Research

The type of research used is analytical observational case control study design which aims to explain the causal relationship of several variables by means of hypothesis testing. The purpose of this research is to conduct an analysis of the factors that influence the incidence of Schistosomiasis in the Lindu District community.

Population and Sample

The population in this study were all people who did laboratory stool tests with positive and negative results in the Lindu Health Centre working area. The sample in this study amounted to 110 (22 cases, 88 controls). Cases are residents who suffer from schistosomiasis with positive stool results from 2020-2023. The controls were neighbours of patients who did not suffer from schistosomiasis with negative stool results. The case sampling technique in this study is exhaustive sampling (total sampling), which is a sample selection technique by surveying the entire existing population or taking all members of the population as samples [10]. While the control sample uses the simple random sampling method on the patient's neighbours. The sample withdrawal steps are as follows:

a. Case samples researchers took registers of schistosomiasis patients who tested positive (data derived from laboratory medical records) at the Lindu sub-district health centre for the last 4 years (2020-2023).

b. Controls were randomly selected from neighbours of patients who did not suffer from schistosomiasis with a ratio of cases and controls of 1:4 (22 cases, 88 controls) taken with the same number of 4 neighbours of each patient. This resulted in a total sample size of 110 people.

Data Collection

There are 2 types of data used, namely primary data obtained by direct interviews using questionnaires with respondents who fulfil the criteria for both case and control samples. Secondary data were obtained from the medical records of schistosomiasis cases at the Lindu Health Centre and specialised laboratory records of schistosomiasis in Lindu Sigi District.

Data Analysis

Data analysis was conducted using the STATA application. Data were analysed in three ways, namely univariate, bivariate and multivariate. The bivariate test analysis used the chi square test at the 95% confidence level (α=5%) and the multivariate used the logistic regression test with a 95% confidence level (α=5%).

Ethical Approval

This research has been approved by the Hasanuddin University Health Research Ethics Committee with approval recommendation number 290/UN4.14.1/TP.01.02/2024. Data confidentiality is an agreement between the researcher and the respondent and will not be shared in accordance with the research Informed Consent.

3. RESULT

Table 1: Distribution of Respondents According To Research Variables Based On Respondent Characteristics With Schistosomiasis Incidence

Respondent of Characteristics	Incidence of schistosomiasis		Total (n=110)
	Case (n=22)	Control (n=88)	n (%)
Gender			
Female	12 (54,55)	35 (39,77)	47 (42,73)
Male	10 (45,46)	53 (60,22)	63 (57,27)
Age			
≥ 21 Years	20 (90,90)	87 (98,86)	107 (97,27)
≤ 20 Years	2 (9,09)	1 (1,13)	3 (2,73)
Knowledge			
Less	19 (86,36)	56 (63,64)	75 (68,18)
Good	3 (13,63)	32 (36,36)	35 (31,82)
Occupation			
High Risk	20 (90,90)	61 (69,32)	81 (73,64)
Low Risk	2 (9,09)	27 (30,68)	29 (26,36)
History of Disease			
Available	7 (31,81)	15 (17,04)	22 (20%)
Not Available	15 (68,18)	73 (82,95)	88 (80%)

Source: Primary Data, 2023

The distribution of schistosomiasis incidence based on individual characteristics in Table 1 showed that for the female sex category, the highest proportion was found in the case group at 54.55%, compared to the control group at 39.77.

While the male sex category found a higher proportion in the control group of 60.22%, compared to the case group of 45.46%. In the age category, it appears that most respondents, around 90.90%, aged >21 years suffered from schistosomiasis.

While the least suffering from schistosomiasis was <20 years old, which was 9.09%. In the category of poor knowledge, the highest proportion was found in the case group at 86.36% compared to the control group at 63.64%. While good knowledge of respondents was found higher in the control group by 36.36% compared to the case group by 13.63%.

The occupational category for the risk category was higher in the case group 90.90% compared to the control group 69.32%. While those in the low-risk category, a higher proportion was found in the control group at 30.68% compared to the case group at 9.09%.

History of disease for the existing risk category, a higher proportion was found in the case group at 31.81% compared to the control group at 17.4%. While those in the no risk category, it has been found that the proportion is higher in the control group by 82.95% compared to the case group by 68.18%.

Table 2: Distribution of Cases Based On Water Source Use Behaviour, PPE Use, Drug Taking Behaviour, Latrine Use, Livestock Grazing With Schistosomiasis Incidence In Lindu Sub-District.

Variable	Schistosomiasis Incidence		Total (n=110)
	Case (n=22)	Control (n=88)	n (%)
Use of water source behavior			
Bad	8 (36,36)	6 (6,82)	14 (12,73)
Good	14 (63,64)	82 (93,18)	96 (87,27)
Use of Personal Protective Equipment			
Not wearing	16 (72,72)	20 (22,72)	36 (32,72)
Wearing	6 (27,27)	68 (77,27)	74 (67,27)
Taking Deworming behavior			
Not taking medication	11 (50%)	16 (18,18)	27 (24,44)
Taking medication	11 (50%)	72 (81,82)	83 (75,45)
Latrine use			
No	5 (22,73)	2 (2,27)	7 (6,36)
Yes	17(77,27)	86 (97,73)	103 (93,64)
Grazing animals			
High Risk	15 (68,18)	56 (63,63)	71 (64,54)
Low Risk	7 (31,82)	32 (36,36)	39 (35,45)

Source: Primary Data, 2023

Based on the results of the analysis in table 2 shows that the proportion of water use for the poor category was found to be the highest proportion in the control group at 93.18% compared to the case group at 63.64%.

While in the good category, the proportion was higher in the case group, which was 36.36% compared to 6.82% in the control group. The use of PPE for the non-wearing category, found the highest proportion in the case group at 72.72% compared to the control group at 22.72%.

While in the use category, the proportion was higher in the control group, which was 77.27% compared to the case group of 27.27%. For the category of not taking deworming medication, the highest proportion was found in the case group, at 50% compared to 18.18% in the control group. While in the category of taking medication, the highest proportion was found in the control group, 81.82% compared to the case group by 50%.

The use of latrines showed that for the category of respondents who did not use latrines, the highest proportion was found in the case group at 22.73% compared to the control group at 2.27%. While in the category of respondents using latrines, the proportion was higher in the control group, which was 97.73% compared to the case group of 77.27%.

Grazing livestock where the high-risk category was found to have the highest proportion in the case group at 68.18% compared to the control group at 63.63%. While in the low-risk category, the proportion was higher in the control group, which was 36.36% compared to 31.82% in the case group.

Table 3: Risk Factor Analysis Of Schistosomiasis In Lindu Communities

Risk Factors	Case	Control	OR (CI 95% LL-UL)	Sig p- value
Gender				
Female	12	35	0,5503 (0,1910-1,5685)	0,2103
Male	10	53		
Age				
≥ 21 Years (Productive)	20	87	8,7 (0,4213-518,8812)	0,0405
≤ 20 Years (Not Productive)	2	1		
Knowledge				
Less	19	56	3,6190 (0,9453-20,3544)	0,0407
Good	3	32		
Occupation				
High Risk	20	61	4,426 (0,9509-41,3077)	0,0398
Low Risk	2	27		
History of Disease				
Available	7	15	2,271 (0,6601-7,2027)	0,1213
Not Available	15	73		
Use of water source behaviour				
Bad	8	6	7,8095 (1,9796-31,1582)	0,0002
Good	14	82		
Use of Personal Protective Equipment				
Not wearing	16	20	9,0666 (2,8349-31,4682)	0,0000
Wearing	6	68		
Taking Deworming behaviour				
Not taking medication	11	16	4,5 (1,4634-13,6131)	0,0019
Taking medication	11	72		
Latrine use				
No	7	2	12,6470 (1,8215-138,2065)	0,0004
Yes	17	86		
Grazing animals				
High Risk	15	56	1,224 (0,4148-3,9326)	0,6902
Low Risk	7	32		

Source: Primary Data, 2023

Bivariate analysis results based on table 3, showed that several risk factors such as gender, age, knowledge, occupation, history of disease and grazing animals using the Odds Ratio test with a Confidence Interval (CI) of 95% with a lower limit and upper limit includes the value of one, then the risk is not statistically significant. Thus, it is not a risk factor for the incidence of schistosomiasis in the community in Lindu District, Sigi Regency, Central Sulawesi Province in 2023. While the use of water sources, the use of PPE, taking deworming behaviour, and latrine use, obtained OR and the range of values at the 95% confidence level (CI) with the lower limit and upper limit does not include the value of one, then the risk is statistically significant. To strengthen the bivariate analysis, multivariate analysis was conducted on several variables that had a p value <0.05.

Table 4: Results of Multivariate Analysis Of Schistosomiasis Incidence In Communities In Lindu Sub-District

Variable	OR (95% CI)	p	coef
Use of Personal Protective Equipment	7,89 (2,63 – 23,66)	0,000	2,06
Latrine Use	8,55 (1,26 – 57,82)	0,028	2,14

Source: Primary Data, 2023

Based on Table 4 using the logistic regression equation, it shows that the probability of the behaviour of not using PPE and not using latrines has a chance of suffering from schistosomiasis is 15.89%.

4. DISCUSSION

Water Source Use Behaviour with Schistosomiasis Incidence

Clean water is an essential element of human life. The availability of clean water will affect the basic sanitation of the population [11]. The use of clean water in fulfilling human needs such as bathing, washing, drinking water or other needs is still a major problem in efforts to improve public health status. The source of schistosomiasis infection is water containing cercariae, so the availability of clean water is needed in schistosomiasis endemic areas.

Based on the results of statistical tests using OR, the results of the analysis of the behaviour of using water sources on the incidence of schistosomiasis, obtained an OR of 7.809. This means that people who use poor water sources are 7.809 times more likely to experience schistosomiasis than people who use good water sources. Since the range of values at the 95% confidence level (CI) with lower limit = 1.979 and upper limit = 31.158 does not include the value of one, the risk is statistically significant.

Therefore, the results of this study indicate that clean water use behaviour is a risk factor for schistosomiasis in Lindu sub-district. This is due to the lack of clean water supply and public awareness of healthy behaviour. Although the government has actually built clean water facilities for bath, wash, latrine and made piped wells from springs directly to reduce the transmission of schistosomiasis to the population, these facilities have not been utilised optimally by the population. One of the reasons for not utilising these facilities is that they are not functioning or maintained. In fact, the construction of clean water facilities is intended to prevent residents from using river water for daily needs in the hope that there will be no direct contact with water that has been infected with Schistosoma worms.

This research is in line with research conducted by Akbar [9]. The same thing is also shown by Mc Manus [12] in the Napu highlands of Poso Regency which states that there is an influence of the use of water sources on the incidence of schistosomiasis, where someone who uses a poor water source using a water source from the river is at risk of schistosomiasis when compared to people who use a good water source.

Personal Protective Equipment Use Behaviour with Schistosomiasis Incidence

The use of Personal Protective Equipment is one of the prevention efforts to break the chain of schistosomiasis disease transmission. Schistosoma worms enter the body of humans and mammals through the skin. To prevent the entry of worms into the body, personal protective equipment is needed in the form of boots and rubber gloves when in contact with worm-infected water both at work and through the focus area [13].

Based on the results of statistical tests using OR, the results of the analysis of respondents' use of PPE on the incidence of schistosomiasis, obtained an OR of 9.066. This means that people who do not wear PPE experience schistosomiasis 9.066 times more risk of schistosomiasis than people who wear PPE. Since the range of values at the 95% confidence level (CI) with lower limit = 2.834 and upper limit = 31.468 does not include the value of one, the risk is statistically significant.

So, the results of this study showed that the behaviour of PPE use is a risk factor for the incidence of schistosomiasis in the community in Lindu District. This is because most respondents did not use PPE when working and passing through the focus area. The reason is that it is uncomfortable to wear PPE, they are used to working without PPE because it makes it difficult to do work, especially in the rice fields because the boots are usually embedded in the mud. This creates laziness in using it. And another reason is that the government now rarely facilitates the provision of PPE, especially boots, to the community. Because the community knows that so far, they have received boots from schistosomiasis laboratory health workers. So, in passing through the focus area, they do not wear footwear. Boots are personal protective equipment that must be used when passing through snail or mud focus areas because the average community agricultural area is in the snail focus area [14].

This study is in line with research conducted by Rosmini [15] which states that there is a significant relationship between the use of PPE when carrying out work with the incidence of schistosomiasis. And research conducted by Akbar [9] in the Lindu plains which says that the use of PPE affects the incidence of schistosomiasis. This study is also in line with research conducted by Sumolang [16] in Saint Lucia found that people who do not use PPE when working in rice fields are at risk of schistosomiasis disease compared to people who wear PPE. And also, according to research conducted by Sugiarto [17] in the Bada Plateau, West Lore Subdistrict, Poso District, in Poso District also stated that not using boots is at risk of schistosomiasis disease.

Taking Deworming Behaviour

Based on the results of statistical tests using OR, the results of the analysis of respondents' worming utilisation on the incidence of schistosomiasis, obtained an OR of 4.5. This means that people who do not take deworming medication are 4.5 times more at risk of schistosomiasis than people who take deworming medication. Since the range of values at the 95% confidence level (CI) with lower limit = 1.463 and upper limit = 13.613 does not include the value of one, the risk is statistically significant.

Therefore, the result of this study shows that medication-taking behaviour is a risk factor for schistosomiasis in the community in Lindu sub-district. This is due to the reduced awareness of the community towards the use of deworming programmes. Some respondents said that taking praziquantel deworming medication caused them to feel tired, headache, dizziness and nausea, which interfered with their daily activities. And other reasons researchers found some respondents said that they received information from health workers to consume deworming only patients, no more deworming every 6 months. According to the researcher's assumption, *paraziquantel* deworming every 6 months in the community, especially in schistosomiasis endemic areas, can help overcome infection from the parasitic worms that cause this disease, and can reduce the occurrence of additional cases every year.

This study is in line with research conducted by Akbar [9] in the Lindu plains who said that the use of health programmes, especially taking medication, is at risk of schistosomiasis incidence. This study is also in line with research conducted by Gatitude [18] in Poso district.

Latrine Use Behaviour with Schistosomiasis Incidence

The habit of defecating in any humid place is an advantage for the snails that transmit schistosomiasis as a breeding ground. Kittur [19] stated that if everyone in endemic

areas were to defecate in family latrines, it would at least reduce the incidence of schistosomiasis.

Based on the results of statistical tests using OR, the results of the analysis of respondents' latrine use on the incidence of schistosomiasis, obtained an OR of 12.647. This means that people who do not use latrines experience schistosomiasis 12.647 times more at risk of schistosomiasis than people who use latrines. Since the range of values at the 95% confidence level (CI) with lower limit = 1.821 and upper limit = 138.206 does not include the value of one, the risk is statistically significant.

The result of this study shows that latrine use is a risk factor for schistosomiasis in Lindu sub-district. This is because most people in Lindu use inadequate latrines. The condition of the latrine does not provide water to clean themselves, so after defecating they go to the river / ditch. Thus, the behaviour of defecating in any place will cause worm eggs that come out with feces will spread with the flow of water and this condition has the potential if it finds an intermediate host in the form of Oncomelania Hupensis Lidoensis snails, causing the spread of worm eggs more freely and allowing reinfection or new infections in other healthy people. According to Soedarto [20], the large number of people who bathe, wash and defecate in rivers can cause schistosomiasis disease transmission to continue in the community and the morbidity rate will remain high. Efforts to prevent the occurrence of risk in the community for certain diseases if the target is aimed at the environment, then the target can be aimed at the physical environment such as the provision of water and latrines [21].

5. CONCLUSION

Both PPE and latrine use behaviour are associated with schistosomiasis risk in Lindu communities. Using the logistic regression equation, the probability value is 15.89%, which means that respondents who do not wear PPE and do not use latrines have a risk of suffering from schistosomiasis by 15 times, meaning that if someone experiences schistosomiasis with the use of latrines and PPE, then the probability of someone getting schistosomiasis is 15.89%. Of the two variables, the most risky for schistosomiasis is the use of PPE (Personal Protective Equipment) where the results show that the p-value = 0.000 (p-value <0.05).

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