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Relationship of Gastrointestinal Nematode Infections to the Productivity of Young Lamb in Traditional Farming System

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Abstract

Helminthiasis is a parasitic disease that causes economic losses in sheep farming by reducing productivity and increasing mortality, particularly in young lambs. Infected lambs are often asymptomatic, making detection challenging. This study aimed to analyze the correlation between gastrointestinal worm infections and the productivity of young lambs, measured by daily weight gain (DWG), chest circumference, and abdominal circumference. The study was conducted over six weeks using 14 lambs aged less than one year (I0), with seven lambs in Cibanteng Village and seven in Cikarawang Village. The McMaster method was used to determine the total egg count per gram of feces (EPG), while statistical analysis was performed using a t-test and Pearson correlation coefficient (r). The results showed a significant difference ($P < 0.05$) in parasitic infection levels between Cibanteng and Cikarawang Villages, with a higher average EPG in Cibanteng. Pearson correlation analysis indicated a significant negative correlation ($P < 0.05$) between EPG and DWG in Cibanteng Village, with a correlation coefficient of -0.343, suggesting that an increase in EPG is associated with a decrease in DWG, albeit with a weak correlation strength.

Keywords: helminthiasis, young sheep, productivity, parasitic infection, egg per gram (epg)

Introduction

Parasitic infections, particularly helminthiasis, represent a critical challenge to livestock productivity, particularly in small-scale farming systems, prevalent in developing countries such as Indonesia. According to the Ministry of Agriculture (2023), mortality rates in young livestock are predominantly attributed to infectious diseases rather than accidents or other external factors. Among these diseases, gastrointestinal parasitic infections rank as the second leading cause of mortality, following those occurring during birth and weaning. These infections, especially in young animals, not only result in death but also significantly impair growth, decrease feed conversion efficiency, and reduce overall productivity, thereby causing substantial economic losses to farmers (Nurdayanti et al., 2021).

In Indonesia, the challenge of controlling parasitic infections in livestock is further compounded by the widespread use of traditional farming practices, particularly in small-scale sheep farming. Practices such as continuous grazing, morning grazing, and feeding pasture contaminated with untreated manure significantly increase the risk of parasite exposure in sheep. These conditions foster an environment conducive to parasite proliferation, exacerbating infection risk and subsequent health issues. According to Susilo et al. (2020), Nematodosis, a disease caused by nematode parasites, is the most prevalent type of helminthiasis in sheep, with a reported prevalence of 56.25%. Nematode species such as *Haemonchus contortus* are notorious for causing anaemia, weight loss, and stunted growth in infected sheep (Hassan et al., 2011).

The impact of parasitic infections on livestock productivity is profound, as they directly affect key growth parameters such as daily weight gain, chest circumference, and abdominal circumference. These metrics are vital indicators of livestock health and are commonly employed to assess the overall productivity of sheep (Nurdin et al., 2023). The mechanisms through which parasitic infections impede productivity are well-documented. Parasites impair the digestive process by damaging the gastrointestinal tract, thereby hindering the absorption of nutrients and reducing feed conversion efficiency. As a result, infected animals exhibit slower growth rates and may experience a reduction in the quality of meat and milk production. This issue is particularly critical in small-scale sheep farming, where the economic sustainability of farms depends heavily on maximizing livestock productivity.

The primary objective of this study is to assess the relationship between helminthiasis and the productivity of young sheep in the villages of Cibanteng and Cikarawang, West Java, Indonesia. This relationship will be evaluated using key indicators of sheep productivity, including changes in daily weight gain, chest circumference, and abdominal circumference. These parameters are essential for understanding the physiological impact of parasitic infections on sheep health and productivity. Furthermore, this study aims to investigate the environmental and managerial factors that may influence parasite infection levels in these regions. Studies have shown that environmental conditions, such as rainfall and temperature, significantly affect the transmission dynamics of parasitic larvae, which impacts the likelihood of infection in livestock (Pertiwi et al., 2023).

To quantify parasitic infection levels, this study will employ the McMaster method to determine the number of worm eggs per gram of faeces (EPG). The McMaster method is a well-established and reliable technique for assessing the degree of parasitic infection and identifying the species of parasites present in livestock (Tariq et al., 2008). In conjunction with productivity measurements, this method will provide valuable insights into the impact of parasitic infections on sheep performance. It is anticipated that the findings of this research will offer important recommendations for improving parasite management practices and enhancing productivity in small-scale sheep farming in Indonesia.

Moreover, this study will examine the predominant parasitic species affecting sheep in these villages. Nematodes, particularly those from the *Strongylidae* family, such as *Haemonchus* and *Trichostrongylus*, are the most common parasites affecting small ruminants. These parasites are responsible for significant reductions in growth and productivity due to their direct feeding on host tissue, leading to anaemia and malnutrition (Hamid et al., 2023). Understanding the parasitic species involved in these infections will allow for more targeted and effective interventions.

In addition to the biological factors, this study will explore how managerial practices, such as grazing management and feed quality, influence parasite infection levels. Previous studies have shown that optimal grazing times and improved feed management can reduce the likelihood of parasitic infections in livestock (Winarso et al., 2015). By considering biological and managerial factors, this research aims to comprehensively understand the factors contributing to parasitic infections in sheep and their effects on productivity.

Methodology

This study was conducted in Cibanteng and Cikarawang Village, West Java, Indonesia. Stool examination was carried out in Helminthology laboratory, School of Veterinary Medicine and Biomedic, IPB University.

Experimental Research

Livestock data was collected from UPT Peternakan Ciampea dan Dramaga. A field study was conducted in Farm I0 (less than 1 year). Primary data were taken directly, i.e., weight gain, increase in daily weight gain, chest circumference, and abdominal circumference. Sheep faecal samples were collected directly from the rectum, placed in labelled plastic bags and stored in a cool box with ice. The samples were then transported to the laboratory and kept in a refrigerator until analysis was completed. The McMaster method determined the number of eggs per gram (TTGT) of faeces.

Data Collection

Sheep Performance Measurement

Body weight (kg) was measured once weekly in the morning before feeding using a 100 kg capacity hanging scale while ensuring the animal remained calm. Abdominal circumference (cm) was recorded using a measuring tape around the mid-abdomen. In contrast, chest circumference (cm) was measured by positioning the tape around the thoracic cavity, just behind the scapula. Daily weight gain (g/day) was calculated as the difference between final and initial body weight divided by seven days.

Determination of The Number of Eggs per Gram (TTGT)

Two grams of faeces samples were weighed and mixed with 58 ml of saturated salt or sugar solution. The mixture solution was filtered with a sieve, and then the filtrate was collected and transferred to another glass while stirring to ensure homogeneity. A filtrate sample was taken with a pipette and transferred to McMaster Slide. This preparation was allowed to stand for five minutes before counting. A number of was counted for each counting chambered r, and sums from two counting careers were multiplied by 100 to obtain the total number of eggs per gram (EPG).

The Number of Eggs per Gram (EPG) Formula:

$$\text{EPG} = \frac{n}{bt} x \frac{Vtotal}{Vhitung}$$

Keterangan:

n	: sums of eggs
bt	: feces weight (gram)
Vtotal	: Total volume of flotation solution
Vhitung	: Volume of mixture inserted to counting chamber (mL) (0,3 mL)

Data Analysis

The obtained data on the number of helminth eggs were then analyzed using a T-test to determine the difference in the number of helminth eggs per gram of feces (EPG) between Cibanteng and Cikarawang villages. The mathematical model according to Walpole (1995) was as follows:

$$t = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\frac{{S_1}^2}{n_1}} + \sqrt{\frac{{S_2}^2}{n_2}}}$$

Results and Discussion

Type of Egg Worms

There were two types of nematode eggs identified from the EPG examination namely strongyloid and trichurid. Therefore, it can be analysed that sheep in both Cibanteng and Cikarawang Village were infected by nematode worms. Picture of two types of nematode eggs were shown in figure 1.

1. *Strongil* 2. *Trichuris sp*

Figure 1. Strongyloid and Trichurid egg

Shatyaayyupranathasari *et al.* (2021) state that strongyloid-type nematodes can infect small and large ruminants, swine, and horses. The common type of strongyloid nematodes in sheep is *Haemonchus sp, Trichostrongylus sp, Oesophagostomum sp, Nematodirus sp, Bunostomum sp, Cooperia sp, Chabertia sp, and Ostertagia sp*. The species of Trichuris that commonly infects sheep is *Trichuris ovis*.

The Number of Egg Per Gram Feces

The number of eggs per gram of faeces (EPG) from Cibanteng and Cikarawang Village is shown in Table 1. EPG values ranged between 214,29 to 2.085,71 eggs/gram. Mean of EPG from Cibanteng Village (1.295,24 ± 576,95 eggs/gram) was significantly higher (p<0,05) than Cikarawang Village (376,19 ± 193,29 eggs/gram). EPG represent the degree of infection which was categorized as low (0-99 eggs/gram), medium (100-499 eggs/gram) and high (>500 eggs/gram) (Nielsen *et al.*, 2010). Cibanteng Village was categorized as having a high infection level, while Cikarawang Village had a medium infection level. Compared to other studies, Mbula (2022) observed that the mean of Bali Cattle EPG in Kupang Regency was 204 eggs gram-1 and 200 eggs gram-1 for male and female cattle, respectively. Zalizar (2017) reported that dairy cow EPG in Malang Regency was 201 eggs/gram.

Table 1. Mean of EPG in Cibanteng and Cikarawang Village

Village	nth-week observation						Mean
	1	2	3	4	5	6	
Cibanteng	757,14	1.000	1.114,29	857,14	2.085,71	1.957,14	1.295,24 ± 576,95a
Cikarawang	214,29	242,86	728,57	257,14	442,86	371,43	376,19 ± 193,29b

a,b means in a column with different mark are significantly different

Mean of EPG from weekly observation was shown in Figure 2.

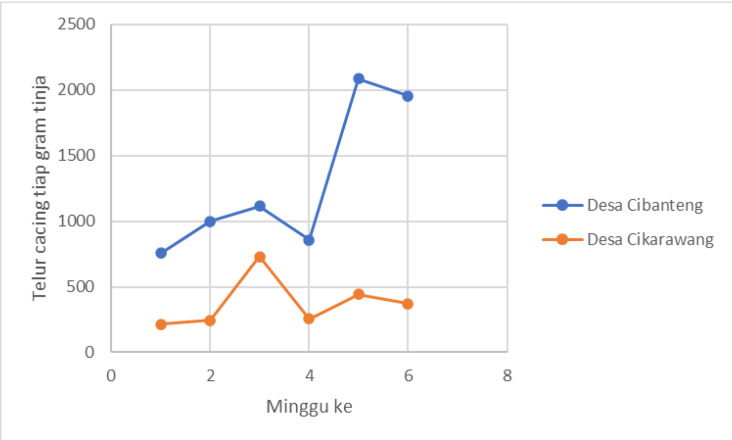

Figure 2. Mean of EPG graph

The significant increase in EPG in Cibanteng Village during the fifth week resulted from relatively high rainfall. Rainwater facilitated the dissemination of infective larvae in livestock forage. Additionally, rainfall affected livestock immunity to diseases such as helminthiasis. Environmental and managerial factors also contributed to the infection level in sheep.

Infection level in the gastrointestinal tract is associated with the quantity of forage contaminated with infective larvae ingested by the sheep. The difference in total EPG between Cibanteng and Cikarang villages were presumed to result from variations in forage harvesting time. Farmers in Cibanteng collected forage in the morning, whereas farmers in Cikarawang collected it at noon. Winarso *et al*. (2015) reported that strongyloid eggs possessed an infection risk 2,20 times less and lower infection degree in female cattle than in male cattle, which was associated with the feeding behaviour, forage source and feeding pattern in different semi-intensive system farming. Hamid *et al*. (2016) supported this, stating that a strongyloid egg could be easily disseminated since no intermediate host was required.

Members of nematodes with strongyloid-type eggs are highly abundant. Nematodes such as Haemonchus sp., Cooperia sp., Trichostrongylus sp., and Ostertagia ostertagi can reduce livestock productivity, leading to economic losses (Muthiadin et al., 2018). Strongyloid infections occurred in an average of 33.33% of livestock (41 out of 123 animals). Their direct life cycle, which does not require an intermediate host, allows these parasites to persist in the environment. After being excreted from the rectum along with faeces, nematode eggs develop into larvae in the environment. Upon reaching the infective larval stage, these larvae attach to forage and can be ingested by livestock. Once hatched in the gastrointestinal tract, the larvae mature into adult worms within the host (Zalizar, 2017).

Tasawar et al. (2007) further stated that grazing behaviour and breed or species differences might influence immunity to nematode infections. Additionally, lowland areas with frequent water flow, which serve as habitats for Fasciola sp., increase the likelihood of parasitic infections. The risk of infection is exacerbated by the common practice of farmers leaving wet forage in the morning without wilting it first.

Sheep Production Performance

The production performance of sheep is crucial for farm development. Performance indicators such as an increase in daily weight, chest circumference, and abdominal circumference can reflect the production level of sheep. Table 2 presents observation results of increased daily weight, chest circumference, and abdominal circumference.

Table 2. Mean Production Performance of Sheep in Cibanteng and Cikarawang Villages

Variable	Desa	nth-week observation						mean
		1	2	3	4	5	6	
Body Weight (kg)	Cb	14,00	13,93	14,36	14,76	15,20	15,43	14,61 ± 0,62B
	Ck	21,00	22,29	22,13	22,59	23,26	23,77	22,50 ± 0,96A
Daily Weight Gain (g/head/day)	Cb	-10,20	61,22	57,14	63,27	32,65	-	40,82 ± 31,05a
	Ck	183,67	-22,45	65,31	95,92	73,47	-	79,18 ± 73,74a
Chest circumference (cm)	Cb	56,26	55,59	56,50	56,86	57,21	57,79	56,70 ± 0,77B
	Ck	68,36	68,00	69,29	69,66	69,74	70,13	69,20 ± 0,84A
Abdominal Circumference (cm)	Cb	68,29	73,30	68,16	68,01	69,21	70,86	69,64 ± 2,08B
	Ck	81,51	82,79	84,29	84,49	84,23	84,30	83,60 ± 1,20A

Note: Numbers with different lowercase letters in the same row indicate no significant difference (P>0.05), while numbers with different uppercase letters in the same row indicate a highly significant difference (P<0.01). Cb = Cibanteng Village and Ck = Cikarawang Village.

Sheep growth was associated with an increase in daily weight gain. The resultset showed that the hat daily weight gain increased in Cibanteng Village (40,82 ± 31,05 g/head/drelativelyativelyy lower than in Cikarawang Village (79,18 ± 73,74 g/head/day). The increase in daily weight gain negatively correlated with EPG, in which Cibanteng Village was higher than Cikarawang. Zalizar (2017) stated that parasitic worms can feed on animal tissues, suck blood or bodily fluids, or absorb nutrients. Additionally, parasitic worms can damage intestinal epithelial cells, reducing the intestine's ability to digest and absorb food and produce enzymes responsible for the digestive process. Furthermore, accumulating many parasites in the intestines or stomachs of livestock can lead to blockage or obstruction, halting the digestion process.

The body size is linearly correlated with livestock body condition. Chest and abdominal circumference were body measurements correlated with increased body weight. Chest circumference inferred the livestock growth rate, increasing height and skeletal size since a positive correlation existed between chest circumference and post-weaning growth rate (Haryanti et al., 2015; Wahyudi et al., 2023). The abdominal circumference has a strong relationship with body weight because approximately 90 per cent of the abdominal and chest contents determine the difference between fat and thin body conditions, affecting body weight (Victori et al., 2016).

Sheep's Chest circumferences in Cibanteng and Cikarawang Village were 56,70 ± 0,77 cm and 69,20 ± 0,84 cm, respectively. They were considered relatively large. At the same time, abdominal circumference in Cibanteng and Cikarawang Village were 69,64 ± 2,08 cm and 83,60 ± 1,20, respectively. Based on the t-test, there were significant differences ($p<0,05$) in chest and abdominal circumference between Cibanteng and Cikarawang villages, in which Cibanteng values were lower than Cikarawang. These findings were by body weight comparison. Body measurement adjusts according to body weight, particularly chest and abdominal circumference (Wahyudi *et al.,* 2023). This is by Victori *et al*. (2016), who wrote that body weight was strongly associated with body morphometrics, especially body length, body height and chest circumference.

The Relationship Between Egg Per Gram (EPG) Count and Daily Weight Gain, Chest Circumference, and Abdominal Circumference

Various internal and external factors can influence sheep productivity. One of the key external factors affecting productivity is the high level of helminthiasis, which can hinder daily weight gain and subsequently impact chest and abdominal circumference. The relationship between EPG count and daily weight gain, chest circumference, and abdominal circumference can be assessed by calculating the correlation coefficient, as presented in Table 3.

The results of the Pearson correlation coefficient (r) and coefficient of determination (r^2) analysis indicate a very weak relationship between EPG count and daily weight gain (DWG) in Cikarawang Village (-0.054; 0.29%). Similarly, a very weak correlation was observed between EPG count and chest circumference in Cikarawang

Village (0.071; 0.50%) and between EPG count and abdominal circumference in Cibanteng Village (-0.121; 1.46%). A weak correlation was found between EPG count and DWG in Cibanteng Village (-0.343; 11.76%) and between EPG count and chest circumference in Cibanteng Village (-0.249; 6.20%).

Table 3. Pearson correlation coefficient (r) and coefficient of determination (r^2) between the number of EPG and daily weight gain and body measurements based on the village.

Peubah	Village	
	Cibanteng	Cikarawang
EPG and Daily Increase of Body Weight	-0,343* (11,76%)	-0,054 (0,29%)
EPG and Chest Circumference	-0,249 (6,20%)	0,071 (0,50%)
EPG and Abdominal Circumference	-0,121 (1,46%)	0,415* (17,22%)

* = significantly correlated

A moderately strong correlation was observed between EPG count and abdominal circumference in Cikarawang Village (0.415; 17.22%), indicating that EPG count influenced 17.22% of the variation in abdominal circumference, while the remaining variation was attributed to other factors. The moderate correlation between EPG count and abdominal circumference in sheep from Cikarawang Village suggests that a lower EPG count is associated with a larger abdominal circumference. This may be due to improved nutrient digestion, which positively impacts DWG. As DWG increases, body weight and morphological measurements, including abdominal circumference, increase.

The hypothesis testing results indicate a significant correlation (P<0.05) between EPG count and daily weight gain (DWG) in Cibanteng Village (-0.343; 11.76%) and between EPG count and abdominal circumference in Cikarawang Village (0.415; 17.22%). Other variables showed non-significant relationships (P>0.05), indicating no meaningful correlation among them.

The negative correlation between EPG count and DWG in Cibanteng Village (-0.343) with a low coefficient of determination (11.76%) suggests that an increase in EPG count leads to a decrease in DWG in sheep. This finding aligns with Pramu et al. (2020), who stated that helminthiasis does not directly cause mortality in sheep but significantly reduces productivity and body weight. Infected livestock experience impaired growth due to decreased feed intake and conversion efficiency. Nutrient absorption can be hindered, reducing feed utilization by 15–20%, resulting in weight loss, weakness, and reduced appetite (Purwaningsih et al., 2017).

The positive correlation between EPG count and abdominal circumference in Cikarawang Village is attributed to the higher DWG in this area. Ashari (2015) explained that linear body measurements serve as indicators of livestock quality, as they correlate directly with DWG. Higher weight gain positively affects the animal's morphological development. Additionally, the low helminth infection level in Cikarawang (376.19 ± 193.29 EPG) may have contributed to this finding. According to Nofyan et al. (2010), helminth infections are classified into three severity levels: mild (EPG 1–499), moderate (EPG 500–5,000), and severe (EPG >5,000). The low infection level in Cikarawang suggests parasitism had not yet significantly affected growth.

Besides disease, low DWG, slow chest circumference growth, and slow abdominal circumference growth may also be influenced by other factors, such as feed quality and nutrient content. Table 4 presents the nutritional requirements for sheep based on body weight.

Table 4. Nutritional Requirements of Sheep

Body weight (kg)	PBBH (gr)	Protein (gr)	ME (M.kal)	TDN (gr)	Ca (gr)	P (gr)	Vit. A
15	150	72	5,6	370	2,9	1,9	500
20	150	75	6,9	456	2,9	1,9	670
25	150	77	8,2	542	3	2,1	830
30	150	80	9,5	628	4,2	2,2	1.000
35	150	83	10,7	707	4,3	2,3	1.670
40	100	78	10,1	668	3,4	2,1	1.330

The feeding treatment for sheep raised in Cibanteng and Cikarawang consisted solely of ad libitum forage provision. However, forage alone is considered insufficient to meet the nutritional requirements of sheep, as its nutrient content is relatively low and only supports basic metabolic needs. According to Purbojo et al. (2018), a diverse diet with high energy and protein content can result in significantly higher growth rates than sheep fed only a basal diet. Proper feed management positively influences daily weight gain (DWG), and optimal body weight growth directly affects morphological parameters such as chest and abdominal circumference. The linear body measurements of sheep reflect the size of their digestive organs, determining their feed intake capacity. Taofik and Depison (2008) further emphasized that sheep can achieve their maximum growth potential only when their basic nutritional needs are met. The greater the difference between basal maintenance requirements and the nutrients available for growth, the closer the animal's performance aligns with its genetic potential. In addition to nutrition, environmental stress can also hinder sheep's growth. Environmental stress can alter feeding patterns, causing livestock to become more selective in their feed choices, ultimately affecting nutrient partitioning between maintenance and production needs.

Conclusion

This study revealed that sheep in both Cibanteng and Cikarawang villages were infected with gastrointestinal nematodes, with Cibanteng showing significantly higher EPG counts. A weak negative correlation between EPG and daily weight gain (DWG) was observed in Cibanteng, indicating that higher parasitic infection levels hindered growth. In contrast, no significant correlation was found in Cikarawang, likely due to lower infection levels. Body measurements, such as chest and abdominal circumference, also differed between villages, reflecting the impact of parasitic infections on sheep growth. The findings emphasize the importance of effective parasite management in improving sheep productivity, particularly in small-scale farming systems. Further research on optimal grazing and feed management practices is recommended to reduce parasitic infections and enhance livestock health and productivity.

References

[Kementerian Pertanian] Direktorat Jenderal Peternakan dan Kesehatan Hewan. 2023. Statistik Peternakan dan Kesehatan Hewan. Jakarta (ID): Direktorat Jenderal Peternakan dan Kesehatan Hewan Kementerian Pertanian RI. ISSN: 2964-1047

Ashari, Suhardini dan Andriati. 2015. Tampilan bobot badan dan ukuran linier tubuh domba ekor gemuk pada umur tertentu di Kabupaten Lombok Timur. *Jurnal Ilmu dan Teknologi Peternakan Indonesia*. 1(1): 24-30. https://doi.org/10.29303/jitpi.v1i1.6

Hamid PH, Kristianingrum YP, Prastowo J, Silva LMR. 2016. Gastrointestinal parasites of cattle in Central Java. *American Journal of Animal and Veterinary Science* 11(3): 119-124. https://doi.org/10.3844/ajavsp.2016.119.124

Hamid L, Alsyari A, Tak H, Mir SA, Almoyad MAA, Wahab S, Bader GN. 2023. An insight into the global problem of gastrointestinal helminth infections amongst livestock: does nanotechnology provide an alternative?. *Journal Agriculture*. 13 (7): 1-19. https://doi.org/10.3390/agriculture13071359

Haryanti Y, Kurnianto E, dan Lestari C. 2015. Pendugaan Bobot Badan Menggunakan Ukuran-Ukuran Tubuh pada Domba Wonosobo. *Jurnal Sain Peternakan Indonesia*, 10(1), 1–6. Retrieved from https://ejournal.unib.ac.id/jspi/article/view/663

Hassan MM, Hoque MA, Islam SKMA, Khan SA, Roy K, Banu Q. 2011. A prevalence of parasites in Black Bengals goats in Chittagong, Bangladesh. *International Journal of Livestock Production*, 2(4), 40-44.

Macarthu, E. 2010. Hutchinson GW Nematode Parasites of Small Ruminants, Camelids and Cattle Diagnosis with Emphasis on Anthelmintic Efficacy and Resistance Testing.

Winarso A, Mbula VKD, dan Sanam MUE. 2022. Infection with Strongyle in Bali Cattle (*Bos sondaicus*) in Kupang Regency. *Veterinary Biomedical and Clinical Journal*, 4(1), 16–21. https://doi.org/10.21776/ub.VetBioClinJ.2022.004.01.3

Muthiadin C, Aziz IS, Firdayana. 2018. Identifikasi dan Prevalensi Telur Cacing Parasit pada Feses Sapi (*Bos* Sp.) yang Digembalakan di Tempat Pembuangan Akhir Sampah (TPAS) Tamangapa Makassar. *Biotropic* 2018. 2 (1): 17– 23. https://doi.org/10.29080/biotropic.2018.2.1.17-23

Nielsen MK, Baptiste KE, Tolliver SC. Collins SS, Lyons ET. 2010. Analysis of Multiyear Studies in Horses in Kentucky to Ascertain Whether Counts of Eggs and Larvae Per Gram of Feces are Reliable Indicators of Numbers of Strongyles and Ascarids Present. *Vet. Parasitol* 174(1-2). 77-84. https://doi.org/10.1016/j.vetpar.2010.08.007

Nofyan E, Kamal M dan Rosdiana I. 2010. Identitas jenis telur cacing parasite usus pada ternak sapi (*Bos* sp.) dan kerbau (*Bubalus* sp.) di rumah potong hewan Palembang. *Jurnal Penelitian Sains*. 6(10): 6-11.

Nurdayanti, Widiarso BP, Pratiwi DE, Wijaya FMP. 2021. Analisis jalur pengetahuan, intensitas penyuluhan terhadap persepsi peternak pada penggunaan serbuk daun Nangka sebagai obat cacing pada domba. *Jurnal Penyuluhan*. 17(1): 25-39. https://doi.org/10.25015/17202132921

Nurdin, R. A., Latif, U. T. A., Wirawan, H. P. 2023. Identifikasi parasit pada feses domba (*Ovis aries*) menggunakan metode uji apung dan uji sedimentasi pada Balai Besar Veteriner Maros. *Filogeni: Jurnal Mahasiswa Biologi*. 3(2); 65-71. https://doi.org/10.24252/filogeni.v3i2.29828

Pertiwi VR, Silaen OSM. 2023. Pengaruh pemeliharaan intensif pada kambing terhadap infeksi parasite cacing gastrointestinal di desa Rajabasa lama Kabupaten Lampung Timur. *Jurnal Veteriner dan Biomedis*. 1(2): 72-76. https://doi.org/10.29244/jvetbiomed.1.2.72-76.

Pramu, Putra RS dan Zakariya AZ. 2020. Efek pemberian infusa biji labu kuning (*cucurbita moschata durch*) terhadap cacing Fasciola sp. secara in vitro. *Jurnal Penelitian Peternakan Terpadu*. 2(2): 39-45. https://doi.org/10.36626/jppt.v2i2.282

Purbojo SW, Yuwono P dan Socheh M. 2018. Pertambahan bobot badan harian dan ukuran lingkat dada domba yang diberi energi pakan yang berbeda (*daily body weight gain and girth of sheep fed different energy*). Prosiding Seminar Nasional dan Call for Papers: Pengembangan Sumber Daya Perdesaan dan Kearifan Lokal Berkelanjutan VIII 14-15 November 2018. No ISBN: 978-602-1643-617.

Purwaningsih, Noviyanti dan Sambodo P. 2017. Infestasi cacing saluran pencernaan pada kambing kacang peranakan ettawa di Kelurahan Amban Kecamatan Manokwari Barat Kabupaten Manokwari Provinsi Papua Barat. *Jurnal Ilmiah Peternakan Terpadu*. 5(1): 8-12. http://dx.doi.org/10.23960/jipt.v5i1.p8-12

Shatyaayyupranathasari HP, Sudarnika E, Ridwan Y. 2021, Prevalensi dan Faktor Risiko Infeksi Cacing Saluran Pencernaan pada Kuda Delman di Kota Bogor. *Acta Veterinaria Indonesiana* 9(2): 87-96. https://doi.org/10.29244/avi.9.2.87-96

Susilo H, Abdilah NA, Amelia KR. (2020). Identifikasi telur cacing parasite pada feses hewan ternak di Propinsi Banten. Indonesia. *Biodidaktika: Jurnal Biologi dan Pembelajarannya. 15*(2): 21-30. http://dx.doi.org/10.30870/biodidaktika.v15i2.8719

Taofik A dan Depison. 2008. Hubungan antara lingkar perut dan volume ambing dengan kemampuan produksi susu kambing peranakan ettawa. *Jurnal Ilmiah Ilmu-Ilmu Peternakan* 11(2): 59-65. https://doi.org/10.22437/jiiip.v11i2.749

Tariq KA, Chishti MZ, Ahmad F, Shawl AS. 2008. Epidomology of gastrointestinal nematodes of sheep managed under traditional husbandry system in Kashmir valley. *Veterinary Parasitology*. 158(2008): 138-143. https://doi.org/10.1016/j.vetpar.2008.06.013

Tasawar Z, Minir U, Hayat CS, Lashari MH. 2007. The Prevalence of Fasciola hepatica in Goats Around Multan. *Pakistan Vet. J*. 27(1): 5-7.

Victori A, Purbowati E, Lestari CMS. 2016. Hubungan antara ukuran-ukuran tubuh dengan bobot badan kambing Peranakan Etawah jantan di Kabupaten Klaten. *Jurnal Ilmu-Ilmu Peternakan* 26 (1): 23 – 28. https://doi.org/10.21776/ub.jiip.2016.026.01.4

Wahyudi FE, Maylinda S, Susilorini TE. 2023. Hubungan antara Ukuran Linear Tubuh dengan Bobot Badan Domba Texel dan Domba Awassi. *Jurnal Agripet*. 23(1):85-90. https://doi.org/10.17969/agripet.v23i1.24871

Winarso A, Satrija F, Ridwan Y. (2015). Prevalensi trichurosis pada sapi potong di kecamatan Kasiman, Kabupaten Bojonegoro, Jawa Timur. *Jurnal Kajian Veteriner, 3*(2), 225-230. https://doi.org/10.35508/jkv.v3i2.1045

Zalizar L. 2017. Helminthiasis Saluran Cerna pada Sapi Perah. *Jurnal Ilmu-Ilmu Peternakan* 27(2): 1-7. https://doi.org/10.21776/ub.jiip.2017.027.02.01