Prevalence and Risk Factors of Fascioliasis and Paramphistomiasis in Cattle in Borangan Village, Central Java: A Field Evaluation of Control Measures

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Abstract. Fascioliasis and paramphistomiasis are crucial trematode infections that cause substantial economic losses in cattle production in Indonesia. Thus, there is a need to evaluate the effectiveness of these trematode prevention programs. This study assessed the prevalence of *Fasciola* spp. and *Paramphistomum* spp. and the associated risk factors in Borangan Village, Klaten Regency, Central Java, as part of a community service project. In this study, 101 fecal samples were collected, and 98 farmers were surveyed. The samples were examined using the sedimentation technique at the Disease Investigation Center (Balai Besar Veteriner) Wates. The prevalence of fascioliasis was 24.75%. Of the total, coinfections of *Fasciola* spp. and *Paramphistomum* spp. were found in 4.95% of samples. The risk factors evaluation showed no significant difference in odds ratio (OR) between groups with different anthelmintic management practices and different feeding managements. The results showed that there were only slight differences in the prevalence of trematodes in the cattle that received anthelmintics treatment in less than 6 months (25%), more than 6 months (26.67%), and never received anthelmintics (23.53%) prior to the survey; prescribed anthelmintics by veterinarian (27,27%) compared to self-prescription (25.93%); and fed using wet forages (26.19%) compared to dry forages (17.65%). The findings indicate inadequate prevention programs for fascioliasis and paramphistomiasis. Future programs are necessary to assess and improve anthelmintic drug practices and cattle management strategies to reduce infections effectively.

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1 Introduction

Fascioliasis and paramphistomiasis are one of the major parasitic diseases affecting smallholder livestock farmers that have public health implications. Fascioliosis (caused by *Fasciola* spp.), usually found in the liver and bile ducts, whereas paramphistomiasis (associated with *Paramphistomum* spp.), affects the rumen and reticulum [1,2]. Co-occurrence of fascioliosis with paramphistomiasis complicates diagnosis, clinical interpretation, and control decisions in the field [1,2]. These endoparasitic diseases contribute to decreased productivity and measurable economic losses, reducing feed conversion ratio, lowering the meat production and quality, decreasing milk production in dairy animals, and have the potential for zoonotic transmission [3,4,5].

In the Southeast Asia region, the occurrence of *Fasciola* spp. is widely distributed, with considerable prevalence in different countries and types of management systems [6]. This situation was mainly caused by similar risk landscapes of the region, such as wet grazing areas, communal drinking points, seasonal flooding, and smallholder management [5,6]. In a region like Indonesia, a warm and humid climate favors the development of infective eggs and larvae in the environment and the presence of intermediate hosts. With the addition of poor sanitation practices and lack of routine parasite prevention measures in smallholder farms, controlling the infection still become a major challenge in the regions [5]. Additionally, co-infections by both *Fasciola* spp. and *Paramphistomum* spp. is a challenging issue because its transmission is driven by environmental exposure and management practices; meanwhile, control efforts depend on accurate diagnosis and sustainable interventions [7]. These imply that control programs should be based on evidence and ecological situation [7,8].

In the One Health context, which involves animals, humans, and the environment, the importance of these parasitic diseases is not only for the veterinary field; it has become a public health concern [6,9]. The One Health approach requires comprehensive control and prevention programs, especially in endemic areas where risks of animal, human, and environmental exposures intersect [6]. Persistent infections caused by poor farm management, such as in the smallholder farms setting, indicate the importance of a tailored prevention and control program [7]. In that regard, community services programs, such as routine participatory parasite monitoring, livestock farmers' education, and locally extension programs, offer benefits for the prevention and control of the disease. Community-oriented programs can help to convert evidence-based studies on prevalence and risk factors into feasible actions [7].

Initiative to conduct disease monitoring is important to determine the infestation rate of *Fasciola* spp. and *Paramphistomum* spp. in a region, to identify local risk factors, and to further develop appropriate control strategies based on the community information. Therefore, this study aims to determine the prevalence of fascioliasis and paramphistomiasis in cattle and to analyze the risk factors associated with those diseases in Borangan Village, Central Java. Furthermore, this study can support the effort to optimize cattle productivity and reduce economic losses caused by the endoparasitic diseases fascioliasis and paramphistomiasis in smallholder livestock farms.

2 Method

2.1 Study site

This study was part of the university's Student Community Services-Community Empowerment Learning program (KKN-PPM) in Borangan Village. The program was part of the university's initiative to foster transformative learning experiences for students and to integrate community-focused projects aligned with Sustainable Development Goals (SDGs) principles. Borangan Village, Manisrenggo District, Klaten Regency, Central Java Province, is a region dominated by irrigated agricultural land, and livestock were generally managed under a semi-intensive rearing system. Although most cattle were kept in pens, the green fodder obtained from the paddy field has the potential to be contaminated with *Fasciola* spp. and *Paramphistomum* spp. The wet environmental conditions resulting from high rainfall, along with dense vegetation around irrigation channels, support the survival of freshwater snails, which serve as intermediate hosts, making this area at risk of fascioliasis and paramphistomiasis.

2.2 Sampling method

The cattle population was calculated from local government data and direct interviews conducted across all 12 sub-regions of Borangan Village during the community service. The results showed that in Borangan, there were 192 farmers with a total cattle population of 376. In this study, we randomly selected farmers and obtained their consent to participate in the study. A total of 101 farmers were interviewed. The number of participants needed for the survey in this study was estimated to be at least 65, assuming 50% of respondents answer a question similarly, with a 95% confidence level and a 10% margin of error. Meanwhile, the sample size for the trematode investigation was estimated at 47 or more, with a 95% confidence level, a 10% margin of error, and a prevalence of fasciolosis of 16.5% [5]. We collected one fecal sample from each farm; thus, a total of 101 samples were acquired and tested for fascioliasis and paramphistomiasis using the sedimentation method.

2.3 Sample collection and testing

The sample collected was cattle fecal matter from within 24 hours of excretion. Approximately 20 g of fecal matter was collected in a ziplock polypropylene bag for each sample. Samples were stored on ice without preservatives. All samples were transported in the ice box and submitted to Balai Besar Veteriner Wates within 3 days of collection. Samples were tested for *Fasciola* spp. and *Paramphistomum* spp. eggs using the sedimentation method [10] at Disease Investigation Center (DIC) Wates. The test was performed once per sample, with no repetitions.

2.4 Data management and analysis

All responses of the survey were stored in comma-delimited (.csv) format in Microsoft Excel (Microsoft Corp., Redmond, WA, USA) using coded variables. Descriptive analysis was conducted using the R software to describe the quantitative information from the questionnaire results. Categorical variables were described using frequency distributions, percentages, and 95% confidence intervals. To measure the association between the prevalence of fascioliosis and paramphistomiasis, the Chi-square test and logistic regression were performed at 5% significance level.

3 Results

3.1 Livestock population

In our study, we observed that in Borangan Village, Manisrenggo District, Klaten Regency, the cattle population was 376, managed by a total of 192 farmers. On average, each farmer keeps 1–2 cattle. The most common breeds raised were Simmental crossbreed (60.20%), Ongole crossbreed (24.49%), and Limousin crossbreed (13.27%), which, based on the interview, are primarily maintained for fattening and breeding purposes. Most cattle farmers are 30–50 years old (64.36%), and their main occupation is farmer, where they raise cattle as a secondary source of income. Livestock are managed around their house intensively (78.79%) and fed with fresh fodder from nearby fields (81.82%). Cattle farming is small-scale and family-based, continuing through generations, with an average number of cattle of 2 or fewer (1.935 ± 0.82) (Table 1).

Table 1. Demographic characteristics of the survey respondents in Borangan village

No	Questionnaire items	Number of responses	Percentage (95% CI)
1	**Age**	***n* = 101**	
	<30	0	0 (0.00-3.59)
	30-50	65	64.36 (54.21-73.64)
	>50	16	15.84 (9.33-24.45)
	Prefered not to say	20	19.80 (12.54-28.91)
2	**Cattle breed**	***n* = 98**	
	Simmental crossbreed	59	60.20 (49.82-69.96)
	Ongole crossbreed	24	24.49 (16.36-34.21)
	Limousin crossbreed	13	13.27 (7.26-21.62)
	Friesian Holstein crossbreed	2	2.04 (0.25-7.18)
3	**Number of cattle**	***n* = 92**	
	Average	1.935 ± 0.82	
4	**Cattle management**	***n* = 99**	
	Intensive	78	78.79 (69.42-86.36)
	Semi-intensive	21	21.21 (13.64-30.58)
5	**Feed type**	***n* = 99**	
	Fresh grass	81	81.82 (72.80-88.85)
	Stored grass (dried)	18	18.18 (11.15-27.20)
6	**Last anthelmintics therapy**	***n* = 97**	
	<3 bulan	21	21.65 (13.93-31.17)
	3-6 bulan	14	14.43 (8.12-23.03)
	6-12 bulan	29	29.90 (21.02-40.04)
	Never	33	34.02 (24.70-44.34)
7	**Who prescribed anthelmintics drugs**	***n* = 97**	
	Self-administered	52	53.61 (43.19-63.80)
	Veterinarians	22	22.68 (14.79-32.30)
	Don't know/Not sure	23	23.71 (15.66-33.42)
8	**Veterinarians' visit**	***n* = 97**	
	Rare	71	73.20 (63.24-81.68)
	Sometime	21	21.65 (13.93-31.17)
	Often	5	5.15 (1.69-11.62)
9	**Heard about Fasciolosis before**	***n* = 101**	
	Yes	3	2.97 (0.62-8.44)

	No	98	97.03 (91.56-99.38)
10	**Know about previous Fasciolasis case**	***n* = 97**	
	Know	0	0 (0-3.73)
	Don't know	97	100 (96.27-100)

3.2 Prevalence of *Fasciola* sp. and *Paramphistomum* sp.

This study recorded a prevalence of 24.75% (16.34-33.16%) (n=25) for fascioliasis and 4.95% (0.72-9.18%) (n=5) of fascioliasis and paramphistomiasis coinfection from 101 tested samples. Egg concentration ranges from 1 to 21 eggs per gram (EPG) for fascioliasis and 1-5 EPG for paramphistomiasis. All (n=5) paramphistomiasis occurred as a coinfection with fascioliasis. *Fasciola* spp. eggs were detected in mixed breed (n=6), Limousin cross (n=3), and Simmental cross (n=16) cattle, but not in Holstein Friesian cross nor Ongole cross cattle. However, samples from Holstein Friesian cross (n=2) and Ongole cross (n=9) cattle are also fewer in number. Fascioliasis was detected in 5 out of 12 village sub-regions, while paramphistomiasis was only detected in 2 sub-regions. The prevalence of fascioliasis and paramphistomiasis in each village sub-region is in Table 2.

Table 2. Prevalence of fascioliasis and paramphistomiasis by village sub-region.

No.	Village Sub-region	Fascioliasis	Paramphistomiasis
1	Kedusan (n=10)	5 (50.00%)	2 (20.00%)
2	Kijilan (n=2)	1 (50%)	0 (0%)
3	Pungkruk (n=25)	8 (32.00%)	0 (0%)
4	Ngremang (n=23)	7 (30.43%)	0 (0%)
5	Candran (n=10)	3 (30.00%)	3 (30.00%)
6	Jatirejo (n=13)	1 (7.69%)	0 (0%)
7	Pabrikrejo (n=1)	0 (0%)	0 (0%)
8	Mranggen (n=6)	0 (0%)	0 (0%)
9	Borangan (n=6)	0 (0%)	0 (0%)
10	Cikal Rejo (n=4)	0 (0%)	0 (0%)

3.3 Infection risk factors

The Chi-square test results show that no statistically significant risk factors ($p < 0.05$) were identified from the questionnaires. Prevention with anthelmintic drugs also shows no significant difference in odds ratios in the treated group and the untreated group, whether the drug was administered within 3, 6, or 12 months prior to sampling. There were no statistically significant differences in the odds ratio of infection between cattle that received anthelmintics from a veterinarian and those that self-administered. These findings suggest a relatively similar exposure to fascioliasis and paramphistomiasis among the population. However, through the analysis, certain groups of cattle were found to possess a higher proportion of contracting fascioliasis than others. Risk factors analyzed in this study are as seen in Table 3.

Table 3. Risk factors associated with fascioliasis on cattle in Borangan Village.

Variable	Cases	Percentage	Odd Ratio	95% CI	P-value
1. Breed					
Simmental cross (ref)	16	27.1%	-	-	-
Mixed breed	6	40.0%	1.79	0.55-5.84	0.33
Holstein Friesian cross	0	0%	0	-	-
Limousin cross	3	23%	0.80	0.20-3.33	0.77
Ongole cross	0	0%	0	-	-
2. Housing system					
Stall (ref)	19	24.4%	-	-	-
Semi intensive	6	28.6%	1.24	0.42-3.65	0.69
3. Feed					
Dry forages (ref)	3	16.7%	-	-	-
Wet forages	22	29.3%	2.08	0.55-7.86	0.28
4. Anthelminthic treatment					
Yes, within 3 months (ref)	5	23.8%	-	-	-
Yes, 3-6 months	4	28.6%	1.28	0.27-5.91	0.75
Yes, 6-12 months	8	27.6%	1.22	0.33-4.44	0.76
No or >12 months	8	24.2%	1.02	0.29-3.66	0.97
5. Anthelmintic administration					
By veterinarian (ref)	6	27,3%	-	-	-
By self	14	26,9%	1.02	0.33-3.13	0.97
6. Farm animals					
Cattle only (ref)	22	30,6%	-	-	-
With other ruminants	3	11,5%	0.30	0.08-1.10	0.07
7. Farmer age					
>50 years (ref)	18	27.7%	-	-	-
<50 years	6	37.5%	1.57	0.49-4.99	0.45

4 Discussion

This study evaluated the prevalence and risk factors of fascioliasis and paramphistomiasis through field observations as part of community services in Borangan village, Klaten, Central Java. The study assessed the demographic information, knowledge, and practices of livestock farmers related to fascioliasis and paramphistomiasis through face-to-face interviews. The findings of this study provide insight into the situation of fascioliasis and paramphistomiasis and identify areas for improvement that can aid farmers and animal health agencies in developing effective parasite control and management programs. Additionally, to guide future studies on the effectiveness of the anti-parasitic program and research.

4.1 *Fasciola* sp. and *Paramphistomum* sp. prevalence in Borangan

In Indonesia, fascioliasis prevalence varied across regions. Compared to previous studies, fascioliasis prevalence in Borangan Village, Central Java (24.75%) was higher than in Lampung (3.8%), Banten (5%), and other previous studies in Central Java (17%) [1,11]. In comparison to Southeast Asia, this finding was within the range shown in the previous study, where the prevalence of fascioliasis was between 17.0 to 61.3% in cattle [6]. Meanwhile, the prevalence of paramphistomiasis in our study was similar to the previous study in Central Java (4%) [11], but lower than several other regions in the island of Java, including 23.3% in Banten [1], 47% in Yogyakarta [12], and the island of Sumatra, 32.9% in Lampung [1] and 76.7% in Aceh [14]. In terms of coinfection, our study found that 4.95% of our sample were positive for *Fasciola* spp. and *Paramphistomum* spp. which were lower compared to study in Aceh (27%), Lampung (26.6%), Banten (10%), and Yogyakarta (21.05-28.95%) [1,12,13]. These variations are likely attributed to the differences in geographical, environmental, and management conditions [1,6].

4.2 Fascioliasis and Paramphistomiasis Risk Factors in Borangan

Across different breeds, the highest apparent prevalence of contracting *Fasciola* spp. was in mixed-breed cattle (40%). Simmental cross cattle were more often (27.1%) infected with *Fasciola* spp., than the Limousin cross (23%). Previous study found similar trends, with Simmental breed having higher proportion of infestation than Limousin, likely caused by differences in grazing behavior or immune susceptibility [6, 12]. However, the difference in the odds ratio across different breeds could just be reminiscent of farming attitudes and practices. The author's observation shows that in Borangan Village, mixed-breed cattle tend to be valued less economically than cattle crossed from prestigious breeds, such as Simmental and Limousin. This might contribute to mixed-breed cattle receiving worse farm management than prized cattle breeds, exposing cattle to other predisposing factors. It was also found that under endemic environmental conditions, exposure to other risk factors overwhelms any inherent resistance, making breed differences less apparent [3].

Cattle kept with a semi-intensive housing system have a higher prevalence (28.6%) compared to cattle kept in stalls (24.4%). A similar finding by a previous study was attributed to higher parasite exposure in traditional (extensive) and semi-intensive management systems than in stalls. Cattle with free access to forages often graze on untreated grass contaminated with infective metacercaria [1]. Stall housing system limits cattle from its environment, rendering metacercaria contamination dependent on human introduction, whether accidental or due to improper farming practices.

Cattle fed with wet forages had a greater proportion (29.3%) of getting infected with *Fasciola* spp., than cattle fed with dry forages (16.7%). Metacercariae of *Fasciola* spp. can survive on fresh or moist vegetation for several days [5]. Exposure of forages to sunlight for at least 8 hours, either by drying or wilting, effectively inactivates metacercaria [4].

Lack of statistically significant association between risk factors and fascioliasis in Borangan Village may reflect strong environmental influence and lack of proper anthelmintic program. Fascioliasis transmission in Southeast Asia is linked to the agricultural system and practices that integrate livestock with flooded rice paddies in the same area. The almost constant presence of snail habitats creates continuous exposure through contaminated water and vegetation that overshadows the protective effects of proper farm management, rendering other factors insignificant [3]. High rainfall and humidity also sustain aquatic snail populations such as *Lymnaea*, ensuring persistence of the parasite life cycle even with infection control programs implemented [5].

4.3 Prevention program evaluation

There is no significant difference in the odds ratio between cattle previously given anthelmintics and those not. Cattle administered with anthelmintic treatment within 3 months, 3-6 months, and 6-12 months also possess indifferent odds of contracting *Fasciola* spp, even when differentiated between groups that receive self-administered and veterinarian-administered drugs. The lack of a statistically significant difference between the treated and untreated groups of cattle in Borangan Village might be attributed to a recall bias or inaccurate information due to poor recording of deworming frequency and sanitation practices [1]. This result indicates a declining drug efficiency or irregular treatment practice. Different flukicides used to treat fascioliasis were found to exhibit suboptimal efficacy (70-90%) when administered as a single dose [14]. Veterinary service in Borangan Village is virtually only available by appointment with a veterinarian outside of the district. The timing of administration relative to climatic cycles could also affect the effectiveness of anthelmintics, particularly those anthelmintics that are effective only against adult flukes [15]. In self-treatment groups with no veterinary guidance, improper dosing also leads to poor therapeutic outcomes [1].

Another factor that is likely behind the ineffectiveness of anthelmintic treatment is the emergence of flukicide resistance. Flukicide resistance has previously been reported in both *Fasciola gigantica* and *Fasciola hepatica* populations across Asia, reducing efficacy down to less than 90% fecal egg count reduction [14]. This reduced efficacy indicates established resistance according to the World Association for the Advancement of Veterinary Parasitology (WAAVP) standard, and sublethal doses of anthelmintics due to underdosing or repeated use of a single compound also drive rapid selection of resistant fluke [8]. These practices are thought to be common in Borangan Village, where the majority of farmers practice self-treatment for their livestock. However, further studies are needed to observe the potential of resistance.

4.4 Study limitations

There are limitations that need to be considered before interpreting our results. Our respondents were mostly working as farmers who did not treat their livestock as their primary source of income. Therefore, the results might be more prone to a recall bias when they were asked about their animals. The results of this study should also be interpreted with caution, as they may not reflect the conditions of general livestock farmers, especially in other regions. Moreover, the apparent lack of association between parasite prevalence and risk factors might also be attributed to a lack of control programs and standardized use of anthelmintics, particularly among self-treating farmers. Based on the questionnaire, farmers generally do not understand the type of deworming drug used. According to observation, one of the most available drugs to them is albendazole, which is only effective against mature *Fasciola* spp. [15]. Treatment failures in fascioliasis control are often associated with improper drug choice and administration [8]. Future studies should evaluate the variety of drug choices within populations that can obscure the relationship between variables due to varying levels of protection and the possibility of anthelmintic resistance development.

5 Conclusion

This study shows a high prevalence of fascioliasis in Borangan Village, Central Java, Indonesia, and a lower prevalence of paramphistomiasis as a coinfection. Breed, feed type, housing system, and anthelmintic treatment did not show any statistically significant association with infection status. These findings suggest a relatively similar exposure to infection risk due to common risk factors, including the proximity to rice paddy and reservoir for intermediate hosts. The absence of significant differences among risk factors may also reflect a lack of appropriate anthelmintic use practices. This study could help improve the antiparasitic practices program among farmers and veterinarians and provide insights for further studies related to fascioliasis and paramphistomiasis.

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