Sheep’s gastrointestinal helminth infection at several districts in North Sumatra

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Abstract. High adaptability to the environment is an important reason for the farmer to raise sheep, one of which is the adaptation of sheep to parasite attack infections. Infection of nematode parasite is commonly found in the digestive tracts of sheep. The purpose of this activity is to investigate the gastrointestinal helminth infection in sheep in five districts in North Sumatra. This research was conducted in December 2019 to February 2020 by collecting sheep feces in the districts of Batu Bara, Labuhan Batu Utara, Asahan, Serdang Bedagai and Deli Serdang, North Sumatra. The number of eggs in stool were examined (eggs g⁻¹) as a method of Fecal Egg Count Reduction Test (FECRT). The results showed that there was no difference in number eggs g⁻¹ of stool in sheep that were kept with intensive and semi-intensive systems. The effect of sex, body weight and age of the sheep also showed no difference in the number of eggs g⁻¹ of their faeces. However, the results showed that the number of sheep’s worm eggs g⁻¹ of stool from Labuhan Batu Utara district was higher (P <0.05) when compared to other areas, which was 73.33 eggs g⁻¹ of feces. Whereas the sheep in Deli Serdang showed the lowest number of worm eggs (P <0.05) which was 23.33 eggs g⁻¹ of feces. In all study locations, Haemonchus contortus eggs were found in sheep feces indicates gastrointestinal heminth parasite infected sheep in those areas.

1. Introduction
Sheep is widespread small ruminant and found in almost all location in Indonesia. The population of sheep in Indonesia in 2019 was 17,794 head with the largest population in West Java, Central Java, East Java and North Sumatra. The sheep population in North Sumatra reaches 701,999 head [1] In general, the types of sheep that are widely kept in North Sumatra are local Sumatran sheep and few are encountered crossbreeding of hair sheep. Local Sumatran sheep are easily recognized by observing their general characteristics in their thin tails and coarse wool. The origin of this sheep is not known with certainty, but if it is related to the thin tail characteristic, it seems that this sheep is related to the Javanese sheep. These sheep have the advantage of adapting to a wet tropical climate, reproducing throughout the year and being resistant to several diseases [2]. 80% sheep rearing systems are still cultivated with conventional systems with little or no technological touch by utilizing the potential of natural resources available around [3].

As is known, genetic and environment factors are the two main things that greatly affect livestock productivity. The ability of livestock will be influenced by livestock genetics, while the environment will support genetic factors in order to work optimally. Local sheep have their own advantages because they can generally adapt well to local climates and have good adaptations to disease or...
parasite attacks in the local area [4]. The North Sumatra region consists of plantation agro-ecosystems including oil palm, rubber, coconut, coffee, tea, cocoa and sugar cane plantations, but its area is dominated by oil palm and rubber plantations. According to Central Bureau of Statistics [5] the area of oil palm plantations in North Sumatra reached 1,601,900 ha, while rubber reached 409,100 ha. The community uses forages in the plantation area to obtain the forage needs, both with a cut and carry system or a grazing system [1]. Farmers can rely on feed ingredients available in the plantation area. The feed ingredients that can be obtained from the plantation area are sourced from natural vegetation, which types and growth varies greatly, depending on plant age [6].

One of the problems to keep of sheep in temperate and tropical areas is a parasite attacks [7, 8]. There are many parasites as gastrointestinal helminth, and *Haemonchus contortus* is the one that most commonly attacks small ruminant and causes haemonchosis. The *H. contortus* attack may cause a decrease in livestock productivity and increase the number of mortalities. The condition of livestock such as sex, age and health condition of livestock are factors related to the level of attack. In addition, climate such as rainfall and temperature also affect the increase in infection in livestock [9]. Parasite transmission in livestock can occur through feed or drinking water that has been contaminated with parasites [10]. Tests on the response of local Sumatran goats to *H contortus* infection showed that local Sumatran sheep tended to be more resistant to the effects of *H contortus* infection even though the nutritional conditions were worse when compared to crossbred sheep [11]. The purpose of this study was to estimate parasite attacks on sheep in several areas in North Sumatra.

2. Material and methods

The study was carried out in five area (Batubara, Labuhan Batu Utara, Asahan, Serdang Bedagai and Deli Serdang Regency) which is located in North Sumatra. This research was conducted from December 2019 to February 2020 to observed the gastrointestinal parasites infected by counting the number of worm eggs in sheep feces in each observation base on different sex, age, body weight and maintenance system. Sheep raised by farmer with a grazing system of maintenance (extensive) or without grazing (intensive). Sheep identification was obtained by conducting interviews with farmer.

2.1. Faecal collection and preparation

Faecal samples were collected from 112 male and female sheep, 1 to 3 years old and 10 to 40 kg of body weight. Feces samples were collected directly from the rectum of the sheep and put in a plastic bag and closed so that it does not contain air and stored at 4 °C until further processing in the laboratory. The calculation of the number of eggs used the fecal egg count reduction test (FECRT) method. Three grams of feces from each sheep were dissolved with 17 ml of water for a few minutes, after being soft then crushed and then added with a solution of 40 ml of saturated salt to float the nematode eggs. After that, while stirring, the fecal solution was taken with a pipette equipped with a filter and the solution was put in the Whitlock counting room [12]. Nematode eggs are counted (in counting rooms) and the number is multiplied by 40. The number of eggs is calculated in units of eggs g⁻¹ of feces [12].

2.2. Statistical analysis

Data collected on prevalence and numbers of gastrointestinal parasite in fecal samples of sheep and goat were statistically analyzed using Analysis of variance (ANOVA) with general linear model procedure.

3. Result and discussion

The result showed that the study area caused a difference in the number of worm eggs found in sheep feces (table 1). North Labuhan Batu Regency is the area with the highest number of worm eggs found in sheep feces, that is 73.33 eggs g⁻¹ of feces. While the number of worm eggs found in Batubara, Asahan and Serdang Bedagai and Deli Serdang Districts were not looked different, the average number of worm eggs found was 35.51 eggs g⁻¹ of feces. This difference may occur due to several
things that affect the number of worm eggs found in sheep feces. Regional locations variation such as local elevation, rainfall and hydrology of area can affect the average number of worm eggs. However, this factor is also supported by the way of the farmer kept the sheep and their attention to the health condition of the livestock. Farmers in North Labuhan Batu Regency only rely on the provision of animal feed from grazing activities. Grazing is carried out only 4-5 hours a day without additional feeding, this affects the condition of the livestock so that it experiences higher parasite attack infections. The level of infection experienced by livestock depends on the management of the rearing and the level of contamination of the pasture [13].

The management system applied did not affect (P >0.05) the number of worm eggs found in sheep feces (table 1). Both with intensive and semi-intensive maintenance systems the average number of worm eggs found was 45.29 eggs g⁻¹ feces. The farmer applied an intensive and semi-intensive maintenance system, which means the farmer kept the sheep all day in the pen or the sheep are kept in the pen in the morning and then in the afternoon as the grazing time. With an intensive maintenance system, farmer will provide forage with a cut-and-carry system and also provide additional feed in the form of tofu dregs or fermented sago which is a source of feed that is found in their location. The forage provided is obtained from oil palm or rubber plantation areas which are also same locations for grazing. This is probably why the number of worm eggs in sheep that are intensively reared is the same as the number of worm eggs found in sheep that are reared in a semi-intensive system. The forage obtained by farmers with the cut and carry system may have been contaminated with worm larvae from sheep grazing in the same area. Worm eggs that are in the sheep's body are excreted to the outside environment through feces. The development of worm eggs begins with the first stage, which is in the form of a first stage larva (L1) which develops in the egg after 1 to 2 days of hatching. The length of time the eggs hatch is very much influenced by environmental conditions. Then L1 develops into the second stage larvae (L2). The third stage larvae will breed well and are protected because they have a sheath that can protect against bad environmental conditions. If forage contaminated with L3 is eaten by livestock, L3 will enter the digestive tract, then develop into stage 4 larvae (L4) and will become adult worms [L4].

| Parameter            | Eggs g⁻¹ of feces |
|----------------------|-------------------|
| Study area           |                   |
| Batubara             | 37.14 ± 27.06 bc  |
| Labuhan Batu Utara  | 73.33 ± 42.29 a   |
| Asahan               | 33.85 ± 26.31 bc  |
| Serdang Bedagai     | 47.74 ± 37.83 b   |
| Deli Serdang        | 23.33 ± 16.7 c    |
| Management system    |                   |
| Intensive            | 42.29 ± 32.93 a   |
| Semi intensive       | 48.29 ± 39.23 a   |

Table 1. Eggs g⁻¹ feces of *H. contortus* in different study area and management system.

Adult strongylid nematodes exist as female and male; the female produces a relatively large number (depending on the species) of eggs which are usually ovoid, strongylid (70–150 μm), which are excreted in the feces to the outside environment. The first stage larvae (L1) develop in the eggs and then hatch (within 1-2 days, depending on environmental conditions) and develop to the second stage larvae (L2). Both L1s and L2 feed on bacteria and other microorganisms in the external environment (feces). After molting, the protected third stage (L3) larvae reproduce (usually within 1-2 weeks, depending on species, temperature, humidity, pH and/or other factors). The cuticle sheath around L3 prevents it from eating but protects it from relatively harsh environmental conditions. After
L3 is digested by the animal and passes through the stomach, it exits (L3) and (after the tissue phase) develops to the fourth stage larvae (L4) and then becomes an adult at the predilection site in the digestive tract. The time from L3 to egg production by an adult female is usually 3 to 4 weeks.

The results showed sex did not cause the large number of worm eggs in sheep feces ($P > 0.05$) table 2. Worm eggs were found in the feces of male and female sheep with the average number of worm eggs being 49.79 eggs g$^{-1}$ of feces. The results of this study are the same as [15] which show that gender has no effect on the magnitude of this parasite infection in livestock. The results indicated that both male and female livestock were susceptible to parasite attack. However, several other studies reported different results, male sheep showed a higher percentage of infection than female cattle [16] and on the other hand, female sheep showed higher infection than male [17]. This is presumably due to the difference in immunology between male and female sheep which causes differences in the adaptability to infection in both. In addition, the effect of physiological status between males and females also affects the level of infection in male and female cattle [18].

**Table 2. Eggs g$^{-1}$ feces of H. contortus in different sex, age and body weight.**

| Parameter          | Eggs g$^{-1}$ of feces |
|--------------------|------------------------|
| **Sex**            |                        |
| Female             | 41.69 ± 32.78          |
| Male               | 57.89 ± 44.66          |
| **Age**            |                        |
| < 12 months        | 44.24 ± 33.07          |
| 12 to 24 months    | 54.4 ± 39.38           |
| 24 to 36 months    | 33.55 ± 34.79          |
| > 36 months        | 39.53 ± 35.32          |
| **Body Weight**    |                        |
| < 10 kg            | 64 ± 43.36             |
| 10 to 20 kg        | 44.8 ± 27.86           |
| 20 to 30 kg        | 37.5 ± 31.62           |
| 30 to 40 kg        | 45 ± 42.73             |
| >40 kg             | 55 ± 39.2              |

Likewise, there is no different number of worm eggs both of young and old sheep feces ($P > 0.05$), that is an average of 42.93 eggs g$^{-1}$ of feces. The results of other studies also reported the same thing that the age of the livestock did not affect the amount of livestock infection against parasites [19]. This indicates that both young and old livestock are susceptible to parasite infection. The same result also occurred in the observation of the number of worm eggs in sheep with different body weight. The same number of worm eggs ($P > 0.05$) was found in sheep with different body weights, namely 42.29 eggs g$^{-1}$ of feces. The body weight of the livestock will be related to the body score condition, if the body weight is high, the body score condition of the livestock will be high and vice versa. Sheep with poor body score condition are proven to be more susceptible to parasite attacks [20]. Sheep with lower body weight experience a higher attack of parasite infection which is probably caused by the immune system that forms immunity against parasites not working properly [21]. These different results indicate that sheep with high body weight are also susceptible to parasite infection as well as sheep with low body weight.

4. Conclusions
In all study locations in Batubara, Labuhan Batu Utara, Asahan, Serdang Bedagai and Deli Serdang districts, *Haemonchus contortus* eggs were found in sheep feces so that it can be concluded that the gastrointestinal helminth parasite infected sheep in those areas. The management system, sex, age and body weight of the sheep did not affect the infection in them.
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