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The Relationship of *Paramphistomum* sp. Infection and Distribution of Paramphistomiasis in Libureng District, Bone Regency

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ABSTRACT

This study aims to calculate the number of presences of *Paramphistomum* sp. in cattle faeces, to determine the level of symptoms caused by its presence, and to analyse the relationship between their number and the level of symptoms in cattle. The qualitative descriptive method is implemented through direct laboratory observation in cattle faecal samples. Samples were obtained from Balinese cattle in Bone Regency. The test was conducted using a sedimentation test at the Maros Veterinary Centre. Data analysis using a table of the *Paramphistomum* sp. number in cattle faeces and the number of eggs per gram (EPG). The results showed that the number of parasites *Paramphistomum* sp. in cattle faeces, 1,980/grams of eggs was found on the first slide and 600/grams on the second slide. The symptoms caused by its presence showed moderate infection, ranging from 500-5,000 eggs per gram. Farmers are advised to routinely check livestock faeces, provide deworming as recommended, maintain the cleanliness of the cage, and manage feed and drinking water properly to prevent *infection with Paramphistomum* sp. In addition, grazing rotation is also important to reduce the risk of reinfection, so that it can improve livestock health and prevent economic losses.

Keywords: Balinese cattle (*Bos sondaicus*), *Paramphistomum* sp., sedimentation test.

INTRODUCTION

Balinese cattle are one of the livestock that cannot be separated from people's lives, especially in Bali. For the people in Bali, Balinese cattle have an essential function: agricultural labour, financial function, and religious facility (Cattleya et al., 2023). The Balinese cattle maintenance system in Bali is by grazing during the day and caged at night some are caged continuously (Dina et al., 2021). Cattle farmers in Indonesia face various serious challenges related to livestock health, especially due to viral, bacterial, fungal, and parasitic infections (Saukhan et al., 2023). Extreme climate change and suboptimal cage management cause stress and lower the immune system of cows, making them susceptible to diseases and worm infections. In addition, feeding that is not by nutritional needs, low application of biosecurity, and unwise use of antibiotics also worsen the health condition of livestock and trigger antimicrobial resistance (Tolistiawaty et al. 2016). Therefore, increasing

farmers' awareness of integrated livestock health management is essential to prevent economic losses and ensure sustainable livestock productivity (Arif et al., 2023).

Parasites in livestock can cause various health problems that impact weight loss, slow growth, and even death, which can significantly affect the selling value of livestock (Aminah et al., 2022). One of the worm eggs that often causes infections in the stomach is the stomach worm (*Paramphistomum* sp). *Paramphistomum* is a genus of parasitic flatworms from the group of Trematodes is commonly parasitic in ruminant livestock and some wild mammals (Samarang et al., 2022). Infection by these worms can lead to a serious disease called paramphistomiasis or amphistomiasis, especially in young cattle and sheep (Pfukenyi & Mukaratirwa, 2018).

Symptoms of paramphistomiasis include severe diarrhoea, anaemia, depression, lethargy, and gastrointestinal, and, in severe cases, can lead to death if left untreated (Darmin. et al., 2015). The disease is widespread worldwide and is widely found in livestock areas such as Australia, Asia, Africa, Eastern Europe, and Russia (Khedri et al., 2015). Control of *Paramphistomum* worm infection is important to maintain livestock health and productivity in these regions (Purwaningsih et al., 2018). Average prevalence of *Paramphistomum* sp. in Indonesia the highest is in West Sumatra at 99.5% and in Aceh at 94.5%, in addition to West Nusa Tenggara at 80%, Lampung at 69.84%, South Sulawesi at 53.23%, South Kalimantan at 52.23%, South Kalimantan at 56%, Java at 41.6%, Palembang at 32.20%, East Nusa Tenggara at 32.27%. and Manokwari 18.52% (Darmin. et al., 2015).

The presence of worm parasites, especially *Paramphistomum* sp, in livestock is a serious problem that farmers often overlook, although it has a major impact on livestock health and productivity (Bella et al., 2023). The presence of worm parasites, especially *Paramphistomum* sp, in livestock is a serious problem that farmers often overlook, although it has a major impact on livestock health and productivity (Bella et al., 2023) The problem of parasitic infections in cattle is a common challenge faced by farmers in Indonesia, mainly due to the lack of attention to parasitic diseases (Aprilliani Nurdin et al., 2023). Several previous studies have highlighted the high prevalence of worm infections in cattle in various regions, which is caused by farmers' lack of awareness of parasite control. The methodology commonly used in these studies is the examination of faecal samples with sedimentation techniques to detect the presence of worm eggs (Jumarni & Raemon, 2023). A study by Mubarok et al. (2015) in Sobangan Village, Mengwi District, Badung Regency, found a prevalence of trematode infection of 5.51% in Balinese cattle, with the types of worms identified as *Paramphistomum* spp. and *Fasciola* spp. This study emphasizes the importance of early detection and control of parasitic infections in cattle through faecal examination using sedimentation methods. These results can serve as a reference for farmers and the livestock industry in implementing parasitic infection prevention and control measures to improve livestock health and productivity.

Based on the description above, the purpose of this study is to establish the relationship between the number of parasites *Paramphistomum* sp. with symptom levels in cattle.

METHOD

The sedimentation method is an effective diagnostic technique for detecting parasitic worm eggs in cow faecal samples. Several studies have supported the use of this method in the identification and assessment of the prevalence of gastrointestinal parasitic infections in livestock. One of the studies by Sayekti and Haryatmi (2020) in Gading Wetan Hamlet, Klaten, used the sedimentation method to identify helminth parasites in cows. The results showed a prevalence of infection of 50%, with the detected species including *Fasciola* sp., *Trichuris* sp., and hookworms.

Time and Place of Research

This research was carried out on November 13rd, 2023 – January 5th, 2024, at the Parasitology Laboratory, Veterinary Centre, Maros, South Sulawesi.

Sample Handling

Faecal samples were obtained from Balinese cattle in Bone Regency, South Sulawesi. They are processed by arranging them on a testing table according to the registration number (EPI) and specimen number. Unprocessed faecal samples were stored in the refrigerator or given preservatives such as formalin 10% to prevent the development of worm egg larvae.

Preparation of Test Solution

The production of saturated NaCl begins with the preparation of NaCl and aquades (distilled water). Then NaCl is added in aquades and a water bath for 2 hours at a temperature of 57oC. After that, it is cooled at room temperature until it is about to be used. The 0.1% methylene blue solution began with the preparation of 0.1 grams of methylene blue and aquades. Next, methylene blue was dissolved in 100 ml of aquades and stirred until well mixed.

Sedimentation Test Technique (Sedimentation Method)

Tools and materials were prepared. Then the faeces were weighed as much as 1 gram and then placed in a plastic pot bottle. Next, add 30 ml of saturated NaCl and stir until well mixed. After that, the faeces are filtered with the results of the filter and put into a 15 ml centrifuge tube. This step was done continuously until the faecal sample ran out and was done sequentially. After all the samples have been completed, the centrifugal tube containing the results of the faecal filter is balanced with a centrifugal scale. Then centrifuged at 1500 rpm for 5 minutes.

Furthermore, the supernatant was removed so that only sediment (sediment) was left at the bottom of the tube. After the precipitate is taken using a drop pipette and then placed on the prepared glass. Next, 0.1% methylene blue is added and stirred until smooth and covered with a glass cover. After that, it was observed under a microscope with a magnification of 100x.

Data Analysis

The formula for calculating the number of eggs per gram (EPG) is as follows:

$$EPG = \frac{Number\ of\ Eggs\ x\ Total\ Volume}{Volume\ Chamber\ (cc)\ x\ Faeces\ Weight\ (g)}$$

Table 1. Classification of *Paramphistomum* sp. infection rate based on the number of Eggs per Gram of Faeces (EPG).

Number of eggs (grains/gram of faeces)	**Infection Rate**
1-499	Light
500-5000	Keep
>5000	Heavy

The calculation of EPG using the sedimentation method is an important diagnostic tool in determining the level of parasitic infection in livestock. By knowing the level of infection, farmers and animal health professionals can look at the level of symptoms that arise in Balinese cattle and can take appropriate measures the control and prevent parasitic diseases (Prawestry et al., 2021).

RESULT AND DISCUSSION

The type of sample used came from cattle faeces, estimated to be adolescent to adulthood. Based on the results of observation and sedimentation tests on cattle faeces samples, results can be seen in Table 2. and Figure 1.

The number of *Paramphistomum* sp. eggs on cattle faeces

Table 2. Results of the Presence of the Number of *Paramphistomum* sp. Eggs on cattle faeces

Sample Type	***Slide Number***	***Types of species***	***Number of eggs***
Cattle faeces	1	*Paramphistomum* sp.	33 eggs
	2	*Paramphistomum* sp.	40 eggs
Total Amount			73 eggs

Based on the table above, the results are not much different from both slides made from different registration numbers (EPI). On slide number 1, 33 *Paramphistomum* sp eggs were found (shown on the slide), while on slide number 2, 40 *Paramphistomum* sp eggs were found. (seen on the slide) then the total number of the two slides is 73 *Paramphistomum* sp eggs after the number of *Paramphistomum* sp eggs is known. The results you were calculated using the formula for calculating the number of eggs per gram (EPG).

Based on the results of the Egg Per Gram (EPG) calculation, the following results were obtained:

$$\text{EPG} = \frac{\text{Number of Eggs x Total Volume}}{\text{Volume Chamber (cc) x Faeces Weight (g)}} = \frac{33 \text{ x } 30}{2 \text{ x } 1} = 1.980/\text{gram}$$ (moderate infection on slide 1)

$$\text{EPG} = \frac{\text{Number of Eggs x Total Volume}}{\text{Volume Chamber (cc) x Faeces Weight (g)}} = \frac{40 \text{ x } 30}{2 \text{ x } 1} = 600/\text{gram}$$ (moderate infection on slide 2)

The results of the calculation of the EPG formula, namely on slide 1, obtained the number of *Paramphistomum* sp. eggs as much as 1,980/gram, while on slide 2, it was obtained as much as 600/gram.

Based on the results of observations on two samples of Balinese cattle faeces using the sedimentation method, the number of eggs *of Paramphistomum sp.* is as much as 1,980/gram on the first slide and 600/gram on the second slide. This number is in the category of moderate infection (500–5,000 EPG). However, it is important to note that two samples are not enough to provide an idea of the prevalence of Balinese cattle in bone districts or statistically significant infection intensity. The distribution of *Paramphistomiasis* in Bali cattle in Libureng District, Bone Regency according to Darmin et al. (2015) can be seen on Table 3.

Table 3. Distribution of *Paramphistomiasis* in Bali cattle in Libureng District, Bone Regency.

Desa	**Number of Samples**	***Paramphistomum* sp.**	
		Positive	**Negative**
Baringeng	6	2	4
Tompobulu	5	3	2
Ponre-ponre	5	4	1
Laburasseng	5	4	1
Tappale	5	5	0
Polewali	3	2	1
Suwa	2	1	1
Pitumpidange	4	1	3
Wanuawaru	4	3	1
Ceppaga	6	3	3
Mattiro walie	8	4	4
Mario	6	4	2
Poleonro	6	3	3
Tanabatue	3	2	1
Swadaya	5	2	3
Binuang	4	2	2
Mattiro deceng	4	2	2
Bunce	10	3	7
Mallinrung	6	4	2
Mattiro bulu	3	3	0

Results of Microscopic Observation of the Presence of *Paramphistomum* sp. in Cattle Faeces

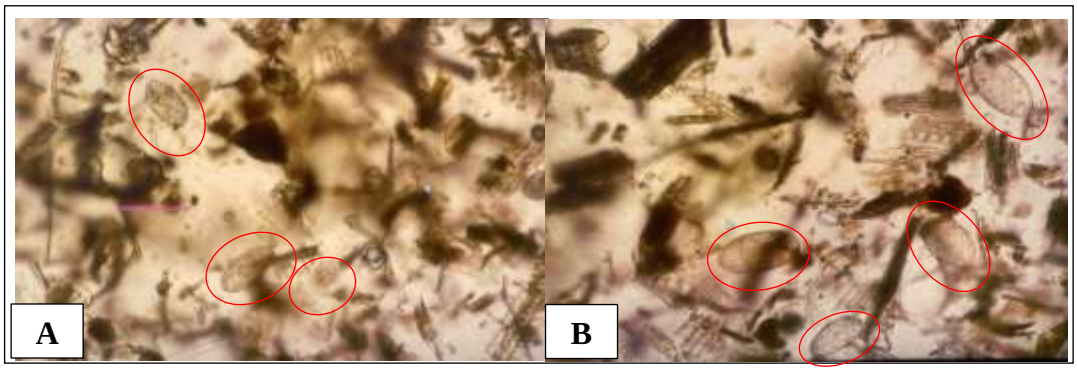

Figure 1. Microscopic observation of the presence of *Paramphistomum* sp. (red circle) in cattle faeces.

In Figure 1., the characteristics of *Paramphistomum* sp. are that it is oval, a kind of embryo, has no colour (transparent), transparent purplish walls, small protrusions are found at the posterior end, and the size the *Paramphistomum* sp. eggs are very large (Panyarachun et al., 2013).

Paramphistomum sp. belongs to the class Trematoda where its life cycle requires snails as its host or intermediate *host*. The final host invasion can occur if farm animals drink or graze in water containing *Metacercariae worms* (Larasati et al., 2017). *Paramphistomum* sp.'s survival and spread depend on the presence of snails in the environment around the livestock pen, which acts as *an intermediate host* (Barkah et al., 2021). The humid and juicy state of the cage becomes a comfortable place for snails to survive and breed (Khair et al., 2023). This result is in line with the theory of Taylor et al. (2016) that geographical factors such as the environment that has high humidity and temperature of more than 27°C can affect the presence of snails and make the prevalence of *Paramphistomum* sp., the condition of each area with a suitable environment will be the development of the *Paramphistomiasis* stage (Aprilliani Nurdin et al., 2023)

Results of the Number of *Paramphistomum* sp. in Cattle Faeces

The result of the presence of the number of *Paramphistomum* sp., which is shown in Table 5.1 shows that the number of eggs shown in slide 1 obtained the number of *Paramphistomum* sp eggs as many as 30 eggs (shown on the slide) and in slide 2 obtained the number of *Paramphistomum* sp eggs as many as 43 eggs (shown on the slide), so that a total of 73 *Paramphistomum* sp eggs were obtained. Furthermore, the number of eggs of *Paramphistomum* sp. appears to be calculated by calculating the number of eggs per gram (EPG), so that the result obtained in slide 1 is the number of *Paramphistomum* sp. as much as

1,980/gram while in slide 2 the number of *Paramphistomum* sp. eggs was obtained. 600/gram (Cattleya et al., 2023).

The Level of Symptoms Caused by the Presence of *Paramphistomin* sp.

The level of symptoms caused by the presence of *Paramphistomum* sp. showed that the number of eggs/gram obtained was included in **the category of moderately** infected because the number of eggs obtained was 1,980/gram on the first slide and 600/gram on the second slide so that it entered 500-5,000 per gram (moderate infection). **The category of mild** infection is if the number of eggs ranges from 1-499 eggs per gram. **The category of medium** infection if the number of eggs ranges from 500-5,000 eggs per gram while the category of severe infection if the number of eggs ranges >5,000 eggs per gram (Rozi et al., 2015).

The symptoms caused by mild infections are still not visible or do not show clinical symptoms. However, if left for a prolonged period, they can interfere with the work of the rumen and cause the cattle's body to become thin and economically disadvantaged (Lestari et al., 2017). Symptoms of moderate infection cause castles to experience decreased milk production in female cattle, weight loss, meat production and decreased fertility (Indrasanti et al., 2020). In contrast, severe infections can cause the effects of gastroenteritis or known inflammation of the digestive tract (stomach and intestines), which is characterized by symptoms of diarrhoea and vomiting in young cattle and even leads to death (Prawestry et al., 2021).

The relationship between the number of eggs *Paramphistomum* sp. with the Level of Symptoms Caused in Balinese Cattle and Distribution of *Paramphistomiasis* in Bali cattle in Libureng District, Bone Regency

There is a relationship between the number of *Paramphistomum* sp. eggs found and the symptoms caused in Balinese cattle. According to the theory of (Darmin et al., 2015). the lower the number of *Paramphistomum* sp eggs, the level of symptoms caused is still not visible or does not show clinical symptoms. This result is in line with the research that the higher the number of *Paramphistomum* sp eggs, the more severe the infection can cause gastroenteritis or inflammation of the gastrointestinal tract in the stomach and intestines, diarrhoea, and even death.

The existence of secondary data from the distribution of Paramphistomiasis cases in Libureng District, Bone Regency can be used as contextual support in understanding the spread of this disease. Paramphistomiasis in Balinese cattle in Libureng District, Bone Regency can be said to be quite high, which is 57%. Distribution data show that Paramphistomiasis is indeed one of the significant cases of gastrointestinal parasites in the region. This reinforces the indication that although the number of primary samples is limited, the infection of Paramphistomum sp. in Balinese cattle in Libureng is not a sporadic occurrence, but part of a wider pattern of disease distribution. Thus, two samples showing moderate infection through sedimentation test techniques can be seen as an early representation of broader epidemiological

conditions, and serve as an important basis for encouraging research with greater sample coverage.

The results of the histopathological examination of the rumen of severely infected cattle by *Paramphistomum* sp. show a picture of necrosis, inflammation, and papilla rumen are compacted, and there is a crowd of parasites (Amleni et al., 2019). In addition, erosion, infiltration of cells, cell death and many cells with a double nucleus (eosinophils) were found. So, it can be concluded that the changes seen are focused, mild and limited (Depari et al., 2017). In addition, the results of postmortem examination of infected cattle organs *Paramphistomum* sp. do not show any anatomical changes, but the number of *Paramphistomum* sp. attached to the rumen wall of the cattle shows a darker rumen colour (Wardhani et al., 2022). This result is in line with the theory of David et al. (2013) that the more *Paramphistomum* sp. is attached to the cattle's rumen wall will tend to look brownish or light brown.

The sanitary condition of the cage also needs to be considered, especially livestock manure, which is rarely cleaned and left alone until it dries in the cage. Cage sanitation is an effort to maintain the health of livestock from worm infections and as a preventive measure to prevent livestock from contracting other diseases (Musdalifah, 2015).

Based on the observation of the presence of the number of eggs that have been found using the sedimentation test, it is not effective to use during microscopic observation because it can be seen that there is still a lot of accumulation of faeces that block and cover the parasite, this is due to the sedimentation process, in addition to the lack of faecal samples that are included in laboratory testing is an obstacle to the process of observing the presence of parasitic eggs.

CONCLUSION

Based on the results of the examination of two samples of Balinese cattle faeces with sedimentation test techniques, EPG values were obtained at 1,980/gram and 600/gram, respectively, which are classified as moderate infections. Although the number of primary samples was limited, these findings were supported by secondary data from Libureng District, Bone Regency, which showed that the distribution of paramphistomiasis in Balinese cattle was quite significant. *Paramphistomum* sp. has the potential to cause indigestion, weight loss, malnutrition, and death in livestock, which has a direct impact on farmers' productivity and the sustainability of the local livestock industry. Therefore, follow-up research needs to be conducted with larger sample counts, involving a wider area, as well as combining other quantitative diagnostic methods such as McMaster to improve data accuracy. In addition, it is necessary to conduct an in-depth study of the relationship between EPG values and clinical symptoms as well as an evaluation of parasite control and treatment strategies to support region-based animal health policies and improve the welfare of farmers.

REFERENCES

Aminah, A., Idhatul Setiani, R., & Ekawasti, F. (2022). Identifikasi Endoparasit pada Sapi Brahman Cross (BX) di Rumah Potong Hewan (RPH) Kota Tangerang (Identification of Endoparasites in Brahman Cross (BX) Cattle at the Abattoir in Tangerang). *Acta Veterinaria Indonesiana*, *41–48*. http://www.journal.ipb.ac.id/indeks.php/actavetindones

Amleni, L. D., Amalo, F. A., Maha, I. T., & Selan, Y. N. (2019). Studi Histologi Rumen, Retikulum Dan Omasum Sapi Sumba Ongole (Bos indicus). *Jurnal Kajian Veteriner*, *17*, 103–106. https://doi.org/10.35508/JKV.V0I0.1593

Aprilliani Nurdin, R., Triyani Latif, U. A., & Purnama Wirawan, H. (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

Arif, Q., Veronica, W., Ratna, E., Muhammad, M., & Pratama, S. (2023). Diseminasi Tata Laksana Reproduksi, Kesehatan, dan Sanitasi Kandang serta Aplikasi Pengobatan Massal Ternak Sapi Potong di Desa Tambak Jaya Kecamatan Way Tenong Kabupaten Lampung Barat. *Jurnal Pengabdian Fakultas Pertanian*, *02*(01), 143–160.

David, R. N., Siswatiana, R. T., & Tri Ananda, E. N. (2013). Investigasi keberadaan cacing Paramphistomum sp. pada lambung sapi yang bearasal dari Tempat Pemotongan Hewan di Kota Gorontalo. *Jurnal Peternakan*.

Barkah, A., Hartono, M., Santosa, P. E., & Sirat, M. M. P. (2021). Infestation Level of Gastrointestinal Helminth in Swamp Buffalo (Bubalus bubalis Linn.) in Jati Agung District Lampung Selatan Regency. *Jurnal Ilmiah Peternakan Terpadu*, *9*(1), 1. https://doi.org/10.23960/jipt.v9i1.p1-18

Bella, S., Hartono, M., Adhianto, K., & Santosa, P. E. (2023). *The Influence of Gender on Investment Level and Type of Worms in the Jawarandu Goat's Digestive Tract in Adiluwih District, Pringsewu District*. *7*(4), 565–571. https://doi.org/10.23960/jrip.2023.7.4.565-571

Cattleya, R., Yuwono, E., & Diana, I. (2023). Prevalensi, Identifikasi, Dan Pengaruh Umur Terhadap Trematodiasis Pada Kambing Di Sumbang, Banyumas. *Prosiding Seminar Nasional Teknologi Dan Agribisnis Peternakan*, 119–126.

Darmin. S, P Yuliza. F, & Sirupang. M. (2015). *Prevalensi Paramphistomiasis Pada Sapi Bali Di Kecamatan Libureng, Kabupaten Bone Prevalence of Paramphistomiasis on Bali Cattle in Libureng Sub-District, Bone Regency*. 149–161.

Depari, E. E., Farhani, A., Batan, I. W., & Kardena, I. M. (2017). Gambaran Histopatologi Rumen dan Retikulum Sapi Bali Akibat Adanya Benda Asing. *Jurnal Sain Veteriner*, *35*(1), 35–41.

Dina, P. A., Apsari, I. A. P., & Dwinata, I. M. (2021). Prevalence Of Strongyl Type Nematoda Infection In Bali Cattle In Wet And Drought Low Land Of Bali Province. *Indonesia Medicus Veterinus*, *10*(1), 125–133. https://doi.org/10.19087/imv.2021.10.1.125

Haadijah, J., Sukmanadi, M., Kusnoto, Suprihati, E., Nangoi, L., & Hastutiek, P. (2020). Identification of nematode worms in caecum and colon on sacrificial cattle slaughtered during Eid al-Adha 1439 H in East Surabaya. *Journal of Pharmacy and Science*, *4*(1), 25–30.

Indrasanti, Samsi, D. M., Sufriyanto, S., Nafi, M. I., & Anandita, I. (2020). Trematodiasis pada Sapi Potong di Kecamatan Sumbang Kabupaten Banyumas. *Jurnal LPPM Unsoed Prosiding*, *10*(1), 151–158.

Jumarni, J., & Raemon, R. (2023). Beternak Sapi Secara Tradisional. *Kabanti: Jurnal Kerabat Antropologi*, *7*(1), 142–150. http://journal.fib.uho.ac.id/index.php/kabantiantropologi/article/view/2172

Khair, A. K., Hartono, M., Wanniatie, V., & Dakhlan, A. (2023). Tingkat Infestasi Dan Jenis Parasit Saluran Pencernaan Pada Sapi Peranakan Simental Di Kecamatan Tulang Bawang Udik Kabupaten Tulang Bawang Barat. *Jurnal Riset Dan Inovasi Peternakan (Journal of Research and Innovation of Animals)*, *7*(2), 251–260. https://doi.org/10.23960/jrip.2023.7.2.251-260

Khedri, J., Radfar, M. H., Borji, H., & Mirzaei, M. (2015). Prevalence and Intensity of Paramphistomum Spp. In Cattle from South-Eastern Iran. *Iranian Journal of Parasitology*, *10*(2), 268. /pmc/articles/PMC4522303/

Larasati, H., Hartono, M., Siswanto, dan, Brojonegoro No, S., & Meneng Bandar Lampung, G. (2017). Gastrointestinal Helminths Dairy Cattle Prevalence in Period of June--July 2016 on Public Farm at Lampung Province. In *Jurnal Riset dan Inovasi Peternakan* (Vol. 1, Issue 1).

Lestari, A. I. T. J. A., Adnyana, I. B. W., & Oka, B. M. I. (2017). Prevalensi Dan Gambaran Patologi Infestasi Cacing Paramphistomum Spp. Kota Denpasar (Prevalence And Pathology Infestation Paramphistomum Spp On Rumen Bali Cattle Slaughtered In Abattoirs City Of Denpasar). *Indonesia Medicus Veterinus Januari*, *6*(1), 2477–6637. https://doi.org/10.19087/imv.2017.6.1.20

Mubarok, F., Suratma, N.A., dan Dwinata, I.M. (2015). Prevalensi Trematoda di Sentra PembibitanSapi di Bali Desa Sobangan, Kecamatan Mengwi, Kabupaten Badung. Jurnal Indonesia Medicus Veterinus. ISSN 2301-7848

Panyarachun, B., Ngamniyom, A., Sobhon, P., & Anuracpreeda, P. (2013). Morphology and histology of the adult Paramphistomum gracile Fischoeder, 1901. *Journal of Veterinary Science*, *14*(4), 425. https://doi.org/10.4142/JVS.2013.14.4.425

Pfukenyi, D. M., & Mukaratirwa, S. (2018). Amphistome infections in domestic and wild ruminants in east and southern Africa: A review. *Onderstepoort Journal of Veterinary Research*, *85*(1). https://doi.org/10.4102/OJVR.V85I1.1584

Prawestry, Y. A., Indrasanti, D., & Indradji, M. (2021). Tingkat Infeksi Dan Identifikasi Jenis Nematoda Penyebab Nematodiasis Pada Sapi Potong Berbagai Umur Di Kecamatan Kalibagor Kabupaten Banyumas. *Journal of Animal Science and Technology*, *3*(2), 201–213. https://jnp.fapet.unsoed.ac.id/index.php/psv/article/view/1129

Purwaningsih, P., Noviyanti, N., & Putra, R. P. (2018). Prevalensi dan Faktor Risiko Paramphistomiasis pada Sapi Bali di Distrik Prafi, Kabupaten Manokwari, Provinsi Papua Barat (Prevalence And Risk Factors Of Paramphistomiasis In Bali Cattle In Prafi District, Manokwari Regency, West Papua Province). *Jurnal Veteriner*, *19*(1), 91. https://doi.org/10.19087/jveteriner.2018.19.1.91

Rahayu, A., Ratnawati, S., Idayanti, R. W., Santoso, B., & Luthfiana, N. A. (2020a). Pengaruh Sistem Pemeliharaan secara Intensif dan Semi Intensif pada Itik Magelang. *Jurnal Sain Peternakan Indonesia*, *15*(4), 355–359. https://doi.org/10.31186/jspi.id.15.4.355-359

Rahayu, A., Ratnawati, S., Idayanti, R. W., Santoso, B., & Luthfiana, N. A. (2020b). Pengaruh Sistem Pemeliharaan secara Intensif dan Semi Intensif pada Itik Magelang. *Jurnal Sain Peternakan Indonesia*, *15*(4), 355–359. https://doi.org/10.31186/jspi.id.15.4.355-359

Rozi, F., Handoko, J., & Febriyanti, R. (2015). Infestasi Cacing Hati (Fasciola sp.) dan Cacing Lambung (Paramphistomum sp.) pada Sapi Bali Dewasa di Kecamatan Tenayan Raya Kota Pekanbaru. *Jurnal Sain Veteriner*, *33*(1), 8–15.

Samarang, S., Widjaja, J., Primasari, P., & Syahnuddin, M. (2022). Fasciolosis dan Cryptosporidiosis pada Ternak Sapi di Desa Maranatha, Kabupaten Sigi, Sulawesi Tengah. *Jurnal Vektor Penyakit*, *16*(2), 145–152. https://doi.org/10.22435/VEKTORP.V16I2.6195

Saukhan, G. N. S., Satrija, F., Murtini, S., Suprayogi, A., Siswandi, R., & Soehartono, H. R. (2023). Koinfeksi Fasciola dan Paramphistomum pada Kerbau Lumpur (Bubalus bubalis) di Kabupaten Sumba Timur. *Acta Veterinaria Indonesiana*, *11*(1), 17–25. http://www.journal.ipb.ac.id/indeks.php/actavetindones

Sayekti, F, D, J., Haryatmi, D (2019). Identifikasi Parasit Helmint Pada Ternak Sapi Di Dukuh Gading Wetan Klaten Dengan Metode Sedimentasi. *Cendekia Journal of Pharmacy*. *31*(1), 7–11.

Taylor, M. A., Coop, R. L., & Wall, R. L. (2016). Veterinary helminthology: Superfamily Filarioidea. *Veterinary Parasitology*, *4th edition*, pp. 666–668. https://www.wiley.com/en-us/Veterinary+Parasitology%2C+4th+Edition-p-9780470671627

Tolistiawaty, I., Widjaja, J., Lobo, L. T., & Isnawati, R. (2016). Parasit Gastrointestinal Pada Hewan Ternak Di Tempat Pemotongan Hewan Kabupaten Sigi, Sulawesi Tengah. *BALABA*, *12*(2), 71–78.

Wardhani, L. D. K., Widhowati, D., & Hidayah, N. (2022). Kasus Fascioliasis dan Paramphistomosis pada Pemeriksaan Hewan Kurban di Masjid Nurul Iman Surabaya. *Jurnal Ilmiah Fillia Cendekia*, *7*(2), 141. https://doi.org/10.32503/fillia.v7i2.2551