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Prevalence of Gastrointestinal Parasites of Goats in the Humid Climate of Puducherry

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ABSTRACT

The study was carried out in various regions of Puducherry to determine the prevalence of gastrointestinal parasites in goats from September to December 2022. A total of 200 fecal samples, collected from 18 villages in and around Puducherry were analyzed and results revealed that 171 (85.5%) were sampled positive for gastrointestinal (GI) parasitic infection. The incidence of *strongyle* was highest with an average of 61% from all the samples collected. The parasitic infection was significantly higher in adults (31.5%) than in young ones (14%). Sex-wise analysis revealed a higher infection percentage in females (74.2%) than in males (25.7%). Lack of awareness of deworming and poor management had a major impact on helminth infection in the Puducherry region.

HIGHLIGHTS

- GI parasites among small ruminants were prevalent in varying intensities.
- It is suggested that farmers adopt these practices to improve productivity.
- Field veterinarians should assist with strategic deworming to control GI parasites.

Keywords: Gastrointestinal parasites, helminths, prevalence, goat, Puducherry

Goats are the earliest ruminants to be domesticated (Brunson *et al*., 2020). Goats are good meat producers for consumption in view of its short generation intervals and there is no religious restriction associated with their meat consumption. Goat meat (chevon) rich source of protein and can help in the elimination of protein malnutrition among consumers (Mideksa *et al*., 2016). GI helminth infection is a major constraint in the production of small ruminants of both small and large-scale farming in rural areas of India. GI parasites cause high mortality and lead to a consequential overall economic loss (Sharma *et al*., 2020). GI parasites are common in goats in subtropical and tropical areas of the world. The abundant availability of intermediate hosts, followed by the browsing habits of animals make the goat more susceptible to GI infection till its death. It is known that more than 90% of goats get helminth infection in any stage of their life span (Singh *et al*., 2017). A large number of GI parasites especially *strongyles* are predominantly responsible for poor production, ill health, and death. Environmental factors like temperature, rainfall, and humidity play a significant role in the survival of pre-parasitic stages in the rainy season (Velusamy *et al*., 2015).

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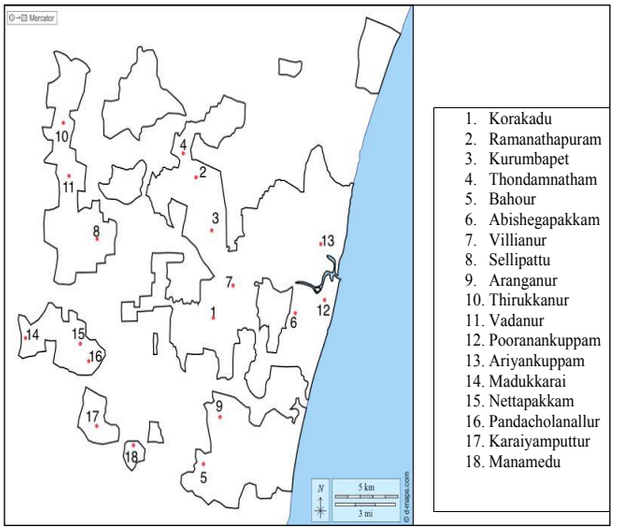
MATERIALS AND METHODS

Study area

The study was conducted in and around the Puducherry district of Union Territory (UT) Puducherry, which stands at an elevation of 3 m (10 ft) above sea level and is located very close to the east coast surrounded by Tamil Nadu state. Puducherry UT covers an area of 293 square kilometers (113.12 sq mt), and has a very hot summer season every year with mercury levels usually rising to 40ºC during April to June which is typically dry with a clear sky. The rainy season is from July to October extending to December with an annual average rainfall of 1050 millimeters (41.3 inches) from the northeast monsoon (Weather and Climate, 2021). The winter is notable from November to March. The temperature never comes below 20ºC.



Study population and study period

In the present study, 200 goat fecal samples were collected from 18 villages (Korkadu, Ramanathapuram, Kurumbapet, Thondamanatham, Bahour, Abishegapakam, Villianur, Sellipattu, Aranganur, Thirukkanur, Vadanur, Pooranankuppam, Ariyankuppam, Madukkarai, Nettapakkam, Pandacholanallur, Karaiyamputtur, Manamedu) managed under an unorganized farming system which were suffering from dullness, inappetence, diarrhea from September to December 2022 rainy season.

Collection and examination of samples

A questionnaire was prepared for the incidence of GI parasites (helminths) infection of goats in terms of various factors like species, age, sex, and type of management practice. Fecal samples were collected directly from the rectum of goats of different ages (6 months to 4 years) at weekly intervals and transported to the Department of Veterinary Parasitology RIVER for further processing. The samples were examined by direct, flotation and sedimentation techniques as well as quantitatively (Stoll's method) as per the technique of Foreyt (2013). Samples not being examined on the same day were stored at refrigerated temperature (4ºC) for next-day examination.

Direct technique

In direct smear examination, a small amount of feces was mixed with normal saline solution and placed on a slide overlapped with cover glass and examined under low power objective lens (10X).

Flotation technique

The fecal samples were suspended in the saturated salt solution and egg oocysts were floated following Willi's technique in a glass tube keeping a slide on top for 10 minutes and the parasitic load was determined by low power objective lens (10X) (Hendrix *et al*., 2022).

Sedimentation technique

Taken 1-2 g of fecal material was homogenized by mortar and pestle in 10-15 ml of distilled water, filtered through the sieve and contents were centrifuged at 2000 rpm for 2 mins. The sediment was examined under low power objective lens (10X).

Stoll's method

Three grams of feces is taken in a test tube, fill the tube up to 45 ml with N/10 NaOH, and added 10-12 glass beads. Close it with a stopper and homogenize the fecal material. 0.15 ml of the suspension is drawn with a pipette and placed on a slide and a cover slip is applied, count the total number of eggs. Multiply the number of eggs by 100, which gives the eggs per 1 gram of feces (Nielsen *et al*., 2022).

The egg per gram (EPG) was estimated by Stoll's method:

$$EPG = \text{eggs counted} \times \frac{\text{Total volume (ml)}}{\text{Examined volume} \times \text{weight of feces}}$$

Prevalence was calculated as the percentage of positive samples in the total number of samples examined. Apart from the overall prevalence (i.e. the infection with any GI parasite) in each goat flock, the prevalence was also calculated for each parasite type, formed by animal species and breed, study site, agro-ecological zone, and farm management type.

RESULTS

Fecal examination revealed 171 samples were positive for GI helminth infection (85.5%) out of 200 samples collected from goats from 18 villages in and around Puducherry. Of various parasitic infections the maximum infection was of *strongyle* (61%) followed by *Coccidia* (53.5%), *Trichuris* spp (12%), *Amphistome* (25.5%), *Moniezia* spp (17%), *Strongyloides* spp (9.5%). As many as 61 (30.5%) samples showed mixed parasitic infection.

Range of EPG values in subclinical GI parasites in goats at different villages of Puducherry

EPG values (Table 2) are taken from some villages based on there heavy infection. The highest EPG count is in Abishegapakkam and Ramanathapuram followed by Thirukkanur.

Rainy season prevalence

In goats infection observed was 93% in the rainy season. Heavy rainfall and high relative humidity predispose to heavy parasitic infections (Raman *et al*., 2015). A higher rate of infection in rainy months may also be allocated

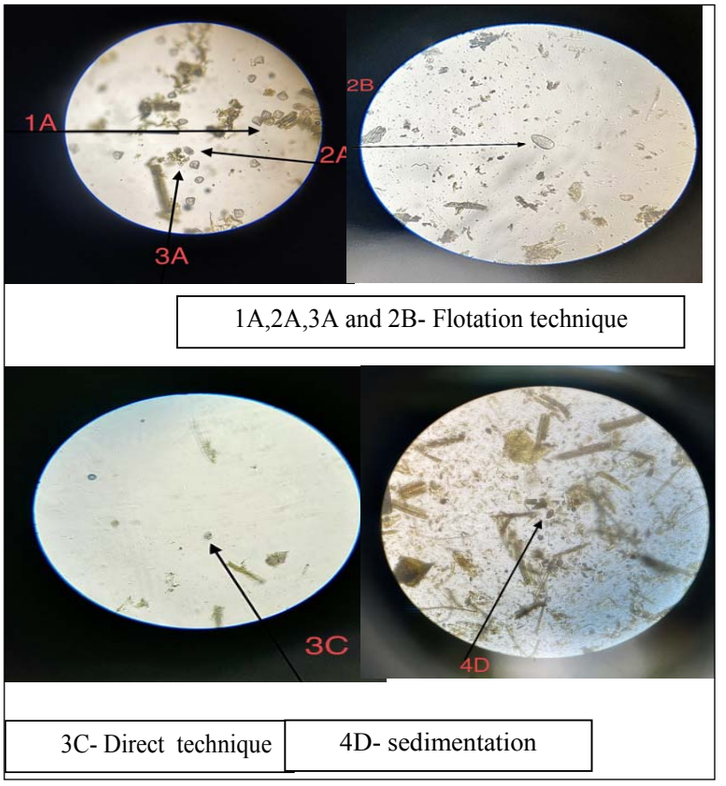


Fig. 1: Examination of fecal samples for the parasites by floatation technique. **(1A)** *Moniezia* spp; **(2A)** *Strongyle* spp.; **(3A)** *Coccidia;* **(2B)** *Amphistomes;* **(3C)** *Strongyloides* spp.; **(4D)** *Trichuris* spp. Magnification: 10X

Table 1: Village-wise prevalence of GI parasites in goats of Puducherry

Sl. No.	Villages	Number of samples examined	Positive samples (%)			Total positive samples (%)
			Single parasitic infection*	Dual parasitic infection**	Mixed parasitic infection***	
1	Korkadu	10	5(50)	4(40)	0	9(90)
2	Ramanathapuram	10	5(50)	2(20)	1(10)	8(80)
3	Kurumbapet	10	5(50)	4(40)	1(10)	10(100)
4	Thondamanatham	13	2(15.3)	5(38.4)	1(7.69)	8(61.5)
5	Bahour	12	1(8.33)	4(33.3)	5(41.6)	10(83.3)
6	Abishegapakkam	10	0	2(20)	8(80)	10(100)
7	Villianur	11	0	2(18.1)	8(72.7)	10(90.9)
8	Sellipattu	10	0	3(30)	7(70)	10(100)
9	Aranganur	10	1(10)	0	8(80)	9(90)
10	Thirukkanur	10	2(20)	7(70)	1(10)	10(100)
11	Vadanur	13	1(7.69)	3(23)	7(53.8)	11(84.6)
12	Pooranankuppam	10	5(50)	2(20)	3(30)	10(100)
13	Ariyankuppam	10	1(10)	6(60)	3(30)	10(100)
14	Madukkarai	11	3(27.2)	5(45.4)	0	8(72.7)
15	Nettapakkam	10	1(10)	5(50)	3(30)	9(90)
16	Pandacholanallur	12	0	7(58.3)	3(25)	10(83.3)
17	Karaiyamputtur	14	3(21.4)	6(42.8)	1(7.14)	10(71.4)
18	Manamedu	14	3(21.4)	5(35.7)	1(7.14)	9(64.2)
Total		**200**	**38**	**72**	**61**	**171**

* *Strongyle, Amphistomes, Coccidia, Strongyloides;* **Strongyle + Coccidia, Strongyle + Amphistomes, Trichuris + Strongyle, Amphistomes + Eimeria; ****Mixed parasitic infections contain more than two parasites viz. Strongyle + Strongyloides + Coccidia, Strongyle + Coccidia + Amphistomes, Strongyle + Coccidia + Strongyloides* + Amphistome, Strongyle + Coccidia + *Strongyloides* + *Moniezia* + *Trichuris.*

Table 2: Egg per gram in goats of Puducherry

Sl. No.	Villages	Range of EPG value sub-clinical	Mean ±SE
1	Vadanur	2200-3600	2933.3±405.5
2	Thirukkanur	3200-4000	3533.3±240.3
3	Aranganur	2000-3600	2733.3±466.6
4	Kurumbapet	1000-2600	1866.6±466.6
5	Ramanathapuram	2600-4400	3200±600
6	Abishegapakkam	3200-4800	4200±503.3
7	Bahour	1800-4200	3200±721.1
8	Korkadu	2800-3800	3300±499.9
9	Thirukkanur	1800-2600	2266.6±240.3
10	Ariyankuppam	2200-2600	2386.3±348.6
11	Pandacholanallur	2300-2800	2546.6±116.2
12	Manamedu	1200-3800	2533.3±751.2

to suitable molarity of salt present in soil which is an important factor for ecdysis (Moiloa, 2017). Such climatic conditions also help in bacterial multiplication, providing nutrition to free-living larvae. It was found evident that *strongyle* was the dominant species affecting the goat flocks. Next to it, the goats are affected with the *Coccidia*, *Amphistomes*, *Moniezia* spp, *Trichuris* spp, and *Strongyloides* spp. The results of Gastrointestinal parasites during the rainy season are summarized in Table 3.

Table 3: Incidence of GI parasites in the rainy season

GI parasite	Total no of positive samples	Positive %
Strongyle	122	61%
Coccidia	107	53.5%
Amphistomes	51	25.5%
Moniezia spp	34	17%
Trichuris spp	24	12%
Strongyloides spp	19	9.5%

Age-wise prevalence

When analyzed for age-wise prevalence of GI parasites in goats (Table 4) the prevalence noted was 14% in kids (age group I), 36% in young (age group II), 33.3% in young adults (age group III) and 31.5% in adult age (age group IV). From the table, it be assessed that there is a significant difference in the prevalence rate of parasitic infection among age group I than age group II, III, IV. The highest infection of GI helminth was found in the age group of (2-3 years). *Strongyle* infection (18.5%) was found more in the adults (age group IV) followed by *Coccidia*, *Amphistomes*, and *Strongyloides* spp. Dual infections were found more prevalent in age group IV (48.1) and the lowest in age group I. Mixed type of infection was found more prevalent in age group III (47.3%) and lowest in the age group I.

Sex-wise prevalence

The total affected population was 171. The overall prevalence of GI infection indicated that, the infection occurs more frequently in females as compared to males (Table 5). The respective percent infection noted were 44 (25.7%) in males and 127 (74.2%) in females. Fecal samples revealed that the highest incidence of *Strongyle* infection was observed in females than males, followed by *Coccidia* and *Amphistomes, Strongyloides* Spp infection (1.57%) is only observed in females. Dual type (46.4%) of infection was found more in females than males. A mixed type (38.6%) of infection was found more in males and females (Table 5).

DISCUSSION

The analysis of fecal samples revealed that out of 200 samples collected 171(85%) were positive for single or mixed GI parasitic infection. These are in line with the findings of (Biu *et al*., 2021). The high parasitic prevalence may be attributed to poor farm management Eg: poor nutrition, poor deworming and availability of susceptible host. However high rates of infection throughout the year in goats were reported by previous workers (Kanyari *et al*., 2017). The majority of the goat are tethered on farmlands as a result of this most of the animals are re-infected due to pasture contamination as they graze in a confined region village wise, single parasitic infection was higher in Korkadu, Ramanthapuram, Kurumbapet,

Table 4: Age-wise prevalence of GI parasites in Puducherry

Age	Infected						Total number of samples positive
	Strongyle	Amphistomes	Eimeria	Strongyloides	Dual infection	Mixed infection	
Age group I	6 (26.8%)	2 (8.69%)	1 (4.34%)	0	10 (43.4%)	5 (21.7%)	24 (14%)
Age group II	4 (11.1%)	1 (2.7%)	1 (2.7%)	0	15 (41.6%)	15 (41.6%)	36 (21%)
Age group III	7 (12.2%)	0	1 (1.7%)	1 (1.7%)	21 (36.8%)	27 (47.3%)	57 (33.3%)
Age group IV	10 (18.5%)	1 (1.8%)	2 (3.7%)	1 (1.8%)	26 (48.1%)	14 (25.9%)	54 (31.5%)
Total	**27**	**4**	**5**	**2**	**72**	**61**	**171**

Age group I- 0-1 year, age group II- 1-2 years, age group III- 2-3 years, age group IV- 3-5 years.

Table 5: Sex-wise prevalence of GI Parasites in Puducherry

Sex	Total	Helminth infection						Overall incidence
		Strongyle	***Amphistomes***	***Coccidia***	***Strongyloides spp***	**Dual infection**	**Mixed infection**	
Male	59	4 (9.09%)	2 (4.5%)	3 (6.81%)	0	18 (40.9%)	17 (38.6%)	44 (25.7%)
Female	141	19 (14.9%)	3 (2.36%)	2 (1.57%)	2 (1.57%)	59 (46.4%)	42 (33%)	127 (74.2%)
Total	**200**	**23**	**5**	**5**	**2**	**65**	**59**	**171**

Poornankupam. While the dual infection was high in Thirukkanur, Pandancholanllur and multiple infections having more than three parasites were high in Villianur, Abhishekapakam, Vadanur. The high incidence of single infection in Korkadu, Ramanthapuram, Kurumbapet, and Poornankupam is due to the fact that infected animals were reared on the intensive grazing system. This statement agreed with the seasonal prevalence of GI parasites in goats of Jammu by Khajuria *et al.* (2013).

The seasonal occurrence of parasitic infection in small ruminants delineates higher infection of helminths in the rainy season. The findings are in consistent with the various published reports (Velusamy *et al*., 2015; Gaherwal *et al*., 2016). The reason for the higher prevalence in the rainy season could be due to the fact that favorable climate conditions like temperature, humidity etc are related to the availability of larvae on seasonal pasture contamination Gaherwal *et al*. (2016). Singh *et al*. (2017) reported that cold stimulus is responsible for the arrested development of larvae.

Strongyle was the most common parasite recorded in our findings with an average percentage of 61% which was in agreement with (Gebeyehu *et al*., 2013). This may be due to the fact that *Strongyle* nematodes are a large group of parasites comprising of *Trichostrongylus, Haemonchus, Mecistocirrus*, etc. Incidence of *Amphistomes* and *Coccidia* are almost equal in our findings. *Strongyloides* spp is the lowest in our findings which is in collaboration with the findings of Ahmed *et al*. (2017).

During the present study, it was found the overall prevalence of parasitic infection was significantly higher in females than males Mushonga *et al*. (2018). The physiological peculiarities of the female animals usually constitute stress factors thus reducing their immunity to infections and being lactating mothers, females happen to be weak and malnourished as a result of which they are more susceptible to infections besides some other reasons (Mir *et al*., 2013). The incidence of *Strongyle* infection in females (14.9%) was more than males (9.09%).

Adults are significantly more prone to parasitic infection with a prevalence rate of 57% than young ones. In our findings, the highest prevalence of GI parasites is found in the age group 2-3 years, Which is in general agreement with Kosar *et al*., (2017), and the lowest incidence in the age group below 1 year because young animals are less susceptible to parasitic infections due to less exposure to grazing, our findings were in accordance with Emiru *et al*. (2013).

CONCLUSION

From the above findings, it was observed that the infections of GI parasites among small ruminants were prevalent in varying intensities. Infected animals should not be allowed to graze on a particular grazing area continuously for several weeks. It is concluded that better management practices and rearing of animals will improve the control conditions coupled with regular deworming. Farmers should be encouraged to adopt this to improve productivity. If this change becomes a practice, large economic gains can be achieved and goat farming can be looked forward as a profitable business venture. Field veterinarians should assist farmers in strategic deworming with broad-spectrum anthelmintics.

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REFERENCES

Ahmed, J., Duguma, A., Regassa, D., Belina, D. and Jilo, R. 2017. Gastrointestinal nematode parasites of small ruminants

and anthelmintics efficacy test in sheep of Haramaya District, Eastern Ethiopia. *Anim. Vet. Sci.*, **5**(3): 39-44.

Biu, A.A., Maimunatu, A., Salamatu, A.F. and Agbadu, E.T. 2021. A fecal survey of gastrointestinal parasites of ruminants on the University of Maiduguri Research Farm. *Int. J. Bio. Hea. Sci.,* **5**(4).

Brunson, K., Lele, R., Xin, Z., Xiaoling, D., Hui, W., Jing, Z. and Flad, R. 2020. Zooarchaeology, ancient mtDNA, and radiocarbon dating provide new evidence for the emergence of domestic cattle and caprines in the Tao River Valley of Gansu Province, northwest China. *J. Arc. Sci.,* **31**: 102262.

Emiru, B., Amede, Y., Tigre, W., Feyera, T. and Deressa, B. 2013. Epidemiology of gastrointestinal parasites of small ruminants in Gechi District, Southwest Ethiopia. *Adv. Bio. Res*., **7**(5): 169-174.

Foreyt, W.J. 2013. Veterinary parasitology reference manual. John Wiley & Sons.

Gaherwal, S., Prakash, M.M. and Dudwe, J. 2016. Prevalence and incidence of nematodes in goats at five different villages of Barwani district (MP). *Int. J. Adv. Res*., **4**(1): 1126-1137.

Gebeyehu, E.B., Seo, M.G., Jung, B.Y., Byun, J.W., Oem, J. G., Kim, H.Y. and Kwak, D. 2013. Prevalence of gastrointestinal parasites in Korean native goats. *J. Anim. Plant Sci*., **23**(4): 986-989.

Raman, M., Pandian, A.S.S. and Manikkavasagan, I. 2015. Impact of climatological parameters on prevalence of gastrointestinal helminths of small ruminants in Tamil Nadu. *J. Agromet.*, **17**(2): 256-258.

Hendrix, C.M. and Robinson, E.D. 2022. Diagnostic parasitology for veterinary technicians-E-book. *Elsevier Health Science.*

Kanyari, P.W.N., Kagira, J.M. and Mhoma, R.J. 2017. Prevalence and intensity of endoparasites in small ruminants kept by farmers in Kisumu Municipality, Kenya.

Khajuria, J.K., Katoch, R., Yadav, A., Godara, R., Gupta, S.K. and Singh, A. 2013. Seasonal prevalence of gastrointestinal helminths in sheep and goats of middle agro-climatic zone of Jammu province. *J. Para. Dis.,* **37**(1): 21-25.

Kosar, S., Afshan, K., Salman, M., Rizvi, S., Naseem, A. A., Firasat, S. and Qayyum, M. 2017. Prevalence and risk factors associated with intestinal parasitic infections among schoolchildren in Punjab, Pakistan. *Trop. Biomed.,* **34**: 770-780.

Mideksa, S., Mekonnen, N. and Muktar, Y. 2016. Prevalence and burden of nematode parasites of small ruminants in and around Haramaya University. *World. Appl. Sci. J.*, **34**(5): 644-651.

Moiloa, M.J. 2017. Gastrointestinal parasites of Angora goats in Lesotho.

Mir, M.R., Chishti, M.Z., Majidah, R., Dar, S.A., Katoch, R., Khajuria, J.K. and Rasool, R. 2013. Incidence of gastrointestinal nematodosis in sheep of Jammu. *Trends. Parasitol. Res.,* **2**(1): 1-4.

Mushonga, B., Habumugisha, D., Kandiwa, E., Madzingira, O., Samkange, A., Segwagwe, B.E. and Jaja, I.F. 2018. Prevalence of *Haemonchus contortus* infections in sheep and goats in Nyagatare District, Rwanda. *J. Vet. Med.*, 2018.

Nielsen, M.K. 2022. Parasite faecal egg counts in equine veterinary practice. *Equ. Vet. Edu.*, **34**(11): 584-591.

Singh, E., Kaur, P., Singla, L.D. and Bal, M.S. 2017. Prevalence of gastrointestinal parasitism in small ruminants in western zone of Punjab, India. *Vet. World*, **10**(1): 61.

Singh, R., Bal, M.S., Singla, L.D. and Kaur, P. 2017. Detection of anthelmintic resistance in sheep and goat against fenbendazole by faecal egg count reduction test. *J. Para Dis.*, **41**: 463-466.

Sharma, D.K., Paul, S. and Gururaj, K. 2020. Gastrointestinal helminthic challenges in sheep and goats in afro-asian region: a review. *J. Anim. Res.*, **10**(1): 1-18.

Velusamy, R., Rani, N., Ponnudurai, G. and Anbarasi, P. 2015. Prevalence of intestinal and haemoprotozoan parasites of small ruminants in Tamil Nadu, India. *Vet. World*, **8**(10): 1205.