Efficacy of anthelmintic towards gastrointestinal nematode infection in thin-tailed sheep at smallholder farms in Sukomulyo Village, Malang Regency

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Abstract. Intensive anthelmintic administration was estimated to cause drug resistancy. Research was conducted to determine the efficacy of albendazole and levamisole anthelmintic in thin-tailed sheep infected with gastrointestinal nematode at smallholder farms in Sukomulyo Village, Malang Regency. A total of 65 sheeps naturally infected with nematode worms were administered albendazole (35 tails) and levamisole (30 tails). Observation of egg per grams (EPG) was conducted using modified McMaster method. To determine treatments’ efficacy, EPG was conducted before and 2 weeks after treatments’ administration. The results showed that in farms that routinely given albendazole, mean treatment efficacy was 83.73% meanwhile in farms that were never receive albendazole was 92.23%. There were no farms that ever receive levamisole before. Mean treatment’s efficacy for levamisole was 95.84%. In conclusion, albendazole and levamisole still effective as anthelmintic towards gastrointestinal nematode infection in thin-tailed sheep. However, the possibility of drug resistance needs to be carefully observed, especially for albendazole.

1. Introduction
According to the Directorate of Animal Husbandry and Animal Health of Indonesia (Direktorat Peternakan dan Kesehatan Hewan), in 2017 the population of sheeps reached 16,462,274 tails. This number is increasing by 10 percent compared with sheep population data in 2013, which was only around 14.92 millions. East Java Province is the third province in Indonesia with the highest sheep population, reaching 1,394,183 in 2017 [1]. One of the area in East Java that populated with sheep is Malang Regency. According to the Malang Regency Central Bureau of Statistics (Badan Pusat Statistik Kabupaten Malang), sheep populations in the Malang Regency area reached 33,284 in 2018 [2].

Most of the type of sheep farming in Pujon Subdistrict, Malang Regency is a smallholder farm with an average population of 5 (five) sheeps for each farmers. Sheep farming is usually a side job besides being vegetables farmers, employee or trader. Since sheep farming activity was not the only job they have, health problems of the sheeps usually abandoned, including worm disease. Generally sheep farmers in this area do not understand about worm medicine (anthelmintic). Only a few farmers have routinely given anthelmintic. This research was conducted to find out the efficacy of anthelmintic administration in livestock that have been given anthelmintic compared those that never receive ones.
2. Materials and methods
A total of 65 sheep naturally infected with nematode worms were administered albendazole (35 tails) and levamisole (30 tails). Observation of egg per grams (EPG) was conducted using modified McMaster method [3]. To determine treatments’ efficacy, EPG was conducted before treatments and 2 weeks after treatments’ administration.

3. Result and discussion
Average temperature of Pujon District, Malang Regency is ranging from 21-29ºC with air humidity around 60-90 percent. Pujon District has a quite high rainfall period with a short period of dry season. This weather supports the life and growth of worm’s eggs and larvae in the environment [4].

Gastrointestinal nematodes are the most frequent type of worms that infect ruminants. Worm infection in thin-tailed sheep can be found on the grass surface contaminated with eggs or infective larvae. Usually, farmers trim the grass in the morning before sunrise. The worm larvae most likely found in the top of wet grass and could be partly cut by the farmer.

Worm infection control can be achieved by improving cage management, selection of resistant livestock, administration of biological agents to kill worm eggs and larvae in grasslands and administration of anthelmintic. However, worm infection control in Indonesia usually restricted to regular administration of anthelmintic.

3.1. Efficacy of Albendazole Towards Gastrointestinal Nematode Infection in Thin-Tailed Sheep at Smallholder Farms in Sukomulyo Village, Pujon District
The efficacy of albendazole drugs in thin-tailed sheep routinely given albendazole presented in table 1. The average efficacy of albendazole reached 83.76 percent. It was hypothesized that the low average efficacy of albendazole (less than 90 percent) was caused by gastrointestinal nematode worms that are resistant to albendazole. Intensive use of anthelmintic in efforts to control worms has led to cases of drug resistance in many countries. Albendazole is a type of anthelmintic which is included in the benzimidazole class.

A number of researchers have reported the occurrence of anthelmintic resistance in livestock, especially sheep. Haryuningtyas, Beriajaya and Gray have reported cases of benzimidazole resistance in sheep and goats in West Java (Dramaga IPB and Ciomas Bogor) and Central Java (Kendal) [5]. Garcia et al (2016), reported that in Columbia, there had been resistance to several anthelmintics in worms that occurred in sheep. This can be seen from the albenzadole efficacy that ranges only between 0-55%; fenbendazol 51,40 - 76,6%; ivermectin 67,30 - 93,1%; levamisole: 0- 78.1%, and moxidectin: 49.2 - 64.1%. These results were the first findings of the presence of multi-resistant anthelmintics in Colombia [6]. Eswaran et al have reported the same case in Tamil Nadu sheep farms, India [7]. The researcher reported the resistance of several worms to the benzimidazole and levamisole anthelmintic. According to Dolinska, cases of Nematode worm resistance against anthelmintics group of benzimidazole and ivermectin have also occurred in Slovakia [8].

The most widely used anthelmintics of ruminants are benzimidazole group, which includes albendazole, since they are easily found and have good efficacy [9]. Many worms that resistant towards benzimidazole anthelmintic have been reported as a result of repeated use of the same type of anthelmintic.

Anthelmintics administration with the same type of anthelmintics can lead to anthelmintics resistance [10, 11, 12]. These events can occur on farms that regularly provide anthelmintics, for example in farms that gives anthelmintics 10 to 15 times a year [13]; or in farms that only provide medicine two or three times a year but last for years.

Mechanism behind drug resistance is simple selection. There are no anthelmintics that can remove 100 (one hundred) percent of worms, a small number of individual worms (which are less sensitive to drugs) will survive, while most others will die and be removed from the livestock. If the selection process occurs repeatedly, resistance genes will accumulate in the worm population so that the effect
of the drug will disappear. This mechanism will be detrimental to farmers since anthelmintics expenses were quite high yet did not managed to overcome worm disease.

Table 1. Efficacy of Albendazol in Thin-Tailed Sheep Routinely Treated with Albendazole

| Farmers Number | Number of Livestock | Initial EPG | Post-Treatment EPG | Efficacy (%) |
|----------------|---------------------|-------------|--------------------|--------------|
| 1              | 6                   | 900         | 200                | 77.78        |
|                |                     | 600         | 0                  | 100          |
|                |                     | 700         | 100                | 85.00        |
|                |                     | 500         | 0                  | 71.00        |
|                |                     | 400         | 0                  | 100          |
|                |                     | 800         | 200                | 75.00        |
|                |                     | 500         | 100                | 80           |
|                |                     | 400         | 0                  | 100          |
| 2              | 5                   | 600         | 100                | 83.33        |
|                |                     | 700         | 200                | 71.42        |
|                |                     | 900         | 200                | 77.78        |
|                |                     |             |                    |              |
| Average of Drug Efficacy | 83.76 |

Table 2. Efficacy of Albendazol in Thin-Tailed Sheep Never Been Treated with Albendazole

| Farmers Number | Number of Livestock | Initial EPG | Post-Treatment EPG | Efficacy (%) |
|----------------|---------------------|-------------|--------------------|--------------|
| 3              | 10                  | 600         | 0                  | 100          |
|                |                     | 600         | 100                | 83.33        |
|                |                     | 500         | 0                  | 100          |
|                |                     | 400         | 0                  | 100          |
|                |                     | 700         | 200                | 71.42        |
|                |                     | 900         | 100                | 88.89        |
|                |                     | 400         | 0                  | 100          |
|                |                     | 500         | 0                  | 100          |
|                |                     | 500         | 100                | 80           |
|                |                     | 400         | 0                  | 100          |
|                |                     | 600         | 100                | 83.33        |
|                |                     | 400         | 0                  | 100          |
|                |                     | 800         | 0                  | 100          |
| 4              | 7                   | 600         | 0                  | 100          |
|                |                     | 700         | 100                | 85.71        |
|                |                     | 700         | 200                | 71.42        |
|                |                     | 400         | 0                  | 100          |
|                |                     | 600         | 0                  | 100          |
|                |                     | 400         | 0                  | 100          |
|                |                     | 400         | 100                | 75           |
|                |                     | 400         | 0                  | 100          |
| 5              | 9                   | 800         | 100                | 87.5         |
|                |                     | 500         | 0                  | 100          |
|                |                     | 600         | 0                  | 100          |
|                |                     | 700         | 200                | 71.42        |
|                |                     | 600         | 0                  | 100          |
| Average of Drug Efficacy | 92.23 |
In contrast to the group that routinely treated with Albendazole, table 2 presented data of the efficacy of Albendazole in group that has not been treated with the Albendazole before. The average drug efficacy reached 92.23 percent. So that, Albendazole is still recommended in treating gastrointestinal nematode worms in groups that have never been treated with the drug.

3.2. Efficacy of Albendazole Towards Gastrointestinal Nematode Infection in Thin-Tailed Sheep at Smallholder Farms in Sukomulyo Village, Pujon District

Table 3 showed that in thin-tailed sheep that have never been treated with Levamisole, the efficacy of the anthelmintics in reducing the number of gastrointestinal nematodes is high. The average drug efficacy reaches 95.84%. There were 22 out of 30 sheeps (73.33%) whose efficacy reaches 100%. On the other hand, in 2 out of 30 cattle (6.67%), the efficacy of Levamisole only reached 80% while all of the sheep had never been given Levamisole. The most likely hypothesis are that the sheep are genetically resistant to anthelmintic.

| Farmers Number | Number of Livestock | Initial EPG | Post-Treatment EPG | Efficacy (%) |
|----------------|---------------------|-------------|--------------------|--------------|
| 6              | 10                  | 700         | 100                | 85.7         |
|                |                     | 700         | 100                | 85.7         |
|                |                     | 600         | 0                  | 100          |
|                |                     | 400         | 0                  | 100          |
|                |                     | 500         | 0                  | 100          |
|                |                     | 700         | 0                  | 100          |
|                |                     | 500         | 0                  | 100          |
|                |                     | 600         | 0                  | 100          |
|                |                     | 800         | 100                | 87.5         |
|                |                     | 400         | 0                  | 100          |
| 7              | 6                   | 500         | 0                  | 100          |
|                |                     | 500         | 100                | 80           |
|                |                     | 300         | 0                  | 100          |
|                |                     | 700         | 100                | 85.7         |
|                |                     | 500         | 0                  | 100          |
|                |                     | 500         | 0                  | 100          |
| 8              | 5                   | 600         | 0                  | 100          |
|                |                     | 400         | 0                  | 100          |
|                |                     | 700         | 100                | 85.7         |
|                |                     | 500         | 0                  | 100          |
|                |                     | 500         | 0                  | 100          |
| 9              | 5                   | 600         | 0                  | 100          |
|                |                     | 500         | 0                  | 100          |
|                |                     | 600         | 0                  | 100          |
|                |                     | 700         | 100                | 85           |
|                |                     | 600         | 0                  | 100          |
| 10             | 4                   | 500         | 100                | 80           |
|                |                     | 400         | 0                  | 100          |
|                |                     | 700         | 0                  | 100          |
|                |                     | 700         | 0                  | 100          |

Average of Drug Efficacy: 95.84

One of the efforts to increase livestock immunity against worm infections is to improve genetics or develop livestock that are genetically immune to certain worms. There is evidence that part of the variation in resistance to worm infections is under genetic control [13]. Resistance is most likely based
on inheritance of genes that play a major role in host immune expression. Some breeds of sheep throughout the world are known to be relatively resistant to infection. Livestock that are sensitive to worms among immune animals must be destroyed to maintain a more resilient livestock population toward worms infection.

Generally, worm parasites rarely cause death directly but are very detrimental to farmers. Gastrointestinal nematodes cause a decrease in body weight in adult livestock and cause growth inhibition in young livestock. These parasites can also cause livestock to experience emaciation, anemia, affect bone length and reduce cattle immunity to other diseases such as viral and bacterial diseases. According to Horning et al, livestock that are experiencing severe worm infections cannot provide a good immune response to vaccination and causing vaccination failure [14].

4. Conclusion
In conclusion, albendazole and levamisole still effective as anthelmintic towards gastrointestinal nematode infection in thin-tailed sheep. However, the possibility of drug resistance needs to be carefully observed, especially for albendazole.

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