Prevalence of gastrointestinal endoparasites in Waringin sheep (*Ovis aries*) fed with complete forage and forage-concentrate

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Abstract. Feed composition has a substantial impact on the persistence of gastrointestinal endoparasite infection in sheep. This study aimed to compare the prevalence of gastrointestinal endoparasites in Waringin sheep (*Ovis aries*) fed with complete forage and feed concentrate in Sidomulyo Village, Langkat Regency, North Sumatra. The study has been conducted from June to August 2020 with a total of 20 sheep for each type of feed. Fecal samples from each sheep were prepared for microscopical examination using sedimentation technique (glass beads). Gastrointestinal endoparasites was identified morphologically. The results documented 3 genera of endoparasites namely *Haemonchus* (Nematoda), *Fasciola* (Trematoda) and *Paramphistomum* (Trematoda). Based on the type of forages, sheep fed with forage-concentrate showed a lower number of helminth eggs than the complete forage group. *Haemonchus* sp was identified as the most frequent parasite in both type of feeds. The intensity was categorized from mild-to-moderate level of infection. Provision of forage-concentrate was then proven to prevent a high rate of infection in Waringin sheep.

1. Introduction

Gastrointestinal parasitic infections are a serious problem in livestock breeding including sheep (*Ovis aries*). Sheep are the first livestock to be domesticated in Central Asia, more than 10,000 years ago, and are now distributed throughout the world as primary sources for milk, meat, fiber and pets [1]. Sheep is an important source of animal protein with a high demand in the market. Gastrointestinal parasitic infections in sheep are highly significant terms of economy because breeding small ruminants has become a source of income, especially for small-scale farmers [2]. Generally, parasitic diseases do not cause instant death to livestock, however, significant losses in the form of weight loss and animal productivity will in turn affect the economical value or the income of the farming community. The effects of gastrointestinal parasite infections vary by livestock species, but they are more evident in sheep and goats [3]. The three classes of parasitic helminth were nematodes, trematodes, and cestodes, which are regarded as the most frequent parasites in sheep[4].

The epidemiology of gastrointestinal parasites in livestock varies depending on local climatic conditions such as humidity, temperature, rainfall, pasture and management practices [5]. Factors from the aspect of livestock management can also affect the infestation of gastrointestinal parasites. These factors greatly determine the incidence and severity of various parasitic diseases in an area. Intestinal worms are frequently observed in cases of parasitic nematodes in small ruminants such as sheep. The species are most commonly found in the abomasum and small intestine.
Some of the notable genera are *Haemonchus*, *Trichostrongylus*, *Nematodirus*, *Cooperia*, *Bunostomum*, *Ostertagia*, and *Oeshagostomum* [6]. The method of examination of gastrointestinal parasitic infections varies depending on the technique while the source of samples is mainly from the animal feces. Stool examination is the most common and routine work in the diagnosis of nematodes especially to detect helminth eggs. Examination for nematode eggs can vary from simple direct smears to more complex methods involving centrifugation and the use of flotation fluids [7]. In a previous study that infection was higher in adults (100%) compared to young sheep (76.1%) [8].

Different feeds may lead to different tolerances for gastrointestinal parasitic infections. Feeding of livestock generally comes from forage consisting of various species of grass and foliars as the main feeds. Sheep require fortification or concentrate diets that are high in carbohydrates for energy production and protein for body building. Several studies have reported that parasitic infections were caused by types of feed, especially forage as an intermediate host for the life cycle of parasitic worms. The occurrence of helmint eggs in the animal feces may also be present in the pasture until the infective larvae are ready to infect the ruminant body. In this study, we evaluated the prevalence of endoparasites from differences in forage feeding and mixed forage concentrates at Waringin Sheep Farm in Sidomulyo Village, Langkat Regency, North Sumatra.

2. Methodology
The samples used in the study were stools from 40 sheep divided into 2 categories, namely 20 sheep fed with complete forage, and 20 sheep fed with mixed feed (forage-concentrate) at Waringin Sheep Farm in Sidomulyo Village, Langkat Regency, North Sumatra. Manure samples were collected from both types of feed and stored in sterile glass bottles and preserved (4°C) prior to laboratory experiments. Samples were analyzed using the Glass Beads Sedimentation method [9]. Helminth eggs was identified under a light microscope with magnification (40×) and compared with photographic guidebooks in the atlas of parasitology. Endoparasite species and their prevalence were analyzed descriptively [10].

3. Results and discussion

3.1. Endoparasite species in Waringin sheep
The study documented three species of gastrointestinal endoparasites classified into Nematoda and Trematoda. The presence of the parasites was consistent in both types of feed as presented in Table 1.

| Class      | Order   | Genus/Species       | Complete forage | Forage-concentrate |
|------------|---------|---------------------|-----------------|--------------------|
| Nematoda   | Strongylida | *Haemonchus* sp     | +               | +                  |
| Trematoda  | Plagiorchiida | *Fasciola* sp      | +               | +                  |
| Trematoda  | Plagiorchiida | *Paramphistomum* sp | +               | +                  |

Based on these results, it can be seen that the species occurrence of parasitic helmint eggs in sheep fed with complete forage and forage-concentrate were similar. The result may due the grazing capacity in pasture by sheep that may accidentally spread parasite egg infection in livestock. Pasture location may become a primary factor in the epidemiology of parasitic disease [11].

*Haemonchus* is a gastrointestinal parasite often found in animals, with considerable number of cases found in livestock such as sheep and goats. In fact, *Haemonchus* is one of the most pathogenic nematode parasites in ruminants involved in widespread morbidity and mortality in sheep and goats. *Paramphistomum* is a parasite commonly found in the rumen and reticulum while their juveniles can be
found in the duodenum. The shape of *Paramphistomum* is not typical of trematodes, conical rather flat with a complete life cycle involving snails as intermediate hosts [12].

3.2. Number of helminth eggs and infection level in Waringin sheep

The number of helminth eggs and comparison of infection levels of gastrointestinal parasitic in sheep fed with complete forage and forage-concentrate is presented in Table 2.

| No. | Species               | Number of eggs | Infection level | Species               | Number of eggs | Infection level |
|-----|----------------------|---------------|----------------|----------------------|---------------|----------------|
| 1.  | *Haemonchus* sp      | 2             | Mild           | -                    | -             | -              |
|     | *Paramphistomum* sp  | 1             | Mild           | -                    | -             | -              |
| 2.  | *Haemonchus* sp      | 2             | Mild           | *Fasciola* sp        | 3             | Mild           |
|     | *Paramphistomum* sp  | 2             | Mild           | *Haemonchus* sp      | 3             | Mild           |
| 3.  | *Haemonchus* sp      | 3             | Mild           | *Fasciola* sp        | 2             | Mild           |
|     | *Paramphistomum* sp  | 1             | Mild           | -                    | -             | -              |
| 4.  | *Haemonchus* sp      | 5             | Mild           | *Fasciola* sp        | 1             | Mild           |
| 5.  | *Haemonchus* sp      | 3             | Mild           | *Haemonchus* sp      | 1             | Mild           |
|     | *Paramphistomum* sp  | 1             | Mild           | -                    | -             | -              |
| 6.  | -                    | -             | -              | *Paramphistomum* sp  | 1             | Mild           |
| 7.  | *Haemonchus* sp      | 7             | Mild           | *Haemonchus* sp      | 3             | Mild           |
| 8.  | -                    | -             | -              | *Haemonchus* sp      | 5             | Mild           |
| 9.  | *Haemonchus* sp      | 7             | Mild           | *Haemonchus* sp      | 2             | Mild           |
| 10. | -                    | -             | -              | *Haemonchus* sp      | 8             | Mild           |
| 11. | *Haemonchus* sp      | 2             | Mild           | *Haemonchus* sp      | 2             | Mild           |
| 12. | *Haemonchus* sp      | 7             | Mild           | -                    | -             | -              |
| 13. | *Haemonchus* sp      | 7             | Mild           | -                    | -             | -              |
|     | *Fasciola* sp        | 2             | Mild           | -                    | -             | -              |
| 14. | *Haemonchus* sp      | 10            | Mild           | -                    | -             | -              |
| 15. | *Haemonchus* sp      | 8             | Mild           | *Paramphistomum* sp  | 2             | Mild           |
| 16. | *Haemonchus* sp      | 10            | Mild           | *Haemonchus* sp      | 1             | Mild           |
|     | *Fasciola* sp        | 1             | Mild           | -                    | -             | -              |
| 17. | *Haemonchus* sp      | 10            | Mild           | *Haemonchus* sp      | 4             | Mild           |
| 18. | -                    | -             | -              | -                    | -             | -              |
| 19. | *Haemonchus* sp      | 3             | Mild           | *Haemonchus* sp      | 3             | Mild           |
| 20. | -                    | -             | -              | -                    | -             | -              |
| Total|                      | 92            |                | Total               | 43            |                |

The results showed that the infection level of gastrointestinal parasitic in sheep fed with complete forage and forage-concentrate was relatively mild, while some of them were negative of helminth eggs. However, the number of helminth eggs was higher in the group of sheep fed with complete forage than in the forage-concentrate group. The findings were assumed that each sheep's immune system to helminth infections was unique. Self-resistance to parasite infections can be hampered by an unbalanced host immune system. Parasitic infections in livestock are caused by a deficiency in the animal's body's ability to fight parasitic worms. [10].
In this study, it was found that the category of mild infection was supported by the sex type where the sheep observed in this study were all rams. Livestock management and method of parasite detection may contribute to the different results. In many cases, it was known that gender also influenced the infestation by gastrointestinal parasites. Females were more exposed to stress than males at certain period of times, for example during gestation because stress weakens the immune system, making them more prone to illness [13].

3.3. Prevalence and intensity of gastrointestinal parasites in Waringin sheep

The prevalence of gastrointestinal parasites and their intensity level in Waringin sheep is presented in Table 3. Based on Table 3, it can be seen that the prevalence of gastrointestinal parasites in sheep fed with complete forage, namely Haemonchus sp with 75% (Common), Fasciola sp with 10% (Often), and Paramphistomum sp 10% (Often). Furthermore, the prevalence of gastrointestinal parasites in sheep fed with forage-concentrate ranged between 15% (Fasciola sp) to 50% (Haemonchus sp). The prevalence of gastrointestinal parasites in forage was higher because the environment influenced the development of nematode and trematode larvae on grass, including temperature, humidity and rainfall [14].

| No. | Species       | Complete forage | Forage-concentrate |
|-----|---------------|-----------------|--------------------|
|     |               | Prevalence      | Category           | Prevalence      | Category |
| 1.  | Haemonchus sp | 75% Common      | 50% Frequently     |
| 2.  | Fasciola sp   | 10% Often       | 15% Often          |
| 3.  | Paramphistomum sp | 10% Often |                              |

The highest prevalence in both types of feed was documented from Haemonchus sp. In the previous study, it was also reported that Haemonchus was the most dominant species with a high prevalence on goats and sheep followed by Trichostrongylus, Oesophagostomum, Bunostomum and Trichuris species [15]. The lowest prevalence was documented from Fasciola sp which has an indirect life cycle, with the larval stage dependent on an intermediate mollusc host for development. Intermediate host species were largely determined by geographic location [16].

| No. | Species       | Complete forage | Forage-concentrate |
|-----|---------------|-----------------|--------------------|
|     |               | Intensity       | Category           | Intensity       | Category |
| 1.  | Haemonchus sp | 5.73 Moderate   | 3.2 Mild           |
| 2.  | Fasciola sp   | 1.5 Mild        | 2 Mild             |
| 3.  | Paramphistomum sp | 1.5 Mild |                              |

Based on Table 4, it can be seen that the intensity of endoparasite attack on sheep faeces fed with different types of feed were different. The highest intensity value was found in sheep fed with complete forage namely Haemonchus sp (5.73) with a moderate category while the intensity value by Fasciola sp and Paramphistomum sp were categorized as mild.

The high intensity value of Haemonchus may due its abundance in the pasture area. In addition, the eggs were released by animals along with feces and then under suitable conditions outside the body of the host or host, the eggs will hatch and become larvae. Infective larvae attached to grass and infected the livestocks, then the larvae will develop into maturity in the abomasum [17].
The mild-to-moderate intensity value obtained in this study may also reflect the good management practice by the Sidomulyo Village. As for information, the sheep were given anthelmintic control at the appropriate dose and time for disease prevention. Control of gastrointestinal parasites in animals by administering anthelmintics will then reduce the level of parasitic infection. However, as the primary feed were still collected from pasture area, the use of anthelmintics may only mitigate the onset of parasitic disease in some points. Therefore, the provision of anthelmintics requires strategy and in-depth knowledge of the pathophysiology and epidemiology of the parasite, in the context of immunity and host management [18].

Environmental conditions outside the host's body greatly affected the emergence of helminth infestations, including temperature, humidity, oxygen availability and livestock breeding systems. A suitable environment will support the hatching of the helminth eggs from the feces and develop into infective larvae that will occupy new hosts. The more ideal the environmental conditions, the less the number and variety of parasitic species found. External factors affect the life of the parasite on the survival of the parasite's life cycle [19].

4. Conclusion
Based on our study, it can be concluded that the species of parasitic helminths found in the feces of sheep fed with complete forage and forage-concentrate were similar namely Haemonchus sp, Fasciola sp and Paramphistomum sp. The most common parasite in Waringin sheep was Haemonchus sp with a higher number of eggs from all parasites in sheep fed with complete forage than the forage-concentrate group. The intensity of parasitic attacks was categorized as mild-to-moderate level of infection. The results showed that the livestock breeding in Sidomulyo Village applied a good management practice in the system.

Acknowledgments
The authors would like to thank the Laboratory of Parasitology, Balai Penyidikan dan Pengujian Veteriner (BPPV) Regional 1, Medan, North Sumatera who already assisted us in identifying the samples.

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