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Effect of Niclosamide spraying on the infection rate of schistosomiasis intermediate host snail (*Oncomelania hupensis lindoensis*) in Poso district, Indonesia

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Abstract

Schistosomiasis is a neglected tropical disease that is transmitted by fresh water and is transmitted by snails. Schistosomiasis in Indonesia is caused by a trematode worm of the type *Schistosoma japonicum* with the snail *O. Hupensis lindoensis* as an intermediary host. The prevalence of Schistosomiasis cases in Dodolo Village, Poso Regency haaas increased from year to year. Chemical control was carried out by spraying niclosaamide molluscidae (Bayluscidae 70% *WP* ®) every 6 months in the habitat since 1982 so there is no recent data regarding is effectiveness. The aims of this study was to determine the characteristics of the physical environment of the molluscide (Bayluscidae 70% *WP* ®) on the *O. Hupensis lindoensis* snail habitat in Dodolo Village, North Love District, Poso Regency. This type research is quantitative using a survey method and using a Pre-Experimentaal approach with one group pretest and posttest conducted in 14 habitats snail in Dodolo Village. Data were analyzed using the Fiedman Test and Cochran. According to research in the Dodolo Village, the physical characteristics of the habitat for *O. Hupensis lindoensis* snail include temperature water between 20^0C – 29^0C, neutral water pH levels in 11 habitats, and soil pH levels between 4.5 and 7.0. The most prevalent habitat type is found in the canals of cacao plantations. *O. Hupensis lindoensis* snail action in its habitats (p=0.05), density (P=0.000), and snail infection rate (P=0.002). This indicates that following the application of *O. Hupensis lindoensis* snails. To the Poso Distrcit health office to increase community involvement in a snail control.

Keywords: Schistosomiasis, Infection rate, Niclosamide Spraying, *O.Hupensis. lindoensis.*

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1. Introduction

A neglected tropical illness called schistosomiasis is spread by freshwater snails. Schistosomiasis in Indonesia is caused by a trematode worm of the type *Schistosoma japonicum with the snail O. hupensis lindoensis* as an intermediary host. It is known that the snail is an amphibious snail. *O. hupensis lindoensis* snails are found throughout the plains in pockets called foci , the focal area varies from several square meters to several thousand square meters [1] . Schistosomiasis is a zoonotic disease, so the source of transmission is not only human sufferers, but also several mammals, including cows, goats, pigs, sheep, deer, dogs, rats, and other infected rodents [2] . Life cycle *of Schistosomiasis sp.* all are similar but highly complex because the parasite alternates between two hosts: an intermediate host (Snail) and a definitive host (such as Humans and Cows) [3] . Transmission of schistosomiasis in Indonesia is the snail *O. hupensis lindoensis*. Transmission of schistosomiasis in Indonesia is as follows: *Schistosoma japonicum eggs* are excreted along with the patient's feces, then hatch in water to become miracidium which will penetrate the body of *O. hupensis lindoensis snail*. In the snail's body, the miracidium will develop into sporocysts, then become cercariae which will come out of the snail's

body. Infection occurs through cercariae that penetrate the skin of humans and/or mammals. This parasitic worm absolutely requires an intermediate snail to carry out its life cycle [4] . Central of Sulawesi is one of them Province of 34 Provinces in Indonesia which are endemis chistosomiasis. There is two districts are Sigi District (Lindu Highlands) and Poso District (Napu Highlands and Bada Highlands) [5] .The prevalence of schistosomiasis cases in Dodolo Village in 2017 – 2021 was 3.36%, 2.07%, 0.38%, 1.04% and 1.72% respectively [6] , while focus in Dodolo village in 2021 as many as 26 foci, with an Infection Rate of 10.99% found in waterways and water seepage in cacao gardens, onion groves, in bushes and untreated rice fields [7] . One of the initiatives to manage schistosomiasis in endemic areas is the suppression of intermediate schistosome snails. The prevalence of schistosomiasis can be decreased by lowering the number of intermediate snails that cause the disease in people. Even though there are other factors contributing to the decline in prevalence, the number of snail foci is one that significantly lowers the prevalence of schistosomiasis [8] . The activity of mapping the habitat of the *Oh lindoensis* snail is one of the many efforts undertaken each year to restrict the growth of the species [9]. In 2008 and 2016–2017, surveys of the *O. hupensis lindoensis* endemic area distribution were conducted. One of the initiatives to manage schistosomiasis in endemic areas is the suppression of intermediate schistosome snails. The prevalence of Schistosomiasis can also be decreased by reducing the number of intermediary snails that cause the disease in people [8] . Incentive control of schistosomiasis has been started since 1982, which has focused on handling humans with mass treatment supported by counseling activities, provision of environmental health facilities, examination of population feces, regular and routine inspection of snails and rats [5] . Schistosomiasis control in several countries has been successfully carried out, one of which is China. Control in China is focused on chemical control to permanently break the chain of schistosomiasis transmission [10] . Chemical control is carried out by spraying *molluscicides niclosamide* (*Bayluscide* 70% WP) at a dose of 0.2 gr/m² every 6 months at the active focus on the focus area [11] . *Niclosamide* is the only chemical molluscicide approved by WHO and has been used in other endemic areas for around 30 years, including China [12] . In Indonesia, efforts to control schistosomiasis are carried out by conducting research on the implementation of the Bada Model concept which can reduce cases, increase knowledge, reduce the number of snail habitat areas in Lengkeka Village [13]. Other effort is map the snail *O.hupensis lindoensis Habitat* in Central of Sulawesi (Central Sulawesi) [1] . This paper aims to determine the effect of spraying *niclosamide* molluscicide (*Bayluscide* 70% *WP* ®) on *Infection Rate* (IR) of Sistosoma japonicum cercariae in schistosomiasis intermediate snails in Dodolo Village, Poso District.

2. Materials and methods

2.1. Research type and design

This research is a quantitative research using a survey method and using a *pre-experimental approach* with *one group pretest and posttest*. The research was conducted in November 2022 - February 2023 in Dodolo Village, Poso Regency. The sampling technique used is *purposive sampling* .

2.2. Methods

The infection rate of S. japonicum cercaria in *O. hupensis lindoensis snails* was calculated as follows: Number of positive cercariae *O. hupensis lindoensis snails divided by the number of O. hupensis lindoensis snails* examined, multiplied by 100%. The spraying activity was carried out by researchers assisted by Schistosomiasis Napu Laboratory staff twice. Before spraying, researchers and laboratory workers conducted a pre-survey in the habitat to determine *the infection rate of O. hupensis lindoensis* snails. *Then the following week, niclosamide molluscicide (bayluscide 70 WP ®)* was sprayed on the *O. hupensis lindoensis snail habitat.* Observation of *infection rate* was carried out 1 month after spraying (Post-survey 1). If *O. hupensis lindoensis* snails are still found, they will be sprayed again. Observation of *infection rate* was carried out 1 month after the second spraying of niclosamide in the *O. hupensis lindoensis snail habitat* (Post-survey 2). Spraying *niclosamide molluscicide (bayluscide 70 WP ®)* using a machine sprayer, spraying is done evenly so that the dose is achieved in every m².

2.3. Analysis

Analysis of the effect of spraying *molluscicides niclosamide* (*Bayluscide* 70% WP) against the Infection Rate of *O. hupensis lindoensis snails* using the Repeated Anova Test if the data is normally distributed, but if the data is not normally distributed then data analysis will be tested with the *Friedman Test.*

2.4. Ethics approval of research

The research has received ethical approval from the Research Ethics Commission of the Faculty of Public Health, Hasanuddin University with number 13986/UN4.14.1/TP.01.02/2022 November 21, 2022.

3. Results

O. hupensis lindoensis snails that were positive for cercariae was carried out by microscopic examination in the laboratory using the *crushing method* and then the level of infection was calculated. The results of calculating *the infection rate of O. hupensis lindoensis* snails in Dodolo Village, North Lore District , Poso Regency can be seen in the following figure. Based on Figure 1. several habitats found positive cercaria schistosomiasis snails during the pre-survey, no positive cercaria *schistosomiasis snails were found* during post-survey 1 and post-survey 2. *The infection rate* of snails in Dodolo Village, North Lore District, Poso Regency ranged from 0 -50% in pre-survey, 0-60% in post-survey 1 and 0-2.63% in post-survey 2. Table 1. shows that the average *infection rate O.hupensis lindoensis* in Dodolo Village, North Lore District, Poso Regency, with the lowest score in the preliminary survey results was 0.00, the highest value was 50.00 with a median value of 1.50 after spraying with *niclosamide molluscicide* (*bayluscide* 70 WP ®) experienced an increase *in infection rate* in the first spraying, but on the second spraying *the infection rate of O.hupensis lindoensis* snails decreased . The highest value was obtained from the second spraying result, which was 2.00, the lowest value was 0.00 and the middle value was 0.00. For more details can be seen in the following table: Based on table 1, it can be seen that there is a difference between *the infection rates* of snails before and after

spraying *niclosamide molluscicide* (*bayluscide* 70 WP ®) in *O.hupensis lindoensis* snail habitat in Dodolo Village, North Lore District, Poso Regency (*p=0.002*).

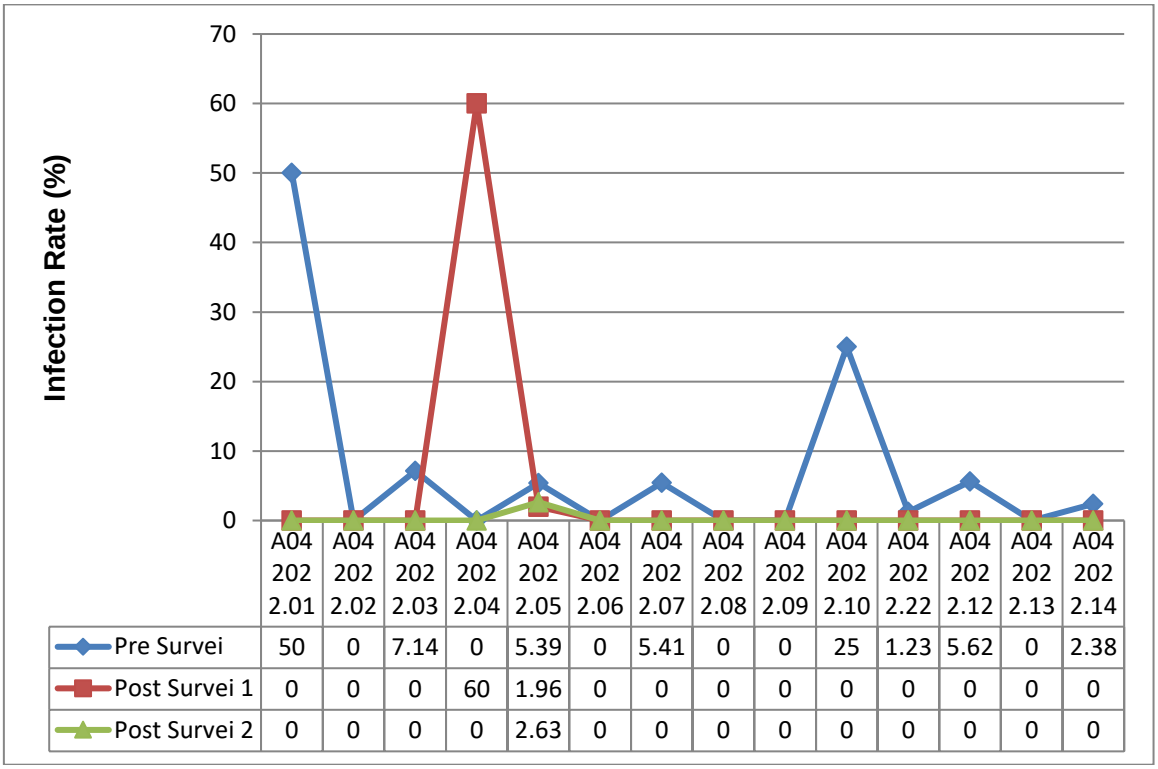
4. Discussion

The high or low cercarial *infection rate* in snails is influenced by the large number of positive schistosomiasis mammals as a source of *S. japonicum* eggs that pass through the snail habitat area [14] . The more schistosomiasis positive animals that defecate in the snail habitat area, the higher the *infection rate of S. japonicum* cercariae in snails. This is because the eggs that come out together with animal feces, after contact with water will hatch into miracidia and penetrate the body of the intermediate host, then develop asexually, including the development of sporocysts of mother and child which produce cercariae [15] . High snail infection rates indicate intense fecal contamination from infected people and animals due to poor sanitation or inadequate processing of livestock manure [16). The infection rate of snails is an important indicator of the possibility of the existence and spread of disease and the occurrence of transmission [17] . *Infection rate* The most common *O. hupensis lindoensis found during the pre-survey was at point 10 (ten) with water channel habitat types in cocoa plantations.* After spraying using *niclosamide molluscicide* (*bayluscide* 70 WP ®) once a month for 2 months in a row *the infection rate decreased* very well, but at point 5 (five) with the same type of habitat *the infection rate* fluctuated from pre-survey to post-survey 2 after spraying *niclosamide molluscicide* (*bayluscide* 70 WP ®). In the opinion of the researchers, the habitat was contaminated with feces of people or mammals infected with *schistosomiasis*. Niclosamidate WP showed strong molluscicidal ability in field tests. Satisfactory results on spraying for different habitats, including marshlands, croplands, ditches and shorelines. Research conducted in Jiangling, Jinzhou City, Hubei Province, China that spraying niclosamide has a fast and sustainable molluscicide effect [18] . Results *of the analysis showed* that there was a difference *in the infection rate of O. hupensis lindoensis* snails before and after spraying *niclosamide molluscicide* (*bayluscide* 70 WP ®) once a month for two months . 70 WP ®) showed a decrease in cercariae positive *O. hupensis lindoensis snails each month* [19] . Results are supported by research conducted in Southwest China, no cercariae survived after contact with niclosamide for 1 minute [20] due to the nature of n- iclosamide to kill schistosoma parasites that live freely in water, miracidium which originates from eggs, and cercariae that develop in molluscs [21] . Research was conducted (Al-Jubury et al., 2020) in Lake Ringen that temperature correlated with the release of cercariae in the snail habitat, namely a temperature of 27 ^{0} C, in this study the average temperature in the active snail habitat of *O. hupensis lindoensis* ranged from 20- 29^{0} C [22]. Some studies state that one of the risk factors for schistosomiasis transmission is the type of work, if a person works in a habitat area or passes through a habitat area, the potential for transmission of schistosomiasis is greater [13]. Study conducted by (Li *et al*., 2016) shows that the release time of niclosamide derivatives can reach 10 (ten) days and the release rate reaches 100%, the results of this experiment show anticercarial abilities, with a good efficiency release system in killing cercariae in the aquatic environment [23]. Research conducted at Renmin in the Dantu District of Zhenjiang City, China, in eradicating cercariae using *niclosamide suspension concentrate* (SCN) has the advantages of fast treatment, easy operation and has a good anti-cercaria effect [24] . Spraying of *niclosamide molluscicide* (*bayluscide* 70 WP ®) was still very effective in reducing the Infection Rate of *O. hupensis lindoensis snails* but had not developed resistance to *S. japonicum cercariae.* In addition to human factors, animals, distribution, and the focus of the O snail's infection rate, h. lindoensis may be impacted by environmental factors such as floods, landslides, or foci covered by materials, which can result in the snail drowning more than 30 to 50 cm below the surface of the ground. In order to be able to reduce the number of foci and prevalence on humans and animals, managing the focus should be done by everyone across linked sectors in an integrated manner. Using a technique other than a stool survey might be more efficient for early diagnosis of schistosomiasis at a low prevalence rate. The best method for eliminating schistosomiasis is control of schistosomiasis integration, which involves both therapy and control of snail foci. Another finding indicated that school-age children's knowledge, attitudes, and risky behavior regarding the prevention of schistosomiasis can be improved. However, in order to predict cases of the disease, its effects, and potential future control measures, a mathematical model of transmission is required. Schistosoma. The habitat of the Oncomelania snail is also influenced by the weather, the kind of soil, the vegetation, and how much water is available for snail growth and cercarial movement. In the focal area of schistosomiasis at normal pH, intermediate conch schistosomiasis was discovered.

Table 1: Infection Rate of *O. hupensis lindoensis snails* in Dodolo Village, North Lore District, Poso Regency in 2022.

Spraying	Means	SD	Median	Min.	Max.	P-Value
Conch Infection Rate						
Pre-survey	7.14	13.97	1.50	0.00	50.00	0.002 *
Post-survey 1	4.35	16.01	0.00	0.00	60.00	
Post-survey 2	0.14	0.53	0.00	0.00	2.00	

(Source: Primary Data)



	A04 2022.01	A04 2022.02	A04 2022.03	A04 2022.04	A04 2022.05	A04 2022.06	A04 2022.07	A04 2022.08	A04 2022.09	A04 2022.10	A04 2022.22	A04 2022.12	A04 2022.13	A04 2022.14
Pre Survei	50	0	7.14	0	5.39	0	5.41	0	0	25	1.23	5.62	0	2.38
Post Survei 1	0	0	0	60	1.96	0	0	0	0	0	0	0	0	0
Post Survei 2	0	0	0	0	2.63	0	0	0	0	0	0	0	0	0

(Source: Primary Data)

Figure 1 Infection Rate of *O.hupensis lindoensis Conch* in Dodolo Village, North Lore District, Poso Regency in 2022.

5. Conclusions

Spraying of *niclosamide molluscicide* (*bayluscide* 70 WP ®) had an effect on the infection rate of *O. hupensis lindoensis* snail cercariae and was different in each *O. hupensis lindoensis snail habitat* .

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

The authors declare that they have no conflict of interest.

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