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Identification of *Trichuris ovis* In Free-Range Goats in Two Villages of Ermera Municipality, Timor-Leste

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ABSTRAK

Trichuriasis umumnya terjadi pada kambing di banyak negara. Namun, ada sedikit penelitian tentang prevalensi dan faktor resiko *Trichuriasis* kambing di Timor-Leste. Penelitian tentang *Trichuris ovis* sebelumnya dilakukan di kotamadya Liquica dengan prevalensi 38% (31,1-45,3%, n=192). Tujuan dari penelitian ini adalah untuk mengetahui prevalensi dan risiko terkait dengan *Trichuriasis* kambing di dua desa di kotamadya Ermera. Kotoran segar dari kambing di desa-desa terpilih dikumpulkan secara *purposive* langsung dari rektumnya dan diuji menggunakan teknik *simple native smear*. Kuesioner diberikan untuk mengumpulkan data tentang lokasi, jenis kelamin dan kelompok umur kambing. Statistik deskriptif digunakan untuk menggambarkan temuan dan rasio Odd (OR) digunakan untuk mengidentifikasi apakah variabel yang diukur memiliki hubungan positif. Hasil penelitian menunjukkan bahwa *Trichuris ovis* teridentifikasi di kotamadya Ermera dengan prevalensi 22,52 (15,1 - 31,4%, n=111). Berdasarkan lokasi, prevalensi tertinggi berada di Lauala 25,49 (14,3-39,6%). Berdasarkan umur, prevalensi tertinggi terdapat pada kelompok umur 8-12 bulan di Lauala dengan prevalensi 29,4 (29,4 - 70,6%) dan 25,00 (25,0 - 75,0%) di Talomoro untuk kedua kelompok usia 0-3 tahun. dan usia 8-12 bulan. Semua variabel (lokasi, jenis kelamin dan kelompok umur) tidak memiliki pengaruh yang signifikan dari sampel positif. Disimpulkan bahwa *Trichuris ovis* hadir di dua desa Ermera dengan prevalensi 22,52 (15,1 - 31,4%).

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ABSTRACT

Trichuriasis are common in goats in many countries. However, there are few studies on the prevalence of and risk factors for goat Trichuriasis in Timor-Leste. The known publication on Trichuris ovis was the one conducted in Liquica municipality with the prevalence of 38% (31.1-45.3%, n=192). The objective of this study was to investigate the prevalence and relevant risk associated with goats' Trichuriasis in two villages in the municipality of Ermera. Fresh faeces from goats in selected villages were purposively collected directly from their rectum and tested using a simple native smear technique. Questionnaires were administered to collect data on sites, sex and age group of goats. Descriptive statistic was used to describe the findings and Odd ratio (OR) was used to identify if the variables measured have any association for being positive. The result showed that the Trichuris ovis was identified in Ermera municipality with the prevalence of 22.52 (15.1 to 31.4%, n=111). Based on location, the highest prevalence was in Lauala 25.49 (14.3 to 39.6%). Based on age, the highest prevalence was found in the age group of 8-12 months in Lauala with the prevalence of 29.4 (29.4 to 70.6%) and 25.00 (25.0 to 75.0%) in Talomoro for both the age group of 0-3 and 8-12 months old. All the variables (sites, sex and age groups) have no significant influence of the positive samples. It was concluded that Trichuris ovis was present in two villages of Ermera with the prevalence of 22.52 (15.1 to 31.4%).

INTRODUCTION

Timor-Leste is a tropical country in Southeast Asia with distinct rainy and dry seasons. Agriculture is the most important industry in Timor-Leste, and livestock is one of the most important subsectors after crop production. Timorese people keep several types of animals for livelihood. Chicken is the most frequent one (49 percent), followed by pigs (22 percent), cattle (12 percent), goats (8 percent), buffaloes (7 percent), and sheep (7 percent). Goats are valuable for their commercial worth, local culture, and traditional ceremonies, as well as being a good source of protein for farmers. Goats are the fourth most common animal kept by farmers, according to Census 2015 (Figure 1).

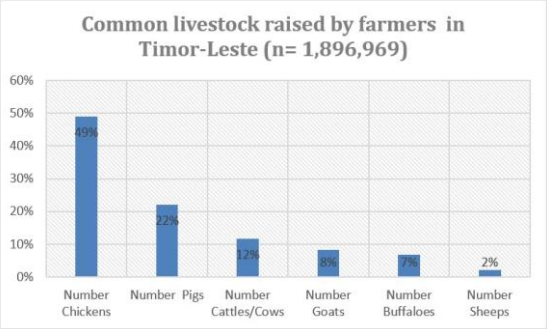

Figure 1. Common livestock raised by farmers (Source: Census Timor-Leste 2015)

In comparison to other animals, farmers keep a small number of goats. According to Census 2015, there are 46,154 goat-keeping households in Timor-Leste, with a total of 158,467 goats. Of these goat-keeping households, 8% of them are in Ermera, with 8,874 goats produced by farmers. There are 111 and 163 goats in Lauala and Talimoro, respectively, where this study took place. As can be observed, the number of goats is quite low because they are not kept as the primary livestock by farmers. However culturally, goats play an important role in the people of

Ermera. Despite the fact that goats are particularly important in Ermera for cultural ceremonies, smallholder farmers in conventional agricultural systems keep limited numbers of goats. The goats are subject to endemic illnesses like *Trichuris ovis* and other gastrointestinal parasites in this traditional production technique, resulting in reduced productivity.

Trichuris ovis is a parasitic worm that is present all over the world and has a substantial economic impact (Bulbul *et al*., 2020). In Timor-Leste, goats are kept by farmers through an extensive rearing system. The extensive raising of goats in traditional settings invariably exposes the flock to a variety of diseases, including different endoparasites, which result in goat death and financial loss for the farmers. Economic losses are also a result of treatment costs.

Trichuris ovis is a parasitic worm that can be found in the intestines of a variety of animals, including goats. It has a direct life cycle in which orally consumed embryonated eggs hatch in the small intestine and the released larvae burrow into the intestinal wall of the caecum and proximal colon, where they mature into adult worms (Bulbul *et al*., 2020). When they burrow into the intestines, they infect the sites. Intestines are infected because the worm resides in the intestine. *Trichuris ovis* infection in the large intestine resulted in mucosal thickening, congestion, haemorrhagic patches, ulcer formation, and nodule formation, along with thickening of the caecal valve (Zainab & Khan, 2016).

An infected goat releases a large number of worm eggs into the environment, contaminating it. A heavy worm burden can cause severe anemia, dehydration, and jaundice in animals, which can lead to death. This is especially true when therapy is rarely employed by farmers in tropical and subtropical climates (Bulbul *et al*., 2020).

Free-range rearing systems of goats are more susceptible to endoparasite infection. *Trichuris ovis* is one such endoparasite that causes a disease named Trichuriasis. Trichuriasis affects goats all around the world, especially it is most common in free-range systems. The goal of this study is to determine the prevalence of *Trichuris ovis* in free-range goats in the Ermera municipality village of Lauala and Talimoro.

METHODS

Study areas. The survey sites for this study were chosen using multistage random sampling. The first five administrative posts in Ermera were listed (Atasabe, Ermera, Hatulia, Letefoho, and Railaco). Then, one administration post was chosen at random, and two villages were chosen at random from that administration post. Ermera administration post, Lauala village, and Talimoro village were chosen for site surveys based on this method.

Samples calculation. The sample size required was calculated based on Cannon (1982). In this study, we want to estimate the prevalence of *T. Ovis* in goats in two villages in Ermera muncipality. The first village is Lauala, which has 111 goats (N1) and Talimoro has 163 goats (N2). We want our

result to have a 95% level of confidence, 10% desired accuracy, and an expected prevalence of 50%. From the Cannon and Roe Table, we see that 96 animals would need to be sampled from a large population (infinite) and we correct this for the "finite" population by calculating using the following formula (Cannon, 1982):

$$\frac{\mathbf{1}}{\boldsymbol{n}} = \frac{\mathbf{1}}{\boldsymbol{n\infty}} + \frac{\mathbf{1}}{\boldsymbol{N}}$$

n = The aproximate sample size required

n∞ = Expected prevalence

N = total population in the site survey

Using the above formula, sample size for Lauala village was calculated as follows:

$$\frac{1}{n} = \frac{1}{n\infty} + \frac{1}{N}$$
$$\frac{1}{n} = \frac{1}{96} + \frac{1}{111}$$
$$\frac{1}{n} = \frac{111 + 96}{10656}$$
$$\frac{1}{n} = \frac{207}{10656}$$
$$207n = 10656$$
$$\mathrm{n} = \frac{10656}{207}$$
$$n = 51$$

Hence, the sample size required for Lauala village was 51, which would be collected evenly in 3 hamlets existing in Lauala village, thus 17 samples were collected from each hamlet.

The same formula was used to calculate the sample size for Talimoro village:

$$\frac{1}{n} = \frac{1}{n\infty} + \frac{1}{N}$$
$$\frac{1}{n} = \frac{1}{96} + \frac{1}{163}$$
$$\frac{1}{n} = \frac{163 + 96}{15648}$$
$$\frac{1}{n} = \frac{259}{15648}$$
$$259n = 15648$$
$$\mathrm{n} = \frac{15648}{259}$$
$$n = 60$$

Based on the above calculation, the sample size required for Talimoro village was 60, which was collected evenly in five hamlets existing in Talimoro village (12 samples were collected from each hamlet).

Samples collection. The samples were collected using purposive sampling. To achieve the study's goal, samples were chosen based on a set of criteria. These criteria include the household must have at least two goats, have at least five years of goat-raising experience, and have goats who are one year old or younger. The samples were taken from November 24 to December 8, 2020.

The following procedures were taken for sampling: First, a goat was restrained. After that, faeces samples were taken directly from the rectum. The sample was then placed in a special plastic bag, labeled, and stored with 10% formalin, and kept in a cool box before being delivered to the laboratory of Quarantine and Biosecurity Directorate, MAP, for examination.

Faeces examination. All fecal samples were examined in the laboratory of the

Quarantine and Biosecurity Directorate, under the Ministry of Agriculture and Fisheries. All samples were examined using a native smear according to the following procedure. First, on a clean microscope slide, a small number of faeces was put at the center. After that, a few drops of water were added. To avoid a lump of fecal material in the center of the coverslip, the bulk was evenly scattered to allow the microscope illumination to shine through. The smear was finally covered with a coverslip and was examined under a light microscope with a magnification of 10x.

Variables observed. There are three variables observed in this study. These are the prevalence of *Trichuris ovis* in goats based on site surveys (villages and hamlets), based on age group and sex.

Prevalence calculation. The prevalence of *Trichuris ovis* was calculated based on the following formula:

$$\text{Prevalence} = \frac{Number\ of\ cases\ of\ disease}{Population\ at\ risk} \times 100\%$$

Calculation of 95% Confidence interval (95%CI). The 95% confidence was calculated using the exact binomial method (Wallis, 2013).

Calculation of 95% Confidence Interval of Odds Ratio (95%CI OR). To quantify the relationship between the test being positive with sites survey, sex, and age group, the odds ratio (OR) was calculated and interpreted using Sheskin (2003)'s method, where 95 percent confidence intervals including the value of one were regarded as not significant and if the lower 95 percent CI was greater than one, the factor was classified as associated with disease, and if the upper 95 percent CI was less than one, the factor was classified as protective (O'Connor, 2019; Sheskin, 2003). The 95% CI of OR was calculated using Woolfs' method (Kahn & Sempos, 1989).

RESULT AND DISCUSION

The prevalence in the two villages is shown in Table 1. The prevalence of *Truchuris ovis* in Lauala village [25.5% (14.3-39.6%)] are higher than Talimoro [20.0% (10.8-32.3%)].

Table 1. Prevalence of *Trichuris ovis* based site survey

Village	Hamlet	Total Samples	Positive	Prevalence (%)	95%CI
	Ervhilat	17	4	23.5	6.8 to 49.9
	Nonabite	17	5	29.4	10.3 to 56.0
Lauala	Sari	17	4	23.5	6.8 to 49.9
Total Lauala		51	13	25.5	14.3 to 39.6
	Bura	12	2	16.7	2.1 to 48.4
	Lima Mesak	12	3	25.0	5.5 to 57.2
	Liberti	12	3	25.0	5.5 to 57.2
	Moris Foun	12	2	16.7	2.1 to 48.4
Talimoro	Nunusua	12	2	16.7	2.1 to 48.4
Total Talimoro		60	12	20.0	10.8 to 32.3
Grand Total		111	25	23.0	15.1 to 31.4

Table 2. Comparison of global test result of samples from Lauala vs Talimoro

Factor	T. ovis Positives	T. ovis Negative	Percent +ve	OR	Lower 95%CI	Upper 95%CI
Lauala	13	38	25.49%	1.37	0.56	3.34
Talimoro	12	48	20.00%	1.00		

As can be seen that globally (test result from the two villages), Lauala village was 1.37 more likely to be positive as compared to Talimoro, however statically there is no difference between locations (95% CI include 1).

Similarly, by using Sari hamlet as a reference factor (RF) to calculate the risk of being positive of *T. ovis* in Lauala village, the result shows that the prevalence for *T. ovis* in the hamlet of Nonabite was 1.4 higher than in another hamlet within the Lauala village. Table 2 shows that all the 95% CI includes one, meaning the factor (sites) has no significant difference from the positive samples. It was also observed that none of the upper 95%CI was less than 1 meaning none of the factors was considered a protective factor.

Table 3. Odds ratio of prevalence based on site survey

Village	**Hamlet**	**Total Samples**	**Positive**	**Negative**	**OR**	**95%CI**
	Ervhilat	17	4	13	1	0.2-4.9
	Nonabite	17	5	12	1.4	0.3-6.3
Lauala	Sari	17	4	13	1	RF
Total Lauala		51	13	38		
	Bura	12	2	10	1	RF
	Lima Mesak	12	3	9	1.7	0.2-12.4
	Liberti	12	3	9	1.7	0.2-12.4
	Moris Foun	12	2	10	0.6	0.1-8.6
Talimoro	Nunusua	12	2	10	0.6	0.1-8.6
Total Talimoro		60	12	48		
Grand Total		111	25	86		

Table 4. Prevalence of *Trichuris ovis* based on sex

Village	**Sex**	**Total Samples**	**Positive (+)**	**Prevalence (%)**	**95%CI**
	Bucks	25	6	24.0	9.4 to 45.1
Lauala	Does	26	7	26.9	11.6 to 47.8
Total Lauala		51	13	25.5	14.3 to 39.6
	Bucks	30	6	20.0	7.7 to 38.6
Talimoro	Does	30	6	20.0	7.7 to 38.6
Total Talimoro		60	12	20	10.8 to 32.3
Grand Total		111	25	22.5	15.1 to 31.4

Table 5. Odds ratio of prevalence of *Trichuris ovis* based on sex

Village	Sex	Total Samples	Positive (+)	Negative (-)	OR	95%CI
	Bucks	25	6	19	1	RF
Lauala	Does	26	7	19	1.2	0.3-4.1
	Bucks	30	6	24	1	RF
Talimoro	Does	30	6	24	1	0.3-3.5
Grand Total		111	25	86		

Based on sex, the prevalence of *T. ovis* in bucks and does are similar in both Lauala (25.5% (14.3 to 39.6%) and Talimoro villages [20.0% (10.8-32.3%)].

By using bucks as a reference factor for both Lauala and Talimoro, as shown in Table 4 above shows that all the 95% CI includes one, meaning the factor (sex) has no significant difference from the positive samples. It is also observed that none of the upper 95%CI for bucks and Does was less than 1 meaning none of the factors was considered a protective factor.

Table 6. Prevalence of T. ovis based on age group

Village	Age Group	Total Samples	Positive	Negative	Prevalence (%)	OR	95%CI
	0 to 3	17	4	13	23.5	1	23.5 to 76.5
	4 to 7	17	4	13	23.5	1	23.5 to 76.5
Lauala	8 to 12	17	5	12	29.4	1.4	29.4 to 70.6
Total Lauala		51	13		25.0		14.3 to 39.6
	0 to 3	20	5	15	25.0	3	25.0 to 75.0
	4 to 7	20	2	18	10.2	1	10.0 to 90.0
Talimoro	8 to 12	20	5	15	25.0	3	25.0 to 75.0
Total Talimoro		60	12		20.0		10.8 to 32.3
Grand Total		111	25	86	22.5		15.1 to 31.4

Table 7. Odds ratio of prevalence of T. ovis based on age group

Village	Age Group	Total Samples	Positive	Negative	OR	95%CI
	0 to 3	17	4	13	1.0	0.2-4.9
	4 to 7	17	4	13	1.0	RF
Lauala	8 to 12	17	5	12	1.4	0.3-6.3
	0 to 3	20	5	15	3.0	0.5-17.7
	4 to 7	20	2	18	1.0	RF
Talimoro	8 to 12	20	5	15	3.0	0.5-17.7
Grand Total		111	25	86		

Using the age group of 4 to 7 in both Lauala and Talimoro as reference factor (RF), as shown in Table 6, the odds ratio calculation shows that all the 95% CI includes one, meaning the factor (age group) has no significant difference to the positive samples. It is also observed that none of the upper 95%CI for age groups was less than 1 meaning none of the factors was considered a protective factor.

Discussions

The prevalence of *Trichuris ovis* in this study, which was 22.52 (95% CI: 15.1 to 31.4%, n=111) is lower than the finding of the previous study of *Trichuris ovis*' prevalence in Liquica municipality which was 38% (95%CI: 31.1%-45.3%, n=192) (Amaral, 2019). Nonetheless, both prevalences of *Trichuris ovis* in Liquica and Ermera municipalities are comparable to *Trichuris ovis'* prevalence reported in other tropical nations such as Pakistan, India, Egypt, and Malaysia, where prevalence rates range from 8.7% to 40.0% (Hassan *et al*., 2019; Ruhoollah *et al*., 2021; Yusof *et al*., 2016).

The severity of infection is proportional to the goat's age, with the most severe infections occurring in young goats aged between 4-6 months old (42.9% compared to older goats aged between 10 to 12 months old (3.1%) (Amaral, 2019). According to this author, this happens owing to the fact that the immunity of young animals is still developing. This is comparable to the findings of Gul & Tak (2016), who discovered that young animals (53.8%) had greater infection rates than adults (32.9%) (Gul & Tak, 2016).

There are 3 variables measured in this survey. These variables include site survey, sex, and age group. The result from the odds ratio calculation revealed that these variables or these factors have no significant difference in the samples being positive (Tables 2, 4 and 6).

Seasons influence the prevalence of *Trichuris ovis*. In our present study, the sample was collected during the month of November and December (was supposed to be the rainy season in Timor-Leste) but in 2020 when this study was conducted, there was no rain until the month of January. The other study of the same parasite in Liquica was conducted during the months of May, which is a rainy season, showed that the prevalence was higher [38% (95%CI: 31.1%-45.3%, n=192)] (Amaral, 2019) compared to the prevalence of *T. ovis* in the current study [22.52 (95%CI: 15.1 to 31.4%, n=111)]. This shows that the prevalence of *T. ovis* is higher in cool temperatures compared to hot temperatures. For example, Gul & Tak (2016) discovered in their study, that the maximum prevalence of *T. ovis* was in winter (59.37% and the lowest was in summer (30.6%) ($p = 0.009$).

In the present study, the prevalence is slightly higher in does [26.9 (11.6 to 47.8%)] in Lauala village but the prevalence was no difference in Talimoro village 20.0% (7.7 to 38.6%) for both bucks and does. This finding is similar to the finding of *T. ovis* prevalence in Srinagar District, India. In Srinagar District, the prevalence of *T. ovis* in does was higher (44.07%) than in bucks (38.9%), however, the difference is statistically negligible ($p > 0.05$).

It is common that younger animals have more risk of being infected with parasites compared to mature animals. The immunity of the host was responsible for the low amount of parasitism observed in mature animals. This is due to the fact that adults have developed an immunity level that increases with infection intensity and duration (Gul & Tak, 2016). In the current study, the prevalence of *T. ovis* in Lauala village was higher in the age group of

8-12 months old [29.4% (29.4 to 70.6%)]. In Talimoro village, however, the prevalence of *T. ovis* was higher in the age group of 0 to 3 months old and 8-12 months old, both with a prevalence of 25% (25.0 to 75.0%). This is in agreement with the finding that juvenile animals had a higher parasite prevalence (53.8%) than adults (32.9%) (Gul & Tak, 2016), however the samples from Gul & Tak (2016) was comparing the age of goats from 2 to 12 month old with those that are older (more than 1 year old) whereas in this study all samples were taken from young goats (one year old and under).

CONCLUSIONS

The results of the study show that *Trichuris ovis* was present in two villages of Ermera. The prevalence of *Truchuris ovis* in Lauala village was 25.5% (14.3-39.6%) and the prevalence of *T. ovis* in Talimoro was 20.0% (10.8-32.3%) with an overall prevalence of 22.52 (15.1 to 31.4%).

Timor-Leste is a newly independent nation. Despite the fact that its independence was proclaimed on November 28, 1974, its independence was only restored in 2002 owing to colonialism. As a result, there are few studies undertaken in the country, and hence less data on animal diseases are accessible. It is suggested that more research be done in other towns and with different livestock species to determine the presence of this worm.

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CONTRIBUTION STATEMENT

In this article, Acacio Cardoso Amaral acts as the main contributor and correspondence contributors, while Joana da Costa Freitas, Odinha Maria de Fátima Gusmão Viegas, and Cremilda Teodolinda Belo dos Santos as member contributors.

REFERENCES

Amaral, A. C. (2019). Prevalence of *Trichuris ovis* in local free range goats in municipality of Liquica, Timor-Leste. In S. Farram, D. M. da Silva, L. F. Soares, N. C. Mendes, C. Fernandes, M. B. Soares, U. Pinto, H. Loney, R. L. William, C. N. Nabais, & M. Leach (Eds.), *Understanding Timor-Leste* (pp. 162–167). Unpublsihed.

Bulbul, K., Akand, A., Hussain, J., Parbin, S., & Hasin, D. (2020). A brief understanding of Trichuris ovis in ruminants. International Journal of Veterinary Sciences and Animal Husbandry, 5(3), 72-74.

Cannon, R. M. (1982). Livestock disease surveys: a field manual for veterinarians. Australian government publishing service.

Gul, N., & Tak, H. (2016). Prevalence of *Trichuris spp*. in small ruminants slaughtered in Srinagar District (J&K). Journal of Parasitic Diseases, 40(3), 741-744.

Hassan, N. M., Farag, T. K., Abu El Ezz, N. M., & Abou-Zeina, H. A. (2019).

Prevalence assessment of gastrointestinal parasitic infections among goats in Giza Governorate, Egypt. Bulletin of the National Research Centre, 43(1), 1-7.

Kahn, H. A., & Sempos, C. T. (1989). Statistical methods in epidemiology (Vol. 12). Monographs in Epidemiology and. Oxford University Press.

O'Connor, A. M. (2019). Interpretation of Odds and Risk Ratios A.M. *Journal of Veterinary Internal Medicine*, *40*(12), 1290–1293. Unpublished.

Ruhoollah, Khan, W., Al-Jabr, O. A., Khan, T., Khan, A., El-Ghareeb, W. R., Aguilar-Marcelino, L., Hussein, E. O. S., Alhimaidi, A. R., & Swelum, A. A. (2021). Prevalence of gastrointestinal parasite in small ruminants of District Dir Upper Khyber Pakhtunkhwa Province of Pakistan. *Brazilian Journal of Biology*, *83*(e248978), 1–5.

Sheskin, D. J. (2003). *Handbook of parametric and nonparametric statistical procedures*. Chapman & Halucrc New York.

Wallis, S. (2013). Binomial confidence intervals and contingency tests: mathematical fundamentals and the evaluation of alternative methods. Journal of Quantitative Linguistics, 20(3), 178-208.

Yusof, A. M., & Isa, M. L. M. (2016). Prevalence of gastrointestinal nematodiasis and coccidiosis in goats from three selected farms in Terengganu, Malaysia. Asian Pacific Journal of Tropical Biomedicine, 6(9), 735-739.

Zainab, T., & Khan, W. (2016). Morphological and histopathological studies of *Trichuris ovis* in goat intestine. J. Parasit. Dis. Diag. Ther, 1, 122-129.