RESEARCH ARTICLE

Seasonal Prevalence and Determinants of Gastrointestinal Parasitism in Goats of Indore District: A Comprehensive Epidemiological Study

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Abstract

Gastrointestinal (GI) parasitism is a major challenge affecting goat health and productivity, particularly in developing regions where goats are vital for the livelihoods of marginal farmers and landless laborers. This study investigated the prevalence and associated determinants of GI parasitism in goats from four blocks of Indore district, Madhya Pradesh, during the summer and monsoon seasons of 2024. A total of 312 fecal samples were analyzed using flotation, sedimentation, and the McMaster method, while coproculture was employed to recover infective larvae. Statistical analysis revealed significant associations between GI parasitism and factors such as season, age, sex, breed, rearing system, body condition, and farmer practices. The findings underscore the importance of targeted control strategies and farmer education to mitigate the burden of GI parasitism in goats.

Keywords: Gastrointestinal parasitism, Goats, Epidemiology, Coproculture.

Ind J Vet Sci and Biotech (2025): 10.48165/ijvsbt.21.2.20

Introduction

Goats, often regarded as the "poor man's cow," play a pivotal role in the livelihoods of millions, particularly in developing nations. Renowned for their adaptability, goats have historically been domesticated for food, clothing, and economic sustenance. With a global population exceeding 1 billion, the majority of goats are reared in Asia and Africa. India alone accounts for approximately 148 million goats, with 13.42% utilized for chevon production (DHAD, 2019). These animals significantly contribute to the economy, providing a reliable source of income for smallholder farmers and landless laborers. Despite their resilience, goats are susceptible to various parasitic diseases, notably gastrointestinal (GI) parasitism, which adversely affects their productivity. GI parasites impair growth, reproduction, and milk yield while leading to economic losses through morbidity and mortality (Sanyal, 1996). Given the socioeconomic importance of goats and the detrimental effects of parasitism, understanding the prevalence and associated risk factors of GI parasites is crucial for devising effective control strategies. This study aims to evaluate the prevalence of GI parasitism in goats reared in the Indore district of Madhya Pradesh, India, while investigating seasonal, demographic, and management-related determinants influencing the occurrence of these infections.

Materials and Methods

The study was conducted in the Indore district of Madhya Pradesh (India), covering four blocks: Depalpur, Indore, Mhow, and Sanwer. A total of 312 fecal samples were collected from goats during the summer and monsoon seasons (April to September 2024). Fecal samples, consisting of 3-5 pellets, were obtained via rectal palpation or freshly voided feces using gloved hands. They were preserved in disposable plastic zip-lock bags containing 10% formalin for morphological studies, while additional samples for copro-culture were collected without preservatives and stored in labeled bags. The samples were processed using qualitative and quantitative parasitological techniques. Qualitative analysis for parasitic eggs was carried out using floatation and sedimentation methods according to Soulsby (1982), while the McMaster egg-counting method was used for quantitative analysis to determine fecal egg count (FEC). Copro-culture was performed on strongyle egg-positive samples to identify infective third-stage larvae (L3) following the method of Roberts and O'Sullivan (1949). The relationship between the prevalence of gastrointestinal parasites and

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How to cite this article: Solanki, H., Agrawal, V., Shakya, M., Jayraw, A. K., Jatav, G. P., & Jamra, N. (2025). Seasonal Prevalence and Determinants of Gastrointestinal Parasitism in Goats of Indore District: A Comprehensive Epidemiological Study. Ind J Vet Sci & Biotech, 21(2), 98-102.

Source of support: Nil

Conflict of interest: None

Submitted 09/01/2025 **Accepted** 22/01/2025 **Published** 10/03/2025

various risk factors, including season, age, sex, breed, flock size, rearing system, physiological condition, body condition score, and farmer practices, was analyzed using the Chi-square test. The analysis also considered factors such as farmers' education level, use of anthelmintics, and knowledge about anthelmintic administration, with results evaluated to determine statistically significant associations.

Results and Discussion

Determinants and Epidemiological Patterns of Gastrointestinal Parasitism in Goats

Among the 312 fecal samples analyzed, 169 were found positive for gastrointestinal (GI) parasites, indicating an Table overall prevalence of 54.16%. Strongyle species were the most prevalent (26.28%), followed by *Eimeria* spp. (23.07%), amphistomes (14.42%), *Trichuris* spp. (5.44%)**,** *Strongyloides* spp. (1.60%)**,** *Moniezia* spp. (1.28%)**,** *Fasciola* spp. (0.96%)**,** and *Schistosoma* spp. (0.64%)**.**

Seasonal variations significantly influenced GI parasitism ($p<0.05$), with the highest prevalence recorded during the monsoon (60.25%), significantly exceeding the prevalence observed in the summer (48.07%). The favorable monsoon conditions, characterized by high humidity and moderate temperatures, facilitate parasite transmission through enhanced larval survival and availability of intermediate hosts, as reported by Soulsby (1982) and Katoch *et al*. (1998).

Sex-wise analysis revealed that males exhibited a higher prevalence (58.82%) compared to females (51.90%), though the difference was not statistically significant ($p>0.05$). This trend aligned with studies highlighting androgen-induced immunosuppression in males versus estrogen-mediated immune enhancement in females (Tariq *et al.,* 2008; Nabi *et al*., 2014).

Age-wise, adults had a higher prevalence (57.50%) compared to kids (43.05%), with *Eimeria* **s**pp. being the dominant parasite in younger animals (Table 1). This difference may be attributed to increased exposure to contaminated pastures among adults, corroborating findings by Shakya *et al.* (2017) and Bhowmik *et al.* (2020).

Geographic variations in prevalence were significant ($p<0.05$), with Mhow reporting the highest prevalence (69.23%), followed by Indore (52.56%), Depalpur (48.71%), and Sanwer (47.43%). These differences likely reflect environmental and management factors. Rearing systems also significantly influenced GI parasitism ($p<0.05$), with extensive systems recording the highest prevalence (61.05%), followed by intensive (60.00%) and semi-intensive systems (43.58%) (Table 2). The higher prevalence in extensive systems is consistent with findings by Magona and Musisi (2002), likely due to increased exposure to environmental contamination.

Breed-specific prevalence revealed significant differences ($p<0.05$), with Jamunapari goats showing the highest prevalence (65.59%), followed by Barberi (55.69%), Sirohi (52.45%), and Beetle (40.50%) (Table 3). These variations suggest breed-specific susceptibility and differences in management practices, as observed by Chauhan et al. (2011). Goats with poor body condition exhibited a significantly higher prevalence (60.81%) compared to those with normal body condition (48.17%)($p<0.05$). Poor health increases susceptibility to parasitic infections, consistent with findings by Taylor *et al.* (2007).

Table 1: Seasonal, sex-wise, and age-wise prevalence of gastrointestinal parasites in goats

Variable		No. examined	Positive (%)	Strongyle (%)	Eimeria (%)	Amphistomes (%)	Trichuris (%)	Strongyloides (%)	Moniezia (%)	Fasciola (%)	Schistosoma (%)	p-value
Season	Summer	156	75 (48.07)	35 (22.43)	33 (21.15)	20 (12.82)	6 (3.84)	2 (1.28)	1 (0.64)	0 (0.00)	0 (0.00)	0.04*
	Monsoon	156	94 (60.25)	47 (30.12)	39 (25.00)	25 (16.02)	11 (7.05)	4 (2.56)	2 (1.28)	1 (0.64)	2 (1.28)	
Sex	Female	210	109 (51.90)	54 (25.71)	46 (21.90)	30 (14.28)	12 (5.71)	3 (1.42)	2 (0.95)	1 (0.47)	1 (0.47)	0.30 (NS)
	Male	102	60 (58.82)	28 (27.45)	26 (25.49)	15 (14.70)	5 (4.90)	2 (1.96)	2 (1.96)	1 (0.98)	1 (0.98)	
Age	Adult	240	138 (57.50)	75 (31.25)	49 (20.41)	40 (16.66)	15 (6.25)	4 (1.66)	3 (1.25)	2 (0.83)	2 (0.83)	0.04*
	Kid (≤6M)	72	31 (43.05)	7 (9.72)	23 (31.94)	5 (6.94)	2 (2.77)	1 (1.38)	2 (2.77)	0 (0.00)	0 (0.00)	

Table 2: Geographic and rearing system-wise prevalence of gastrointestinal parasites in goats

Variable		No. examined	Positive (%)	Strongyle (%)	Eimeria (%)	Amphistomes (%)	Trichuris (%)	Strongyloides (%)	Moniezia (%)	Fasciola (%)	Schistosoma (%)	p-value
Area	Depalpur	78	38 (48.71)	18 (23.07)	12 (15.38)	5 (6.41)	3 (3.84)	1 (1.28)	2 (2.56)	0 (0.00)	0 (0.00)	0.02**
	Mhow	78	54 (69.23)	18 (23.07)	23 (29.48)	17 (21.79)	4 (5.12)	2 (2.56)	0 (0.00)	1 (1.28)	1 (1.28)	
	Indore	78	39 (50.00)	15 (19.23)	22 (28.20)	15 (19.23)	4 (5.12)	1 (1.28)	1 (1.28)	2 (2.56)	1 (1.28)	
	Sanwer	78	38 (48.71)	31 (39.74)	15 (19.23)	8 (10.25)	6 (7.69)	1 (1.28)	1 (1.28)	0 (0.00)	0 (0.00)	
Rearing System	Semi-intensive	117	51 (43.58)	27 (23.07)	26 (22.22)	8 (6.83)	3 (2.56)	2 (1.70)	0 (0.00)	0 (0.00)	1 (0.85)	0.01*
	Intensive	100	60 (60.00)	26 (26.00)	20 (20.00)	2 3 (23.00)	4 (4.00)	2 (2.00)	2 (2.00)	3 (3.00)	1 (1.00)	
	Extensive	95	58 (61.05)	29 (30.20)	26 (27.36)	1 4 (14.73)	10 (10.52)	1 (1.05)	2 (2.10)	0 (0.00)	0 (0.00)	

Table 3: Breed-wise and body condition-wise prevalence of gastrointestinal parasites in goats

Variable		No. examined	Positive (%)	Strongyle (%)	Eimeria (%)	Amphistomes (%)	Trichuris (%)	Strongyloides (%)	Moniezia (%)	Fasciola (%)	Schistosoma (%)	p-value
Breed	Beetle	79	32 (40.50)	17 (21.51)	10 (12.65)	12 (15.18)	3 (3.79)	2 (2.53)	1 (1.26)	1 (1.26)	1 (1.26)	0.012*
	Barberi	79	44 (55.69)	22 (27.84)	17 (21.51)	9 (11.39)	4 (5.06)	2 (2.53)	1 (1.26)	2 (2.53)	0 (0.00)	
	Sirohi	61	32 (52.45)	18 (29.50)	16 (26.22)	8 (13.11)	5 (8.19)	1 (1.63)	1 (1.63)	1 (1.63)	0 (0.00)	
	Jamunapari	93	61 (65.59)	25 (26.88)	29 (31.18)	16 (17.20)	5 (5.37)	0 (0.00)	1 (1.07)	1 (1.07)	0 (0.00)	
Body Condition	Poor (<2)	148	90 (60.81)	46 (31.08)	37 (25.00)	26 (17.56)	8 (5.40)	2 (1.35)	3 (2.02)	2 (1.35)	1 (0.67)	0.034*
	Normal (2-4)	164	79 (48.17)	36 (21.95)	35 (21.34)	19 (11.58)	9 (5.48)	3 (1.82)	0 (0.00)	2 (1.21)	1 (0.60)	

Pregnant females showed the highest prevalence (55.88%), followed by lactating (53.12%) and non-pregnant females (50.00%). Among males, non-breeding individuals exhibited a higher prevalence (60.00%) compared to breeding males (54.54%)(Table 4). Stress-induced immunosuppression during pregnancy and lactation likely contributes to these differences, as noted by Mir *et al.* (2013). Medium-sized flocks recorded the highest prevalence (55.61%), followed by small (54.73%) and large flocks (46.15%), though these differences were not statistically significant ($p>0.05$), suggesting that management practices likely play a greater role than flock size in determining parasite burdens.

Higher prevalence of gastrointestinal (GI) parasites was observed in goats owned by illiterate farmers or those not administering anthelmintics ($p<0.05$) (Table 5), emphasizing the critical role of farmer education and awareness of parasite management in controlling infections, as reported by Kantzoura *et al.* (2012).

Distribution of Strongyle Genera in Goats

Haemonchus spp. was the most prevalent strongyle genus (75.26%), followed by *Oesophagostomum* spp. (9.13%), *Strongyloides* spp. (8.06%), *Trichostrongylus* spp. (5.37%), and *Cooperia* spp. (2.15%). This distribution highlights the pathogenic significance of *Haemonchus* spp., consistent with Khajuria *et al.* (2013) and Tomar *et al.* (2022).

Intensity of Gastrointestinal Parasites in Indore District

Egg/cyst per gram (EPG/CPG) analysis revealed the highest values for strongyles (2282 ± 222) and *Eimeria* spp. (2276 ± 215), while *Strongyloides* spp. and *Trichuris* spp. exhibitedlower

intensities. These findings emphasize the health and productivity impacts of strongyles and *Eimeria* spp. (Cardoso *et al.,* 2012).

Table 4: Flock size-wise and physiological condition-wise prevalence of gastrointestinal parasites in goats

Variable		No. examined	Positive (%)	Strongyle (%)	Eimeria (%)	Amphistomes (%)	Trichuris (%)	Strongyloides (%)	Moniezia (%)	Fasciola (%)	Schistosoma (%)	p-value
Flock Size	Small (0-5)	95	5 (54.73)	25 (26.31)	25 (26.31)	12 (12.63)	7 (7.36)	1 (1.05)	2 (2.10)	2 (2.10)	0 (0.00)	0.55 (NS)
	Medium (6-20)	178	99 (55.61)	49 (27.52)	34 (19.10)	29 (16.29)	8 (4.49)	4 (2.24)	2 (1.12)	2 (1.12)	3 (1.68)	
	Large (>20)	39	18 (46.15)	8 (20.51)	13 (33.33)	4 (10.25)	2 (5.12)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	
Physiological Condition	Lactating Female	64	34 (53.12)	17 (26.52)	9 (14.06)	11 (17.18)	4 (6.25)	2 (1.78)	0 (0.00)	0 (0.00)	1 (1.56)	0.81 (NS)
	Pregnant Female	34	19 (55.88)	10 (29.41)	5 (14.70)	8 (23.52)	2 (5.88)	1 (1.56)	0 (0.00)	0 (0.00)	0 (0.00)	
	Non-Lactating Female	112	5 6 (50.00)	27 (24.10)	32 (28.57)	11 (9.82)	6 (5.35)	0 (0.00)	2 (1.78)	1 (0.89)	1 (0.89)	

Table 5: Prevalence of gastrointestinal parasites in goats based on farmer education level, anthelmintic usage, and knowledge of GI parasites

Factor	Criteria	Number of Goats Examined	Number of Infected Goats	Prevalence (%)	p-value
Farmer education level	Illiterate	73	48	65.75	0.03*
	Literate	239	121	50.62	
Anthelmintic use	No	186	113	60.75	0.007**
	Yes	126	56	44.44	
Knowledge of GI parasites	Lack of Knowledge	180	109	60.55	0.011*
	Awareness	132	60	45.45	

Conclusions

The study highlighted a high prevalence of gastrointestinal parasitism in goats from Indore district, with significant variations linked to environmental, physiological, and management factors. The summer and monsoon seasons, along with specific goat characteristics such as age, sex, breed, and body condition, emerged as critical determinants influencing the parasitic burden. Additionally, inadequate knowledge of anthelmintic use among farmers exacerbated the problem. The application of qualitative and quantitative diagnostic methods provided robust data to assess the epidemiological burden of parasitism. These findings emphasize the need for integrated parasite control programs, including seasonal monitoring, strategic anthelmintic administration, and farmer education for improving goat health, enhancing productivity, and ensuring the socioeconomic sustainability of goat farming.

Acknowledgements

The authors wish to express their sincere gratitude to the Dean, College of Veterinary Science and Animal Husbandry, Mhow, for their invaluable support. Special thanks are also extended to the farmers of Indore district for their cooperation and participation in this study.

References

Bhowmik, M., Hossein, M.A., Mamun, M.A., Hasıb, F., Poddar, S., Hossain, M.A., & Alim, M.A. (2020). Prevalence of gastrointestinal parasitic infections in sheep and goats of Sandwip Island, Chattogram, Bangladesh. *Van Veterinary Journal, 31*(3), 152-157.

Cardoso, C.P., Cardozo, L.L., Silva, B.F.D., & Amarante, A.F.T.D. (2012). Gastrointestinal parasites in goats from Monte Castelo, Santa Catarina, Brazil. *Revista Brasileira de Parasitologia Veterinária, 21*(2), 148-150.

Chauhan, K.K., Rout, P.K., Das, G., Singh, S.K., Shukla, S.N., & Roy, R. (2011). Susceptibility to natural gastrointestinal nematode

infection during different physiological stages in goats and sheep in the semi-arid tropics. *International Journal of Livestock Production, 2*(1), 166-171.

DHAD (2019). 20th livestock census online. Retrieved from https://.nic.in/documents/ statistics/livestock-census.

Kantzoura, V., Kouam, M.K., Theodoropoulou, H., Feidas, H., & Theodoropoulos, G. (2012). Prevalence and risk factors of gastrointestinal parasitic infections in small ruminants in the Greek temperate Mediterranean environment. *Open Journal of Veterinary Medicine, 2*(1), 25-33.

Katoch, R., Mittra, S., Agnihotri, R.K., & Sharma, A.K. (1998). Winter strongyloidosis in sheep and goats at high altitude, a sporadic occurrence in Himachal Pradesh. Indian *Veterinary Journal, 75*(4), 361-362.

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

Magona, J.W., & Musisi, G. (2002). Influence of age, grazing system, season, and agro-climatic zone on the prevalence and intensity of gastrointestinal strongylosis in Ugandan goats. *Small Ruminant Research, 44*(3), 187-192.

Mir, M.R., C.M.Z., Rashid, M., D.S.A., Katoch, R., K.J.K., Mehraj, M., D.M.A., & Rasool, R. (2013). Incidence of gastrointestinal nematodosis in sheep of Jammu. *Young, 117*(62), 52-99.

Nabi, H., Saeed, K., Shah, S.R., Rashid, M.I., Akbar, H., & Shehzad, W. (2014). Epidemiological study of gastrointestinal nematodes of goats in district Swat, Khyber Pakhtunkhwa, Pakistan. *Science International, 26*(1), 283-286.

Roberts, F.H.S., & Sullivan, P.J.O. (1949). Methods for egg counts and larval cultures for strongyles infesting the gastrointestinal tract of cattle. *Australian Journal of Agricultural Research, 1*, 99-103.

Sanyal, P.K. (1996). Gastro-intestinal parasites and small ruminant production in India. In: L.F. Lejambre & M.R. Knox (Eds.), *Sustainable Parasite Control in Small Ruminants*. Australian Centre for International Agricultural Research Proceedings, *74,* 9-112.

Shakya, P., Jayraw, A.K., Jamra, N., Agrawal, V., & Jatav, G.P. (2017). Incidence of gastrointestinal nematodes in goats in and around Mhow, Madhya Pradesh. *Journal of Parasitic Diseases, 41*, 963-967.

Soulsby, E.J. (1982). *Helminths, Arthropods and Protozoa of Domesticated Animals*. 7th edn., Bailliere Tindall, London, UK, pp. 71-790.

Tariq, K.A., Chishti, M.Z., Ahmad, F., & Shawl, A.S. (2008). Epidemiology of gastrointestinal nematodes of sheep managed under traditional husbandry system in Kashmir valley. *Veterinary Parasitology, 158*(1-2), 138-143.

Taylor, M., Coop, R., & Wall, R. (2007). *Veterinary Parasitology.* 3rd edn., Blackwell Publishing, Oxford, pp. 58-93.

Tomar, S.S., Jayraw, A.K., Jatav, G.P., Agrawal, V., Shakya, M., & Jamra, N. (2022). Prevalence of gastrointestinal nematodes in goats of Indore district of Madhya Pradesh. *Veterinary Practitioner, 23*(20), 383-386.