

Occurrence of *Fasciola gigantica* and *Paramphistomum* spp Infection in Aceh Cattle

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Abstract. *Fasciola gigantica* and *Paramphistomum* spp. are trematode helminth causing severe economic losses in cattle farming in Aceh Province, Indonesia. This study was conducted to examine the correlation between the prevalence of *F. gigantica* and *Paramphistomum* spp infections with the body condition and sex of Aceh cattle. In total, 103 cattle (50 males and 53 females) from an abattoir in Banda Aceh were used. The body condition score was recorded and the number of fluke eggs in feces was examined coproscopically. The results showed that *F. gigantica* prevalence was 41% and 72% in females and males, respectively, whereas, the prevalence of *Paramphistomum* spp in females and males was 81% and 72%, respectively. The average number of fasciola eggs was 2.55 eggs/ g feces and 2.75 eggs/ g feces in females and males, respectively, The average number of *Paramphistomum* spp eggs was 127.6 eggs/g feces and 36.8 eggs/ g feces in males, and female respectively. Based on the Body Condition Score (BCS), the prevalence of both trematodes was higher in the skinny cattle (BCS 2 and 3). This study established that the infection of *Fasciola* in BCS 3 was higher than BCS 2 and 4. Male cattle were more susceptible to infection than females.

Keywords: epidemiology, sex influence, Body condition score, *F. gigantica*, *Paramphistomum* spp.

1 Introduction

Fasciola gigantica and *Paramphistomum* spp. are the common trematode helminth infesting cattle and other ruminants worldwide [1-3]. These worms cause severe economic losses in cattle farming due to weight loss, reduced milk production, low fertility rates, and in some cases death [4-5]. Several previous studies reported high morbidity and mortality in young and adult cattle due to these parasitic outbreaks [6-7], delayed growth, anemia, tissue damage, especially in liver and bile ducts, and reduction in productivity [1, 8]. The economic loss in Indonesia due to the infestation of *F. gigantica* and *Paramphistomum* spp. is more than USD = \$ 3.2 billion annually [9].

In general, cattle are infected by trematode when they swallow metacercariae attached to the grass and water [10-11]. Moreover, the density of metacercariae is influenced by the population size of snails *Bulinus* spp. and *Planorbis* spp. as the intermediate hosts. The prevalence of paramphistomiasis and fasciolosis relates to several factors, among them the grazing system [12-13], nutrition status, climate, ecosystem, and genetic aspects [14]. According to Putra *et al.* [13], pasture quality influenced the number of infected animals by trematode, *F. gigantica*, and *Paramphistomum* spp. In cattle fed with forage, the prevalence rate reached 30%, but the value

decreased to 6% - 19% when the cattle fed on concentrate feed. In Indonesia, rice cultivation is part of the culture, and the paddy fields are important habitat for *Fasciola* and *Paramphistomum* metacercariae, a source infection of this trematode. A special case where trematode prevalence rates reached 90% on cattle grazing freely in paddy fields has been reported [15].

A lot of previous studies focused on the infestation of the *F. gigantica* and *Paramphistomum* spp. in ruminants [2, 18-19]. Nevertheless, no study has evaluated the correlation between body condition score (BCS) and trematode infection in Aceh cattle. The BCS is an important practical method of assessing the body condition of the livestock since it is a simple indicator of fat reserves in the body [20]. The information about the correlation between BCS and parasitic disease status is also essential for livestock management decision making. Moreover, the influence of sex on the prevalence and egg number of the *F. gigantica* and *Paramphistomum* spp infestation in Aceh cattle has not been studied previously. This information is essential in preventing the disease caused by the aforementioned parasites. For this reason, this study was conducted to examine the effect of sex and body condition score on the prevalence of the *F. gigantica* and *Paramphistomum* spp. in Aceh cattle.

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2 Materials and Methods

2.1 Collection of parasites

A total of 103 Aceh cattle, consisting of 50 males and 53 females from a slaughterhouse in Banda Aceh City were selected to be examined for fasciolosis and paramphistomosis prevalence rate, body condition score (BCS) and intensity of trematode infection. The feces were collected from rectum coproscopically and put into a transparent plastic bag. All samples were labeled and stored in a cooling container at a temperature of 5 °C before the examination.

2.2 Measurement of body condition score (BCS)

The BCS is a parameter used to analyze the body condition of an animal unit. In this study, it was carried out through observation and palpation on the body fat deposits under the skin around the base of the tail, spine, and hip. Assessment of the body condition was performed visually and by palpation of fat deposits in cattle body parts such as at the hind and quarter of the back, the processus spinosus, processus spinosus to processus transversus, tuber coxae (hooks) between the coxae tuber and the ischiadicus tuber, the right and left tuber coxae, and the base of the tail to the ischiadicus tuber [21]. The score ranges from 1-5, where score 1 = very thin, 2 = lean, 3 = medium, 4 = fat and 5 = very fat.

2.3 Examination of worm eggs

The modification of sedimentation method was used in this study (15). A total of three grams of feces were weighed and put into the mortar and diluted with 20 ml of water. The solution of Tween-80 was added and then homogenized by a magnetic stirrer for 5 min. The solution was filtered using mess 300, and the filtered material was sprayed with water, refilled with 100 ml of water and then left for three minutes before the removal of the supernatant. This procedure was repeated twice. The remaining sediment was further dropped with 1% Methylene blue to distinguish debris from trematode eggs and transferred into a petri dish that was given a line for orientation. The presence of *Fasciola* sp. eggs is characterized by golden yellow, while *Paramphistomum*

spp is bluish-gray. The eggs were counted and recorded using a binocular microscope at 1000X magnification.

2.4 Statistical analysis

The data were subjected to the student T-test to analyze the effect of sex and body condition score on the worms' prevalence and egg number, while the Chi-squared test was used to compare the spread between males and females at a confidence limit of 5%.

3 Results and Discussion

3.1 Results

The study showed that 28 (27%) of the cattle were positively infected by *F. gigantica* and *Paramphistomum* spp and indicated a mixed infection of both parasites in Aceh cattle. Besides, 37 cattle had BCS 2, 47 had BCS 3 and 19 had BCS 4 (Table 1). Generally, there was a positive correlation between prevalence and BSC, where the pervasiveness of parasites increased with an increase in BCS. For example, the prevalence of *Paramphistomum* spp. at BCS 2 was 16%, but increased to 55% and 94% at BCS 3 and BCS 4 respectively. The study also detected a mixed infection of *F. gigantica* and *Paramphistomum* spp. in Aceh cattle. The higher mixed infestation was found in cattle with BCS 3 followed by BCS 2 (Table 1).

The results of the stool examination showed the eggs of *F. gigantica* were golden yellow with a size of 180 µm in length and 95 µm width. The average number of eggs in males was 2.76 eggs gram-1 feces and 2.56 eggs gram-1 feces in females. The eggs of *Paramphistomum* spp. was transparent and showed clear embryonal cells. The egg size was 113-175 µm in length, and 73-100 µm width, and equipped with an operculum. The number of *Paramphistomum* eggs was 127.57 and 36.78 eggs gram-1 feces in males and females, respectively. The student T-test showed the sex of cattle gave a significant effect on prevalence and the number of eggs of the *F. gigantica* and *Paramphistomum* spp. (P<0.05).

The study showed the prevalence of *F. gigantica* in male cattle was higher than in females (Table 2). The contrary finding was found in *Paramphistomum* spp. In which the higher prevalence was recorded in female cattle (Table 2).

Tabel 1. Body condition score and trematode prevalence of 103 cattle

BCS	Total	<i>F. gigantica</i> Prevalence	<i>Paramphistomum</i> spp. Prevalence	<i>F. gigantica</i> + <i>Paramphistomum</i> spp.
5	0	0 (0%)	0 (0%)	0 (0%)
4	19	4 (21%)	18 (94%)	3 (16%)
3	47	17 (36%)	26 (55%)	15 (32%)
2	37	4 (11%)	6 (16%)	10 (27%)
1	0	0 (0%)	0 (0%)	0 (0%)

3.2 Discussion

The study showed 25 and 50 cattle samples were infested by *F. gigantica* and *Paramphistomum* respectively, while the remaining 28 were infected by both parasites. The infestation of helminth in cattle is influenced by both internal and external factors. The external factors include

age, sex, and breed, whilst intrinsic aspects include climate, environment, and farm management [22-23]. Animal age is one of the most important factors in fasciolosis, where the cattle older than 12 months are more susceptible to *F. gigantica* compared to younger ones [24].

Table 2. The number of eggs in feces and the prevalence of *Fasciola gigantica* in cattle

Sex	Sample	Positive	Total of eggs	Average eggs per gram feces	Prevalence (%)
Male	50	36	99	2.75 ^a	72 ^a
Female	53	22	56	2.55 ^a	41 ^b
Total	103	58	155	2.65	56.3

^{a,b} Different superscript in the same column showed a significant difference between male and female (P< 0.05)

Table 3. The average of eggs in feces and the prevalence of *Paramphistomum* spp. in cattle

Sex	Sample	Positive	Total eggs	EpG	Prevalence (%)
Male	50	36	4593	127.6 ^a	72 ^a
Female	53	43	1582	36.8 ^b	81 ^b
Total	103	79	2038	25.82	76.7

^{a,b} Different superscript in the same column showed a significant difference between male and female (P< 0.05) EpG = egg per gram feces.

The prevalence of *F. gigantica* in this study was higher than in other reports in Indonesia and other tropical countries such as Borneo [25], West Java [26], Vietnam [27], and Iran [28].

Based on sex, the prevalence rate of *F. gigantica* in male cattle was significantly higher than in females. Therefore, it was assumed the female had a lower risk factor to *F. gigantica* infection. This finding is in agreement with [12], who examined the intensity of *F. gigantica* in cattle and established that the male's infection rate was higher than in females. This condition was attributed to the hormonal system where the estrogen triggers properties of Reticulo Endothelial System (RES) in cells mediated through direct chemical interaction with lymphoid and nonlymphoid tissue, resulting in the release of soluble immunoregulatory factors. These factors are produced by thymic epithelium in response to an estrogen stimulus. Furthermore, according to [25], the phagocytic activity of the RES in animals may be measured by the number of particles present in the blood. However, it is well-known that estrogen stimulates the level of RES in the animal body. This hormone induces the blood clearance rate and increases the number of phagocytes cells in the liver. By so doing, it enhances the immune system of the female cattle. Besides, the females are rarely used in plowing in the paddy field, especially in gravid condition, and therefore they have less contact with metacercariae, a source of infection. On the contrary, [30] reported a higher prevalence in females than in males in Bangladesh. This difference was attributed to the physiological conditions of female cattle during gravid and lactation. It may also be due to the lack of dietary supplements for production which leads to a decrease in the immunity of females. It is assumed that in malnutrition condition, estrogen interaction with RES is deactivated

The number of parasite eggs in feces showed the male cattle (2.75 eggs/g of feces) had a slightly higher number than females (2.55 eggs g-1 of feces). The number of eggs of *F. gigantica* was higher than in a previous report by [26], who recorded 1.31 eggs/g feces in cattle in Borneo. According to [27], there were 49 eggs/g feces (11.2%) in West Java. This is because Aceh Province is known to have a higher risk of *F. gigantica* infestation region in Indonesia [15, 31].

The study revealed that the BCS 3 dominated in all of the examined cattle. This indicated most of the cattle slaughtered in Banda Aceh municipal were quite lean. This finding was in agreement with [8], who reported that the level of intensity and prevalence of *Paramphistomum* spp. in ruminant of Ethiopia was higher in animals with poor body conditions. The study also showed the cattle sample with BCS 3 was the most infected by *F. gigantica* and *Paramphistomum*. This is, probably, related to age stage, an assertion supported by [15], where cattle with BCS 3 were mainly 2-4 years old, while 1.5 to 2.5 years old mostly had BCS 2. The young cattle are generally free-roaming in a dry field and therefore most exposure to metacercariae. It was assumed that most of the young cattle do not have adequate antibody [32]. On the basis of body condition score, female cattle were more susceptible to *F. gigantica* infestation than the males. Besides, the weight loss in females was significantly higher than in males. This is in agreement with [33] who reported that female cattle in India were more susceptible to *F. gigantica* than the males. However, according to [34], *F. gigantica* leads to weight loss in goat (*Capra hircus*), though it did not specify the difference between males and females in response to the parasite.

4 Conclusion

This study established that body condition score is linked with *F. gigantica* and *Paramphistomum* spp, infections. The parasites mostly infested the cattle with poor body conditions (BCS 2 and 3). The prevalence of *F. gigantica* was higher in males compared to females, whilst the incidence of *Paramphistomum* spp. was higher in females than males. In addition, the female cattle are more susceptibility to *F. gigantica* compared to the males.

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