Prevalence of Gastrointestinal Helminthiasis in Beef Cattle During Dry Season in Bangkalan Regency, Madura, Indonesia

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Abstract. This study aims to observe and determine the risk factor of gastrointestinal helminthiasis among Madura beef cattle and Madura-Limousine crossbreed cattle in Bangkalan Regency during dry season. A cross sectional method was applied in this study design. A total of 240 feces from 240 beef cattle were collected during dry season (July to August 2020). Observation of worms in the feces was conducted using the McMaster method. In addition, the sedimentation method was used to identify worms from the Trematode class. Data were analysed descriptively and statistically using chi-square method. The results showed that the prevalence of helminthiasis during dry season reached 20 %, with the most prevalence eggs type belongs to *Strongyle* spp. (14.5 %), *Fasciola* sp. (3.3 %), *Trichostrongylus* sp. (1.25 %), *Strongyloides* sp. (0.8 %), and *Paramphistomum* sp. (0.8 %). The degree of infection observed from the average number of worm eggs, was mild. Average geometric number of worm eggs per gram of feces (EPG) was *Trichostrongylus* sp. 233 (range 100 to 400), *Strongyle* spp. 122 (range 50 to 350), *Strongyloides* sp. 75 (range 50 to 100), *Paramphistomum* sp. 25 (range 1 to 50), and *Fasciola* sp. 1 (range 0 to 1). Hekminthiasis among beef cattle in Bangkalan Regency was not affected by the type of cow but was significantly affected by gender and age.

Keywords: Animal husbandry, Gastrointestinal disease, livestock, parasite infection

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1 Introduction

Gastrointestinal (GI) helminthiasis remains a major concern among livestock in many countries. In Nigeria, helminthiasis was found throughout the year in beef cattle with the lowest prevalence (55.0 %) was in February [1]. In Thailand (Kanchanaburi Province), the prevalence of gastrointestinal helminthiasis in cattle and goats were 35.7 % and 88 %, respectively [2]. Meanwhile, in India (Srikakulam District, Andhra Pradesh) the prevalence among cattle, buffaloes, sheep, and goat were 43.03 %; 40.8 %; 29.4 % and 21.4 % respectively [3]. In Tanzania (Iringa district), the prevalence of GI nematodes in traditional farm was 67 %, large-scale dairy 44.4 % and 37 % in small-scale dairy cattle [4]. In Europe, the administration of anthelmintics to treat helminthiasis for a long period in livestock has emerged an anthelmintic resistance problem [5].

According to Velde *et al.* [6], cattle grazing in pastures were generally infected with GI parasites and cause gastroenteritis. Calves can acquire those disease they were first grazed and suffered from diarrhea, decreased growth, and decreased body weight, and in severe cases, death. In adult cattle the infection can be subclinical but could cause decrease production of meat [6].

Gastrointestinal (GI) helminthiasis is influenced by the environment. The survival and development of free-living stages in the field (egg stage or infective larvae) is strongly influenced by seasons, including temperature, humidity [7, 8], and rainfall [9]. In addition to environmental factors, several previous studies have shown that different types of livestock influence sensitivity to helminth infections. The breed of livestock or species can affect the ability of livestock to deal with infectious diseases. Genetic factors in livestock can cause livestock to be in a state of 'resistance', namely cattle are able to fight infection. In addition, a "tolerance" condition was also found, i.e., even though the livestock was infected by the pathogen, it only slightly affected the condition of the livestock [10]. Zalizar *et al.* [11], showed the average percentage of cattle infected with *Fasciola* sp. based on the type of cattle, respectively, Limousine 35.94 %; Simmental 58.33 %; PO 30.95 % and PFH 58.33 %.

This study was conducted to determine the prevalence and risk factors for helminthiasis during the dry season in Madura (M) beef cattle and Madura-Limousine crossbreed cattle (ML) in Bangkalan Regency, Madura Island, Indonesia. In the area during the dry season there is usually no or least rainfall and higher daytime temperatures.

2 Methods

This study design used a cross sectional method. A total of 240 feces from 240 beef cattle consisting of 120 Madura (M) and 120 Madura-Limousine crossbreed cattle (ML) were collected during the dry season (July to August 2020). Observation of worms in feces was carried out using the McMaster method. The sedimentation method was used to determine the Trematode class. Data were analysed descriptively and statistically using the Chi-square method.

This research was conducted in Bangkalan Regency, which is located on Madura Island. Bangkalan Regency is located between 6°51'39"S to 7°11'39"S and 112°40'06"E to 113°08'04"E. Topographically, Burneh District is located at an altitude of 2 m asl to 10 m asl, with an area of 6 610 ha. Like other regions in Indonesia, Bangkalan Regency has a tropical climate which has an average temperature of 24 °C to 36 °C. Based on BMKG observation data, the weather in July to August 2020 in Bangkalan Regency experienced daily no rain with very extreme criteria, with very low rainfall criteria of 0 mm to 10 mm.

Fig. 1. Examples of male Madura cattle (left) and Madura-Limousine crossbreed cattle (right) of the same age.

3 Results and discussions

Generally, cattle breeders in Bangkalan Regency have Madura (M) beef cattle and Madura-Limousine crossbreed cattle (ML). M cattle are a type of local cattle that are kept in the East Java region. This type of cow can adapt to the tropical climate and its feed requirements are lower than imported cattle [12]. The body's vital size in ML crossbred cattle was greater than that of M cattle. The average PBH of pre-weaned M calves was 445 g h^{-1} ± 48.53 g h^{-1} with a range of 350 g h^{-1} to 510 g h^{-1} of pre-weaned PBH, while the average pre-weaned PBH of ML calves 678 g h^{-1} ± 146.03 g h^{-1} with a pre-weaning PBH range of 340 g h^{-1} to 890 g h^{-1}. The average percentage of pre-weaned PBH for ML calves was 52.36 % higher than M calves [13].

Breeders use extensive and semi-intensive rearing methods. According to Tantri *et al.* [14], extensive livestock rearing can increase the risk of gastrointestinal helminthiasis due to the possibility of cows eating worm larvae in the pasture, especially in the morning. The morning is the time when many infective larvae appear on the grass surface [14].

Table 1. Helminthiasis prevalence in all cattle (M+ML) in Bangkalan Regency on July to August 2020

Total cattle (tail)	Negative helminth (tail)	Positive helminth (tail)	Prevalence (%)
240	190	50	20.83

Table 1 shows that the prevalence of helminthiasis in Madura and Madura-Limousine crossbreed cattle during July to August 2020 reached 20.83 % (50 positive out of 240 heads). These results indicate that the prevalence of helminthiasis during the dry season is low. The dry season with very low rainfall during the study may have contributed to the low worm infection. This is in accordance with Pfukenyi *et al.* [15], which stated that the average number of worm eggs in the wet month (rainy season) was higher than the dry month ($P < 0.001$). The dry season was an unfavourable condition for the development of worm eggs into infective larvae [15].

In contrast to the previous researchs Moyo [16], concluded that in the dry season many adult worms *Trichostrongylus axei* (Cobbold, 1879) and *Haemonchus placei* (Place, 1893) were found in the abomasum and *Cooperia* spp. were found in the small intestine of beef cattle. Total worm burdens ranged from 1 500 to 17 833. Transformed total worm counts were significantly higher during the dry than wet season ($P < 0.1$).

In Table 2, of the 240 stool samples from 240 beef cattle, 14.5 % were positive for *Strongyle* sp.; 0.8 % positive for *Strongyloides*, 1.25 % positive for *Trichostrongylus* sp., 3.3 % positive for *Fasciola* sp. *a*nd 0.8 % positive for *Paramphistomum* sp. Table 2 shows cattle infected by worms from the Nematode and Trematode classes. The types of nematode worms found based on examination of stool samples were the Nematode group, namely *Strongyle* spp*., Strongyloides* and *Trichuris* sp. The types of Trematode worms are *Fasciola* sp. and *Paramphistomum* sp.

Table 2. Types of worm eggs prevalence (%) and average geometric number of worm eggs per gram of feces (EPG)

Types of worm eggs	Result of fecal examination		
	Number of positive sample	Prevalence (%)	Average (EPG)
Strongyle spp.	35	14.5	122 (50 to 350)
Fasciola sp.	8	3.3	1 (0 to 1)
Strongyloides spp.	2	0.8	75 (50 to 100)
Paramphistomum sp.	2	0.8	25 (1 to 50)
Trichostrongylus sp.	3	1.25	233 (100 to 400)
Total	50	20.8	

*The number of cattle examined is 240 tails

Table 2 shows that there are differences in prevalence between each type of worm. *Strongyle* spp. worms have the highest prevalence compared to other worms. Strongyle spp worms may have better survival of free-living stages parasite against drought and high temperatures than other types. Each type of worm has different survival stages of free-living, as described in Pfukenyi *et al.* [16], that Infective 3 Larvae (L3) of *Cooperia* worms are more resistant to heat and drought than other worm larvae [16]. However, according to Blum *et al*. [17], most studies showed that hotter temperatures and changing rainfall can favor or harm some species of worm or snail host (or insect-vector) than others.

Strongyle spp. worms have a simple life cycle (compared to *Fasciola* sp. and *Paramphistomum* sp. worms), because they do not require a host [18]. Cattle infected with *Strongyle* spp. will affect health and cause economic losses because it causes diarrhea, weight loss and poor skin quality.

From Table 2, it can be concluded that the degree of infection observed from eggs per gram (EPG), is mild (average below 200). This is probably due to the dryness factor and hot temperatures that inhibit the reproductive process of female worms.

3.1 Prevalence of helminthiasis based on different types of cattle

There is no significant difference between the prevalence of helminth infections in Madura cattle and Madura-Limousine crossbreed cattle (Table 3). This result is different from previous studies that livestock genetic differences can cause different responses to helminth infections [1, 10, 11].

Table 3. Prevalence of helminthiasis based on different types of cattle

Type of cattle	Total number of cattle	Positive cattle number	Prevalence (%)	*P*-value
Madura	120	18	7.5	0.053
Madura-Limousine	120	30	12.5	
Total	240	48	20	

3.2 Prevalence of helminthiasis based on gender differences

The prevalence of helminthiasis in male Madura cattle was higher than female ($P < 0.05$). The results of this study are the same as that of Guzman's [19] study, infection with worm eggs in bulls (37.08 %) is slightly higher than that of female cows (29 %). Likewise, according to Ola-Fadunsin [1], the prevalence of male beef cattle is about 6.3 times higher than female cattle ($P < 0.01$). Males are thought to eat more grass than females so that males consume more worm eggs/infective larvae of worms attached to the grass.

However, these results differ from the study by Adedipe *et al.* [20] in Nigeria, which showed that both male and female animals were equally to be infected with gastrointestinal helminths [20]. This is due to both sexes of animals are exposed to the same conditions that will affect susceptibility to helminth infections, namely poor feeding, and livestock care. Likewise, Apio *et al.* [8], gender does not affect parasite *infection Eimeria* sp*., Moniezia* spp. and Nematodes *Strongyle* spp.

Table 4. Prevalence of helminthiasis based on gender differences

Gender	Total number of cattle	Positive cattle number	Prevalence (%)	*P*-value
Male	120	39	16.25	0.000*
Female	120	9	3.75	
Total	240	48	20	

*Signs indicate significant differences ($P < 0.05$)

3.3 Prevalence of helminthiasis based on age differences

The highest prevalence of beef cattle in Bangkalan Regency based on age was found in cattle < 2 yr old compared to > 2 yr old ($P < 0.05$). There were 32 samples of positive cows aged < 2 yr with a prevalence of 13.3 %, while those that were positive at the age of >2 yr were 16 samples with a prevalence of 6.6 % (Table 5). This is in accordance with Pfukenyi *et al.* [16], a significantly higher prevalence of infection with GI nematodes, cestodes and coccidia was recorded in calves ($P < 0.01$) than in adults.

The results of Table 5 are also in accordance with the research of Junaidi *et al.* [21], that the cases of nematodosis worm infection in calves are higher than in adult cattle. Junaidi *et al.* [21] said that the prevalence of nematodosis in Bali calves was 61.54 % and mother cattle was 30.44 %. This is because calves have a lower level of immunity than young and adult cattle. Younger cattle are more infected with nematode worms than adults because the number of goblet cells in the intestines of younger cattle has not increased to inhibit the growth of infective larvae of Nematode parasites [22]. Another possibility is due to the organs of the immune system in calves have not reached optimal development and the calf also has not had previous experience of worm infection.

Table 5. Prevalence of helminthiasis based on age differences

Age	Total number of cattle	Positive cattle number	Prevalence (%)	*P*-value
< 2 yr old	120	32	13.3	0.010*
> 2 yr old	120	16	6.6	
Total	240	48	20	

*Signs indicate significant differences ($P < 0.05$)

4 Conclusion

The results showed that the prevalence of beef cattle in Bangkalan Regency during the dry season reached 20 % (48 positive worms from 240 fecal samples), with eggs of *Strongyle* spp. (14.5 %), *Fasciola* spp. (3.3 %), *Trichostrongylus* spp. (1.25 %), *Strongyloides* (0.8 %), and *Paramphistomum* sp. (0.8 %). The degree of infection observed from the average number of worm eggs, was mild. Average geometric number of worm eggs g^{-1} of feces (EPG) was *Trichostrongylus* sp. 233 (range 100 to 400), *Strongyle* spp. 122 (range 50 to 350), *Strongyloides* sp. 75 (range 50 to 100), *Paramphistomum* sp. 25 (range 1 to 50), and *Fasciola* sp. 1 (range 0 to 1). The case of helminthiasis among beef cattle in Bangkalan Regency was not affected by the type of cow but was significantly affected by the gender and age. The prevalence of helminthiasis was higher in bulls than in females. This number was also higher in cattle aged less than 2 yr old than those older than 2 yr.

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