

## Potential Zoonotic Gastrointestinal Nematode Infection from Goat in Sumedang

### *Potensi Zoonosis Infeksi Parasit Nematoda Gastrointestinal Pada Kambing di Sumedang*

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#### ABSTRACT

Potential of zoonotic gastrointestinal nematode infection from livestock in Indonesia is still often overlooked. Farms with a risk for nematodes infection would create a risk of infecting the local community with zoonotic gastrointestinal nematodes. This study aimed to assess the risk of gastrointestinal nematodes from goats that have zoonotic potential in Cibeureum Wetan, Sumedang, and to identify the incidence of nematodes infection among goats. This was a cross-sectional study conducted in August to November 2019 with a total of 52 samples of feces collected directly from goat's rectum to prevent soil contamination. Sampling was performed randomly from goats raised at the Agriculture and Self-Sustaining Village Training Center (*Pusat Pelatihan Pertanian dan Pedesaan Swadaya*, P4S) Simpay Tampomas, Sumedang, Indonesia. The GPS point of the sampling location was recorded. Samples were then examined using the concentration sedimentation method at the Parasitology Laboratory, Faculty of Medicine, Universitas Padjadjaran. Results showed that 22 of 52 samples were positive for gastrointestinal helminth eggs, contained of *Bunostomum* sp., *Strongyloides* sp., *Haemonchus* sp., *Trichostrongylus* sp., *Toxocara* sp. and *Trichuris* sp. The nematode parasites found are parasites that often infect goats.

**Keywords:** gastrointestinal nematoda, zoonosis, goat

#### ABSTRAK

*Potensi zoonosis infeksi nematoda gastrointestinal dari peternakan di Indonesia masih sering terabaikan. Peternakan yang memiliki risiko infeksi, berpeluang menginfeksi penduduk setempat. Penelitian ini bertujuan untuk mengetahui risiko parasit nematoda gastrointestinal dari kambing yang memiliki potensi zoonosis di Cibeureum Wetan, Sumedang dengan melihat kejadian infeksi pada kambing. Penelitian dilaksanakan pada Agustus-November 2019 dengan desain studi potong lintang. Sebanyak 52 sampel feses diambil langsung dari rectum sehingga tidak terkontaminasi oleh tanah. Sampel diambil dari Pusat Pelatihan Pertanian dan Pedesaan Swadaya (P4S) Simpay Tampomas dengan metode random sampling. Pencatatan titik GPS dilakukan pada lokasi pengambilan sampel. Pemeriksaan sampel menggunakan metode sedimentasi konsentrasi yang dilakukan di Laboratorium Parasitologi, Fakultas Kedokteran, Universitas Padjadjaran. Hasil penelitian menunjukkan bahwa sebanyak 22 sampel dari 52 sampel feses kambing positif telur cacing gastrointestinal, yang terdiri dari *Bunostomum* sp., *Strongyloides* sp., *Haemonchus* sp., *Trichostrongylus* sp., *Toxocara* sp., dan *Trichuris* sp. Parasit nematoda yang ditemukan merupakan parasit yang sering menginfeksi kambing.*

**Kata kunci:** nematoda gastrointestinal, zoonosis, kambing

## INTRODUCTION

Gastrointestinal (GI) nematode infections are major health challenge affecting all sector in life.<sup>1</sup> Zoonotic potential of gastrointestinal nematode infection from livestock in Indonesia is still often overlooked. farms that are at-risk for nematodes infection create a risk of infecting the local community with zoonotic gastrointestinal nematodes. Numerous species of nematodes have evolved to inhabit the gastrointestinal tract of animals.<sup>2</sup> *Bunostomum* sp., *Strongyloides* sp., *Trichuris* sp., *Trichostrongylus* sp., *Haemonchus* sp., *Oesophagostomum* sp., *Moniezia* sp., *Paramphistomum* sp., and *Toxocara* sp. are the species that often found.<sup>3</sup>

A study by Rahman in Tangail, Bangladesh, revealed the percentage of nematodes infection in goats 52.11% from 426 goats and sheep samples. Their findings showed 31.22% *Haemonchus* sp., 1.17% *Trichuris* sp., 4.93% *Strongyloides* sp., and 14.79% others nematodes.<sup>4</sup> Another study by Rupa in Baybay City, Leyte, Philippines, revealed the percentage of infection 96,22% from 450 goats samples. Their findings showed 34.79% *Haemonchus* sp., 33.29% *Trichostrongylus* sp., 24.21% *Oesophagostomum* sp., and 7.72% others nematodes.<sup>5</sup> Another study by Yan in Ili Kazakh Autonomous Prefecture, China, revealed the dominant nematode infection species in sheep included 90.06% *Haemonchus* sp., 68.53% *Trichostrongylus* sp., and 48.86% *Ostertagia* sp.<sup>6</sup>

Many factors that could also affect the risk of zoonosis are tropical climate, indiscriminate and open defecation, lack of strategic deworming of a farm, and inadequate medical and veterinary care.<sup>7</sup> A study conducted by Baihaqi in Central Java demonstrated that 14.18% of Wonosobo goats and 10.82% of thin-tailed goats were tested positive for *Trichuris* sp.<sup>8</sup>

Indonesia has a big farming industry. This industry includes some big farms with veterinary services. However, most of them are small-scale farms and many of them are

managed by local cooperatives.<sup>9</sup> Sumedang is one of the areas of potential farms based on local support in West Java.<sup>10</sup> One of the farms is Agriculture and Self-Sustaining Village Training Center (*Pusat Pelatihan Pertanian dan Pedesaan Swadaya*, P4S) Simpay Tampomas, Sumedang, Indonesia in Cimalaka subdistrict. They make organic fertilizers from waste products. The composting process is long and slow process. Bio-activators are usually added to speed up and improve the composting process. Goat's feces is mixed with other ingredients then added with a bio activator. After a certain time, fertilizer is ready to use.<sup>11</sup> Nematodes can still survive in fertilizer. Fertilizing vegetables using feces is one of the main factors causing vegetables to be susceptible to contamination by nematodes eggs. Vegetables that are easily contaminated is cabbage because the position of cabbage is close to the ground and people often consume it raw. Nematodes could infect whoever using that fertilizer and eating plants produced with the help of fertilizer.<sup>12</sup>

Zoonotic diseases are approached using one health concept where the health and diseases in humans are impacted and impacting animals and the environment. Studies on the animal aspect of the disease may improve the health of human beings by informing policies made by the government to control infection.<sup>13</sup> However, there are not many studies performed on zoonotic nematodes infection in animals and no specific community deworming outreach activities are performed by the local Health Office in farm areas. More importantly, there have been not been any epidemiological studies on nematodes infections on animals and humans in the same area. There are no available data on gastrointestinal nematodes infection in goats in that area and also in West Java, Indonesia. These data are important because they can help the Health Office and the Animal Husbandry Office in creating policies to prevent helminthic diseases.<sup>14</sup> The government through the Animal Husbandry Office also requires goat farms to give

anthelmintic to goats three times each year and the goat farms are also supervised by the office.<sup>15</sup> This study aimed to assess the zoonosis risk of gastrointestinal nematodes from goats in Cibereum Wetan, Sumedang, and the incidence of nematodes infection in goats.

## METHODS

This was a cross-sectional study conducted in P4S Simpay Tampomas located in Cibereum Wetan village, Cimalaka Subdistrict, Sumedang District, West Java Province, Indonesia from August to November 2019. P4S Simpay Tampomas is a cooperative farm with 18 sheds and a total of 163 goats.

Two-thirds of the goats in this farm are used for milking while one-third are butchered for their meat. Another product from the farm is fertilizers, which is produced from goat feces. These fertilizers are routinely sold to the locals. There are two known plantations in the area and the farm itself also has its own plantation. Thirty percent of the fertilizers produced from goat feces is used for the dragon fruits in this plantation.

This farm is an intensive farm with no daily grazing. Most of the goats are placed in a shed with separate compartment for each goat. However, some of the goats are not put in the shed. The sheds have a high platform and the feces drops through this platform onto the floor, preventing it from accumulating on the ground.<sup>16</sup>

The management of the farm is responsible for various duties. This farm is also a breeder so the sold young goats to other farms. They feed the goats with a herbal plant, i.e. '*rimpang temulawak*' (*Curcuma zanthorrhiza* L.) for deworming to replace anthelmintic three times every year.

The sample size was determined using a formula for descriptive studies with qualitative variables:

$$\text{Sample size} = \frac{Z_{1-\frac{\alpha}{2}}^2 p(1-p)}{d^2}$$

For the calculation, a Z-score (Z) of 1.64,  $\alpha$  of 0.1, and Confidence Interval (CI) of 90%, absolute precision ( $d^2$ ) of 0.1 and proportion (p) from a previous study of 73.8% were used.<sup>17</sup> This calculation resulted in a minimum sample size of 52.

Samples in this study were collected randomly from the goats. Feces were collected directly from the rectum to prevent soil contamination. The feces was then kept in a small plastic cup and 2-5 ml of 10% formalin solution was added.<sup>18,19</sup> Global Positioning System (GPS) location of the sheds were recorded for epidemiological data in this study.

The identification of helminth infection was performed using the concentration sedimentation method at the Parasitology Laboratory of the Faculty of Medicine, Universitas Padjadjaran. The concentration sedimentation method aims to separate the eggs from large debris present in fecal microscopy examination by making helminth eggs sediment form at the base of the tube after centrifugation. This procedure is more suitable for microscopic examination of goats' feces due to its lower amount compared to humans, with only 4-6 grams of feces. This procedure is also effective for identifying nematodes eggs.<sup>20</sup> The sedimentation of the eggs is due to the use of a formol-ether solution that has low specific gravity. In the present study, each sample was dissolved in 7 ml formalin 10% solution and 3 ml of ethyl acetate. The sample was spun in a centrifuge at 3000 rpm for 3 minutes until the eggs were sedimented in the bottom as a supernatant. A drop of supernatant was placed on a glass slide, covered with cover glass, and then examined under the microscope to determine whether it was positive for nematodes infection.<sup>20,21</sup>

A sample was classified as a positive sample for nematodes infection if eggs, adult helminth, or larvae were identified upon microscopic examination. To prevent bias, each sample was examined by three examiners. The eggs identified qualitatively in

this study were the eggs of nematodes. Identification of eggs was done based on the Bench Aids for the Diagnosis of Intestinal Parasites from World Health Organization.<sup>22</sup> Results of nematodes infection identification were then processed using the Microsoft Office 365 Excel. The incidence of each shed was distributed on a map using the ArcGIS. This study has been approved by the Research Ethics Committee of Universitas Padjadjaran under ethical clearance number: 1086/UN6.KEP/EC/2019.

**RESULTS**

The results from 52 samples obtained from 8 sheds in this study presented 30

negative samples (57.69%), and 22 positive samples (42.31%) for nematode. In Table 1, of the 22 positive samples, three samples were positive for *Bunostomum* sp. (5.77%), five samples were positive for *Strongyloides* sp. (9.62%), six samples were positive for *Trichuris* sp. (11.54%), four samples were positive for *Trichostrongylus* sp. (7.69%), two samples were positive for *Haemonchus* sp. (3.85%), one sample was positive for *Toxocara* sp. (1.92%), and the rest was one sample mixed-nematode infection (*Haemonchus* sp. and *Trichostrongylus* sp.) (1.92%), All positive samples contained the egg form without adult worms.

Table 1. Incidence of Gastrointestinal Nematodes (Qualitative) in Goats by Shed in P4S Simpay Tampomas

	Frequency (n)	Percentage (%)
Negative	30	57.69
<i>Bunostomum</i> sp.	3	5.77
<i>Strongyloides</i> sp.	5	9.62
<i>Trichuris</i> sp.	6	11.54
<i>Trichostrongylus</i> sp.	4	7.69
<i>Haemonchus</i> sp.	2	3.85
<i>Toxocara</i> sp.	1	1.92
Mixed-nematode Infection	1	1.92
Total	52	100

\*All positive samples were found with eggs, without presence of worms



Figure 1. Distribution of Helminth Infection in Goats by Shed in P4S Simpay Tampomas

Figure 1 shows the distribution of 52 samples from the 8 Sheds studied. Samples with positive results were scattered in almost all Sheds, except for Shed 2 which showed all samples (8 samples) with negative results. Shed 8 was the shed with the highest number of samples with 4 of 11 positive samples (1 *Bunostomum* sp., 1 *Strongyloides* sp., 1 *Trichuris* sp., and 1 *Trichostrongylus* sp.). Shed 7 showed 5 of 5 positive samples (1 *Bunostomum* sp., 1 *Strongyloides* sp., 1 *Trichostrongylus* sp., 1 *Haemonchus* sp., and 1 Mixed nematode infection). Shed 4 showed 5 of 7 positive samples (1 *Bunostomum* sp., 1 *Strongyloides* sp., 2 *Trichuris* sp., and 1 *Trichostrongylus* sp.). Shed 5 showed 4 of 8 positive samples (3 *Trichuris* sp., and 1 *Trichostrongylus* sp.). Shed 6 showed 2 of 4 positive samples (1 *Strongyloides* sp., and 1 *Haemonchus* sp.). Shed 1 showed 1 of 2 positive samples (*Toxocara* sp.). Shed 3 showed 1 of 7 positive samples (*Strongyloides* sp.).

## DISCUSSION

Gastrointestinal nematode infections found in goats in this study were *Bunostomum* sp., *Strongyloides* sp., *Trichuris* sp., *Trichostrongylus* sp., *Haemonchus* sp., and *Toxocara* sp. These nematodes are parasites that are often found infecting small ruminants such as goats and sheep and causes diarrhea and malnutrition especially in young animals.<sup>23,24</sup> In this study, the most common nematode egg infection was *Trichuris* sp. (15.38%). While the least is *Toxocara* sp. (1.93%). The Strongylida group is the main nematode that often infects the gastrointestinal tract in goats.<sup>24-26</sup>

The percentage of positive helminth infections in this study was 57.69%, which is much lower than the prevalence in the previous study Nwoke in Ankpa, Nigeria of 73.8%. This difference may stem from the fact that the goats included in their study is under semi-intensive management with daily grazing that may add to the percentage of positive helminth infections present in goat feces.

Daily grazing increases the risk for fecal-oral transmission.<sup>17</sup> The farm in this present study is under intensive management with no daily grazing.<sup>16</sup> This could contribute to the lower percentage of helminth infection.

*Trichuris* sp. Infections was identified in 11.54% of the samples, while a study by Futagbi in a slaughterhouse in Accra, Ghana found an of positive *Trichuris* sp. results in 68.6%, of the samples respectively. This might be due to poor sanitation conditions in the study site.<sup>27</sup> There was no judgment on hygiene conditions in the present study. When compared with past reports, we found Ghana's condition of hygiene is worse than that of Sumedang, where 8% of rural households in Ghana had hygiene facilities,<sup>28</sup> compared to 71.7% in Cimalaka subdistrict. Better hygiene might reduce the transmission of nematodes infection and contribute to the lower incidence in this study.

Hookworm infections in the present study was *Bunostomum* sp. found in 5.77% of the samples. *Bunostomum phlebotomum* is a parasite that is often found in cattle, and sometimes in sheep or goats where it can be a agent of cutaneous larvae migrans in humans.<sup>28</sup> The occurrence of hookworms in goat was study by Futagbi found positive hookworm infections in 20% of their samples. This is much lower than the percentage of other worm infections in their study. However, their study concluded that their method, which was the Kato-Katz technique, was ineffective for identifying hookworm that the result was an underestimate.<sup>27</sup> In contrast, the present study was used the sedimentation concentration method that has been proven to be effective in detecting hookworm eggs;<sup>20</sup> hence, percentages of hookworm infection in this present study are considered quite accurate.

This study demonstrated 57.69% positive helminth infections in the samples, which is much lower than the finding from Choubisa in southern Rajasthan, India, where 82.97% of the goats had helminth infections. They contributed their findings to the rainy

season, as this season provides the humidity necessary for eggs to become mature and infective.<sup>29</sup> This present study was conducted in August 2019 and it was the dry season where the humidity was lower that slowed down the maturation of the eggs into their infective form. This could contribute to the fewer positive findings in this present study.

In a previous study by Bifaw in Wolaita, Ethiopia, 78 out of 159 (49.1%) goats were positive for nematodes infection, consisting of *Trichuris* sp. (2.5%) and *Ascaris* sp. (1.26%). Also, 59.4% of their samples were positive for the *Strongyle* type. They compared their results with other studies and found that Wolaita has fewer nematodes infections than other areas in Ethiopia due to the extensive use of anthelmintics by farmers. This present study even presented a lower helminth infection rate than that of Bifaw *et al.*,<sup>30</sup> with 46.15% of infection rate. This result might be influenced by the use of herbal anthelmintic by the farmers in this study.

The farm under study used a herbal medicine called '*rim pang temulawak*' (*Curcuma zanthorrhiza* L) three times a year as anthelmintic for preventive measure. Several previous studies have discovered significant evidence regarding the anthelmintic effect of *rim pang temulawak* in sheeps,<sup>31</sup> with no significant difference in the effectiveness when compared to mebendazole in eliminating nematode eggs.<sup>32</sup> The administration of this herbal anthelmintic could contribute to a lower percentage of nematode eggs in the present study. Despite these findings, mebendazole and albendazole are still recommended as anthelmintic and could contribute more to lower the infections. As a herbal medicine, '*rim pang temulawak*' is not the recommended anthelmintic advised by the law and in the latest research.<sup>14,15</sup>

Lack of strategy for deworming and veterinary care in this farm might contribute to the presence of helminth infections.<sup>7</sup> There had been no community deworming outreach activities implemented by the Local Health Office. This farm is under the supervision of

the Animal Husbandry and Fishery Office of Sumedang district. Any illness suffered by the goats that could pose zoonotic risk was managed internally with herbal medicines without proper veterinary management.

The distributions of infections were mapped, showing that there are areas without any infection even though they are located near infected areas, making transmission possible. In a study by O'Connell, it was reported that molecular diagnosis has better sensitivity than microscopic examination to assess infection; thus, the result of this study could be improved with the use of molecular diagnostics with better sensitivity for nematodes infections.<sup>33</sup>

There are some limitations encountered in this study. The population of goats in this study is not adequate for meeting the minimum sample size if the CI is 95%. Hence, a CI was set at 90% for the study to be feasible. There were 10 sheds unavailable due to absence of breeder members at the time of the study. Only 8 sheds were available for sample collection. During sample collection, there were difficulties in obtaining feces from the rectum, both because the shed was inaccessible physically or the goats were not producing any feces. Therefore, some samples were obtained from the floor of the shed with the following conditions: the floor was not soiled and the feces was still wet. The identification using direct microscopy also produces a limitation in identifying the exact nature of the species of nematodes, whether it is zoonotic from goats or not.

No inspection was carried out concurrently on humans in surrounding areas, such as the farmers, who carry the most risk to be infected. This makes the correlation between the gastrointestinal nematodes infection in goats and in humans cannot be established. Thus, the impact of gastrointestinal nematodes in goats on the surrounding community, as well as the transmission from goats to people living in surrounding areas cannot be assessed. This creates the need for conducting further studies

to be able to explain and prove the extent of the risk of gastrointestinal nematodes infection between goats and humans.

## CONCLUSION

Nematodes eggs contamination is identified in 57.69% of the goat feces, which can pose a risk of infection among farmworkers, local people, and consumers when the feces is used for fertilizer.

## RECOMMENDATIONS

It is expected that this study could be used as preliminary data for other studies on the topic of infections in farms, local communities, and consumers. To prevent zoonotic helminthiasis, it is suggested that farmworkers should use personal protective equipment (PPE) and always maintain personal hygiene. People who live in the surrounding areas of the farm should also maintain their personal hygiene. Since no community deworming outreach activity yet from the local Health Office, it is suggested that the local government considers doing this activity to prevent helminth infection in the area.

## AUTHORS' CONTRIBUTIONS

HFA planned the study, collected samples, worked in the laboratory, analyzed data, and wrote the article. NF planned and arranged sample collection. NFN wrote the article. LF planned and wrote the article. IK identified the samples and wrote the article. MEH collected samples and reviewed the articles. All authors read the article and finalized it.

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