



Prevalence of Gastrointestinal Parasitic infections in Goats in Western Uttar Pradesh, India

Ramakant¹, Tarun Kumar Sarkar², Amit Kumar Verma³, Prem Sagar Maurya⁴, Vipul Thakur⁵, Arbind Singh^{6*}, Shriya Rawat⁷, Gulab Chandra⁸, Pankaj Kumar Maurya⁹ and Sachin Gautam¹⁰

¹Ph. D. Scholar, Department of Veterinary Medicine, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

²Professor, Department of Veterinary Medicine, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

³Professor and Head, Department of Veterinary Medicine, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

⁴Associate Professor, Department of Veterinary Parasitology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

⁵Assistant Professor, Department of Veterinary Medicine, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

⁶Assistant Professor, Department of ILFC, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

⁷Assistant Professor, Department of Veterinary Public health and Epidemiology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

⁸Assistant Professor, Department of Veterinary Physiology and Biochemistry, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

⁹Ph. D. Scholar, Department of Veterinary Physiology and Biochemistry, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

¹⁰Ph. D. Scholar, Department of Animal Nutrition, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India

*Corresponding Author: Arbind Singh, Assistant Professor, Department of ILFC, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology Meerut, India.

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Abstract

Gastrointestinal parasite in goat caused huge financial losses due to reduction in productivity and health challenges globally. The present study was conducted to determine the prevalence of gastrointestinal parasites in goats in Western Uttar Pradesh. A total of 1117 faecal samples of goats were collected and examined for gastrointestinal parasitic infestations during the period from March 2023 to February 2024. The faecal samples were examined using 10x and 40x objectives lenses of compound microscope by direct faecal wet smears, flotation, sedimentation and modified Ziehl-Neelsen (MZN) staining technique to detect the eggs/ova/larvae/cysts and trophozoites. The overall prevalence of gastrointestinal parasites infections in goats were recorded 70.55%. Total of nine gastrointestinal parasitic eggs (*Fasciola* spp., *Strongyle* spp., *Trichuris* spp., *Strongyloides* spp., *Amphistome* spp., *Moniezia* spp., *Eimeria* spp., *Giardia* spp. and *Cryptosporidium* spp.) were detected in goats during faecal examinations in current study. The highest prevalence of gastrointestinal parasites was recorded in Barbari breed of goat (39.97%) followed by Jamunapari goat (36.93%), Non descript goat (12.18%) and lowest in Sirohi goat (10.91%). The highest prevalence of gastrointestinal parasites reported in age group of 1 -2 years (50.51%) followed by in age group of > 2 years (33.88%) and the lowest one was in < 1 year age group (15.61%). The prevalence of gastrointestinal parasites rate was higher in females (83.88%) in comparison to males (16.12%). The highest

prevalence rate of gastrointestinal parasites were observed during rainy season (47.59%), followed by in summer season (33.63%), and the lowest one during winter season (18.78%). Gastrointestinal parasitism in goat was relatively high in the study area, the development of suitable treatment and control strategies should be suggested to improve the productivity losses.

Keywords: Goat; Prevalence; Gastrointestinal Parasites; Faecal Sample

Introduction

Goat rearing notably contributes to the efficient utilization of land and socioeconomic development both in developed and developing nations of the world [1]. Goats need small funds for investment, obtain maturity quickly, grow rapidly and adapt to similar environmental conditions in comparison to cattle [2]. Goats can moreover adjust to the harsh tropical environment and conveniently be reared on useless land where cattle rearing are not much economical [3].

Parasitism could be a challenge to the health and production of animal around the world resulting in significant financial losses [4]. Goats are commonly suffering from gastrointestinal parasites, resulting in significant financial losses due to mortality and decreased body weight gain in infected animals [5]. The development of GI parasitic infections is impacted by factors of host like sex, age, body conditions along with physiological status [6] and parasitic factors like species of worm and intensity of the population [7].

Goats are susceptible to various gastrointestinal helminths and protozoa. Coccidiosis caused by coccidian parasites of the genus *Eimeria*, prevails predominantly in various parts of the world, either clinically or subclinically and responsible to enteric disease, particularly in young or stressed goats under poor farm management conditions, leading to high mortality in kids [8].

Goats infected with gastrointestinal parasites were exhibited several clinical signs depending upon the species of parasites consisting anorexia, diarrhea and loss of body weight, weakness, rough hair coat, cough, oedema and anaemia [9]. Parasitic infections have negative effect as direct losses associated to acute illness, losses of valuable germplasm, damage of tissues and organs, condemnation of the carcass, cost of transportation, treatment and moreover indirect losses, consisting of reduction in productive potentials, like declined growth rate, weight loss in young growing animals and delay in attainment of puberty age [10]. Gastrointestinal parasites have become progressively challenging in the management of gastrointestinal parasitism in small ruminants due to rising in the resistance against the several anthelmintics [11]. Over the past few decades, controlling of these parasitic diseases depends on anthelmintic drugs. Indiscriminate use of anthelmintic created the alarming situation across the world due to development of re-

sistance [12]. Knowledge on the species specific prevalence of the gastrointestinal parasites can provide baseline data which can be used for designing of effective and sustainable control of economically important parasitic diseases of small ruminants [13]. However, knowledge of prevalence study of gastrointestinal parasitic infection in goats is scanty from these areas. Keeping in view the importance of gastrointestinal parasitism in goat's current study was designed to determine the prevalence of gastro internal parasites in Western Uttar Pradesh, India.

Materials and Methods

- **Ethical Approval:** This study design was approved by Institutional Animal Ethics Committee (IAEC), Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.), India by a vide letter no. of IAEC/SVPUAT/2022/125 dated on 03/12/2022.
- **Study area:** The samples were collected from 4 districts namely Meerut, Baghpat, Saharanpur and Muzaffarnagar) of Western Uttar Pradesh of India (Table 1 and Figure 1).
- **Study period:** This study was carried out during the period from of March 2023 to February 2024.

S. No.	Animal	Districts	No. of collected samples
1.	Goat	Meerut	312
2.	Goat	Baghpat	300
3.	Goat	Saharanpur	248
4.	Goat	Muzaffarnagar	257

Table 1: Total number of samples collected.



Figure 1: Map showing sample collection districts.

Collection of faecal sample

A total of 1117 faecal samples were randomly collected in goat from different parts of the targeted 4 districts such as Meerut, Baghpat, Saharanpur and Muzaffarnagar, which are situated in the Western region of Uttar Pradesh, India. Fresh faecal samples were collected directly from the rectum of goat using lubricated disposable gloves. Separate gloves were used to prevent potential cross-contamination between faecal samples. The gross examination of faecal samples was done for colour, consistency, odour and for presence of larvae and adult worms. At the time of sample collection breed, age, sex and month were also recorded for each animal. From each goat 10 to 20 gram of faeces was collected. Immediately after collection faecal samples were put in clean labeled plastic bags and kept in icebox and carried to the laboratory of Department of Veterinary Parasitology, SVPUAT Meerut to examine the parasitic eggs/ova/larvae/cysts and trophozoites. Samples were processed and analyzed on the same day. However, in the cases where faecal samples could not be analyzed on the same day, they were kept at 2 to 4°C in a refrigerator until further analysis the next day. The faecal samples were examined using 10x and 40x objectives lenses of compound microscope (Nikon Eclipse E200, Tokyo, Japan) by direct faecal wet smears, flotation, sedimentation and modified Ziehl-Neelsen (MZN) staining technique to detect the eggs/ova/larvae/cysts and trophozoites. The diagnostic stages of the parasites were identified from their unique morphological characters [14]. The age of goat was estimated by dental examination. Age of goats were classified as young (< 1 year), 1-2 years and more than 2 years. The year is divided into 3 seasons such as winter, summer and rainy.

Faecal examination

- **Direct wet smear method:** A small quantity of faeces is placed on a slide, mix it gently with a few drops of tap water and spread it evenly to get a translucent film on the slide. Then kept a coverslip over it and examined under the microscope.
- **Faecal flotation method:** Flootation method was performed for determining the eggs of nematode and cestode well as coccidian oocysts. For this method, 5 gram of faecal sample was thoroughly mixed in 50 ml of saturated solution of common salt in mortar and pestle after that, strained through a sieve to remove the coarse faecal material. Then the mixture was placed in 15ml tube in order to form convex surface at the top of the tube and gently placed a coverslip over on it and allowed to stand for 30 minutes and then gently take over the coverslip and kept on slide in order to touch the lower surface of coverslip to slide [14].

- **Sedimentation method:** Sedimentation method was performed for determining the presence and absence of eggs of trematode. For this method, 5 gram of faecal material was mixed in 200 ml of tap water in mortar and pestle and after homogenization and filtrations the mixture poured into a conical bottom of urinary flask. Then allow stand for 30 min. after that supernatant fluid was discarded in single swift action and again refilled the urinary flask with water likewise performed two to three times until the colour of sediment become colorless. This step was repeated three to five times until the supernatant fluid was clear and lastly few drops of sediment taken on slide and a coverslip was put on it and examination was performed under a microscope [14].
- **Cryptosporidium spp.:** Direct faecal smears were prepared on clean grease-free glass slides for detection of *Cryptosporidium* spp. oocysts and stained by the modified Ziehl-Neelsen (MZN) staining technique [15] for confirmation. In short, smears were dried in air, then fixed with absolute methanol for the duration of 5 min. after that smears were transiently passed over a flame and kept on staining rack. Strong carbol fuchsin poured on smears and allowed to stay for 40 min. The slide were then washed under running tap water for 2-5 min, decolourised with 10% H₂SO₄ for fraction of second and then washed again under running tap water. Counter staining were performed with 5% malachite green for 2-5 min and then washed under running tap water for 5 min. After drying, the smears were screened under ×40 and ×100 objectives of microscope for the presence of *Cryptosporidium* oocysts.
- **Giardia spp.:** *Giardia* spp. was identified by direct faecal wet smears method [16]. In briefly, approximately 2 mg for individual faecal samples were mixed with few drop of normal saline solution and then put one drop of lugol's iodine after that cover slip was kept gently on slide and then examined under light microscopy.

Statistical analysis

The collected data were analyzed using IBM SPSS version 20. Descriptive statistics were used to determine the prevalence of the parasites and were statistically analyzed using simple statistical methods such as percentage and chi-square test.

Results

Examinations of faecal samples revealed the prevalence of gastrointestinal parasitic infections in goats of Western Uttar Pradesh, India, throughout the year. A total of 1117 faecal samples were examined and out of these 788 samples were found positive for gas-

Total samples examined	No. of positive	No. of negative	Prevalence (%)
1117	788	329	70.55%

Table 2: The overall prevalence of gastrointestinal parasites.

trointestinal parasites in goats. The overall prevalence of gastrointestinal parasites infections in goats were 70.55% (Table 2). The examinations of faecal samples of goats revealed the presence of several types of gastrointestinal parasites.

The parasitic eggs were identified on the basis of their distinguishing characteristics. A total of nine gastrointestinal parasitic eggs (*Fasciola* spp., *Strongyle* spp., *Trichuris* spp., *Strongyloides* spp., *Amphistome* spp., *Moniezia* spp., *Eimeria* spp., *Giardia* spp. and *Cryptosporidium* spp.) were detected in goats during faecal examinations of goat in current study (Figure 2).

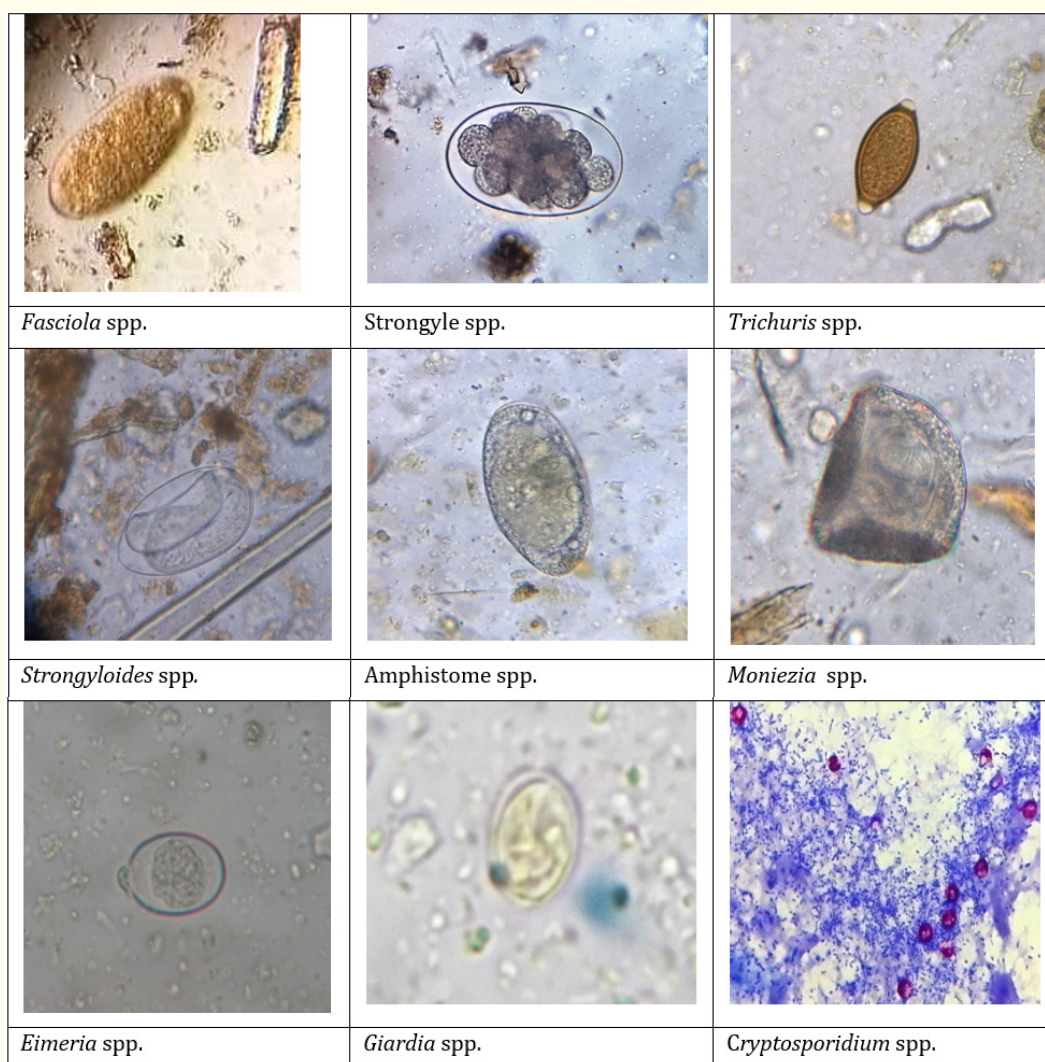


Figure 2: Parasitic eggs detected in the faecal samples of goats by microscopic examinations.

Breed wise prevalence of gastrointestinal parasites

The highest prevalence of gastrointestinal parasites was recorded in Barbari breed of goat (39.97%) followed by Jamunapari goat (36.93%), non descript goat (12.18%) and lowest in Sirohi goat (10.91%) (Figure3). In the Barbari breed of goat the highest prevalence rate was recorded of *Strongyle* spp. (46.03%) followed by *Eimeria* spp. (40.0%), *Moniezia* spp. (3.49%), *Trichuris* spp. (2.86%),

Amphistome spp. (2.86%), *Fasciola* spp. (2.54%) *Strongyloides* spp. (0.95%), and lowest in *Giardia* spp. (0.63%) and *Cryptosporidium* spp. (0.63%) (Table3). In the Jamunapari breed of goat highest prevalence rate was recorded of *Strongyle* spp. (48.11%) followed by *Eimeria* spp. (35.74%), *Moniezia* spp. (4.47%), *Amphistome* spp. (4.12%), *Fasciola* spp. (3.09%), *Trichuris* spp. (2.75%), *Strongyloides* spp. (0.69%), *Cryptosporidium* spp. (0.69%) and lowest in

(0.34%) (Table3). In the Sirohi breed of goat the highest prevalence rate was recorded of *Eimeria* spp. (40.70%) followed by Strongyle spp. (22.09%), Amphistome spp. (12.79%), *Fasciola* spp. (8.14%), *Trichuris* spp. (6.98%), *Moniezia* spp. (4.65%), *Cryptosporidium* spp. (2.33%) and lowest in *Strongyloides* spp. (1.16%) and *Giardia*

spp. (1.16%) (Table 3).In the Non-Descript breed of goat highest prevalence rate was recorded of Strongyle spp. (38.54%) followed by *Eimeria* spp. (35.42%), *Trichuris* spp. (7.29%), Amphistome spp. (5.21%), *Moniezia* spp. (3.13%), *Giardia* spp. (3.13%), *Fasciola* spp. (3.09%) and lowest in *Strongyloides* spp. (1.04%) and *Cryptosporidium* spp. (1.04%) (Table 3).

Parasites	Goat				χ^2 Value
	Barbari (315)	Jamunapari (291)	Sirohi (86)	Non Descript (96)	
<i>Fasciola</i> spp.	2.54 (8)	3.09 (9)	8.14 (7)	3.09 (5)	6.90
Strongyle spp.	46.03 (145)	48.11 (140)	22.09 (19)	38.54 (37)	19.77***
<i>Trichuris</i> spp.	2.86 (9)	2.75 (8)	6.98 (6)	7.29 (7)	7.21
<i>Strongyloides</i> spp.	0.95 (3)	0.69 (2)	1.16 (1)	1.04 (1)	0.25
Amphistome spp.	2.86 (9)	4.12 (12)	12.79 (11)	5.21 (5)	15.24**
<i>Moniezia</i> spp.	3.49 (11)	4.47 (13)	4.65 (4)	3.13 (3)	0.67
<i>Eimeria</i> spp.	40.0 (126)	35.74 (104)	40.70 (35)	35.42 (34)	1.70
<i>Giardia</i> spp.	0.63 (2)	0.34 (1)	1.16 (1)	3.13 (3)	6.72
<i>Cryptosporidium</i> spp.	0.63 (2)	0.69 (2)	2.33 (2)	1.04 (1)	2.41

Table 3: Breed wise prevalence (%) of gastro-intestinal parasites in goats.

Bracket value indicate number of positive animals.

χ^2 , Chi square; ***p < 0.001; **p < 0.01.

The prevalence of Strongyle spp. infections were highly significant (p < 0.001) in Barbari, Jamunapari, Sirohi and Non Descript of goats. The prevalence of Amphistome spp. infections were significant (p < 0.01) in Barbari, Jamunapari, Sirohi and Non-Descript of goats.

spp. (2.44%), Amphistome spp. (0.81%) and lowest in *Fasciola* spp. (0.0%) (Table 4).In the 1-2 year age group the highest prevalence rate was recorded of Strongyle spp. (42.46%) followed by *Eimeria* spp. (31.91%), Amphistome spp. (8.29%), *Fasciola* spp. (5.78%), *Trichuris* spp. (5.53%), *Moniezia* spp. (3.52%) *Strongyloides* spp. (1.51%), *Cryptosporidium* spp. (0.75%) and lowest in *Giardia* spp. (0.25%) (Table 4).In the >2 year age group highest prevalence rate was recorded of Strongyle spp. (61.80%) followed by Amphistome spp. (8.24%), *Trichuris* spp. (7.12%), *Fasciola* spp. (5.78%), *Moniezia* spp. (4.12%), *Strongyloides* spp. (3.37), *Eimeria* spp. (3.37%), *Cryptosporidium* spp. (0.37%) and lowest in *Giardia* spp. (0.0%) (Table 4).

The prevalence of *Fasciola* spp., Strongyle spp., *Eimeria* spp., *Giardia* spp. and *Cryptosporidium* spp. infections were highly significant (p < 0.001) in < 1 year, 1-2 year and in > 2 year age group of goats. The prevalence of Amphistome spp. infection was significant (p < 05) in < 1 year, 1-2 year and in > 2 year age group of goats.

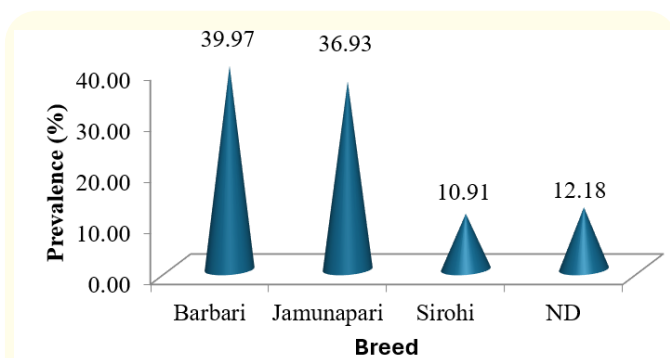


Figure 3: Breed wise prevalence (%) of gastrointestinal parasites in goats.

Age wise prevalence of gastro-intestinal parasites in goats

The highest prevalence of gastrointestinal parasites reported in age group of 1-2 years (50.51%) followed by in age group of > 2 years (33.88%) and the lowest was in < 1 year age group (15.61%) (Figure4). In the < 1 year age group highest prevalence rate was recorded of Strongyle spp. (37.40%) followed by *Eimeria* spp. (31.71%), *Trichuris* spp. (8.13%), *Giardia* spp. (7.32%), *Cryptosporidium* spp. (7.32%), *Moniezia* spp. (4.88%), *Strongyloides*

Sex wise prevalence

The prevalence of gastrointestinal parasites rate was higher in females (83.88%) in comparison to males (16.12%) (Figure 5). In the male the highest prevalence rate was recorded of Strongyle spp. (24.41%) followed by *Moniezia* spp. (17.32%), *Amphistome* spp. (14.96%), *Fasciola* spp. (12.60%), *Trichuris* spp. (11.81%), *Eimeria* spp. (8.66%), *Strongyloides* spp. (7.09%), *Cryptosporidi-*

Parasites	Goat			χ^2 Value
	<1 Year (123)	1-2 Year (398)	>2 Year (267)	
<i>Fasciola</i> spp.	0.0 (0)	5.78 (23)	5.78 (31)	19.24***
<i>Strongyle</i> spp.	37.40 (46)	42.46 (169)	61.80 (165)	30.77***
<i>Trichuris</i> spp.	8.13 (10)	5.53 (22)	7.12 (19)	1.33
<i>Strongyloides</i> spp.	2.44 (3)	1.51 (6)	3.37 (9)	2.50
<i>Amphistome</i> spp.	0.81 (1)	8.29 (33)	8.24 (22)	8.75*
<i>Moniezia</i> spp.	4.88 (6)	3.52 (14)	4.12 (11)	0.50
<i>Eimeria</i> spp.	31.71 (39)	31.91 (127)	3.37 (9)	82.95***
<i>Giardia</i> spp.	7.32 (9)	0.25 (1)	0.0 (0)	42.63***
<i>Cryptosporidium</i> spp.	7.32 (9)	0.75 (3)	0.37 (1)	28.99***

Table 4: Age wise prevalence (%) of gastrointestinal parasites in goats.

Bracket value indicates the number of positive animals.

χ^2 , Chi square; ***p < 0.001; *p < 05.

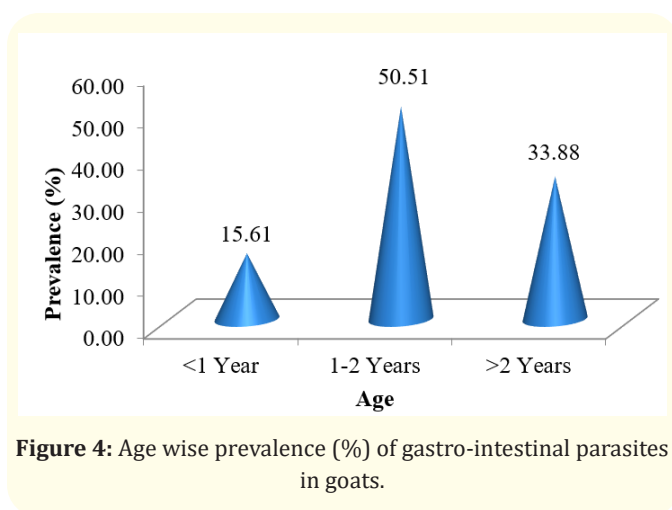


Figure 4: Age wise prevalence (%) of gastro-intestinal parasites in goats.

um spp. (1.57%) and lowest in *Giardia* spp. (1.00%) (Table 5). In the female the highest prevalence rate was recorded of *Strongyle* spp. (34.49%) followed by *Eimeria* spp. (29.80%), *Fasciola* spp. (12.60%), *Amphistome* spp. (8.17%), *Trichuris* spp. (7.72%), *Moniezia* spp. (7.41%), *Strongyloides* spp. (2.57%), *Cryptosporidium* spp. (1.97%) and lowest in *Giardia* spp. (1.36%) (Table 5).

The prevalence of *Moniezia* spp. and *Eimeria* spp. infections were highly significant (p < 0.001) in both male and female goat. The prevalence of *Strongyloides* spp. infection was significant (p < 0.01) in both male and female. The prevalence of *Fasciola* spp. and *Amphistome* spp. infections were significant (p < 05) in both male and female.

Parasites	Goat		χ^2 Value
	Male (127)	Female (661)	
<i>Fasciola</i> spp.	12.60 (16)	12.60 (43)	5.71*
<i>Strongyle</i> spp.	24.41 (31)	34.49 (228)	3.74
<i>Trichuris</i> spp.	11.81 (15)	7.72 (51)	2.33
<i>Strongyloides</i> spp.	7.09 (9)	2.57 (17)	6.81**
<i>Amphistome</i> spp.	14.96 (19)	8.17 (54)	5.85*
<i>Moniezia</i> spp.	17.32 (22)	7.41 (49)	12.76***
<i>Eimeria</i> spp.	8.66 (11)	29.80 (197)	24.51***
<i>Giardia</i> spp.	1.0 (2)	1.36 (9)	0.04
<i>Cryptosporidium</i> spp.	1.57 (2)	1.97 (13)	0.09

Table 5: Sex wise prevalence (%) of gastrointestinal parasites in goats.

Bracket value indicate number of positive animals.

χ^2 , Chi square; ***p < 0.001; **p < 0.01; *p < 05.

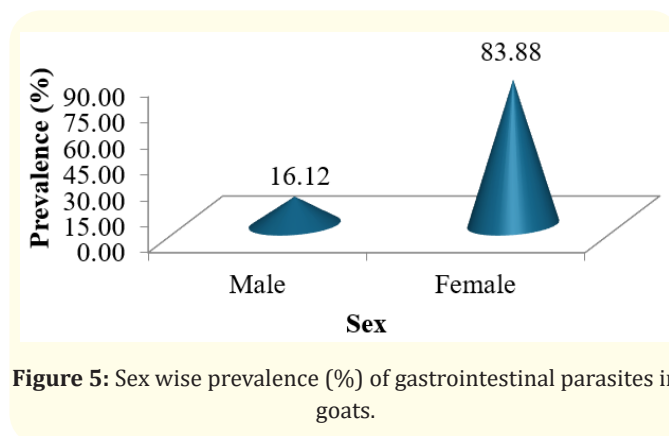


Figure 5: Sex wise prevalence (%) of gastrointestinal parasites in goats.

Season wise prevalence

The highest prevalence rate of gastrointestinal parasites were observed during rainy season (47.59%) followed by in summer season (33.63%), and the lowest during winter season (18.78%) (Figure6). In the winter season the highest prevalence rate was recorded of *Strongyle* spp. (36.49%) followed by *Eimeria* spp. (22.30%), *Fasciola* spp. (12.16%), *Trichuris* spp. (7.43%), *Moniezia* spp. (7.43%), *Cryptosporidium* spp. (4.73%), *Amphistome* spp. (4.05%), *Giardia* spp. (3.38%) and lowest in *Strongyloides* spp. (2.03%) (Table6). In the winter season the highest prevalence rate was recorded of *Strongyle* spp. (34.72%) followed by *Moniezia* spp. (21.89%), *Eimeria* spp. (20.38%), *Fasciola* spp. (8.30%), *Amphistome* spp. (6.79%), *Trichuris* spp. (5.28%), *Giardia* spp. (1.13%) and lowest in *Strongyloides* spp. (0.75%) and *Cryptosporidium* spp. (0.75%) (Table 6). In the rainy season the highest prevalence rate was recorded of *Strongyle* spp. (36.80%) followed by *Eimeria* spp. (26.13%), *Fasciola* spp. (8.26%), *Moniezia* spp. (7.73%), *Amphistome* spp. (5.60%), *Trichuris* spp. (4.80%), *Cryptosporidium* spp. (4.27%) and lowest in *Strongyloides* spp. (3.20%) and *Giardia* spp. (3.20%) (Table 6).

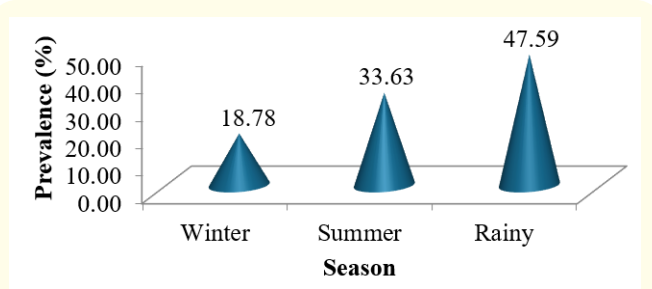


Figure 6: Season wise prevalence (%) of gastro-intestinal parasites in goats.

Parasites	Goat			χ^2 Value
	Winter (148)	Summer (265)	Rainy (375)	
<i>Fasciola</i> spp.	12.16 (18)	8.30 (22)	8.26 (31)	2.21
<i>Strongyle</i> spp.	36.49 (54)	34.72 (92)	36.80 (138)	0.31
<i>Trichuris</i> spp.	7.43 (11)	5.28 (14)	4.80 (18)	1.45
<i>Strongyloides</i> spp.	2.03 (3)	0.75 (2)	3.20 (12)	4.41
<i>Amphistome</i> spp.	4.05 (6)	6.79 (18)	5.60 (21)	1.34
<i>Moniezia</i> spp.	7.43 (11)	21.89 (58)	7.73 (29)	32.75***
<i>Eimeria</i> spp.	22.30 (33)	20.38 (54)	26.13 (98)	3.01
<i>Giardia</i> spp.	3.38 (5)	1.13 (3)	3.20 (12)	3.20
<i>Cryptosporidium</i> spp.	4.73 (7)	0.75 (2)	4.27 (16)	7.67*

Table 6: Season wise prevalence (%) of gastrointestinal parasites in goats.

Bracket value indicate number of positive animals.

χ^2 , Chi square; ***p < 0.001; *p < 05.

The prevalence of *Moniezia* spp. infection was highly significant (p < 0.001) in the winter, summer and rainy season. The prevalence of *Cryptosporidium* spp. infection was significant (p < 05) in the winter, summer and rainy season.

Discussion

In the present study, the prevalence of GI parasitic infections in goats was observed throughout the year. Occurrence of parasitic gastroenteritis is a common problem in sheep and goat in major

part of the world including India. The present study revealed overall prevalence of gastrointestinal parasites infection was 70.55% in goats. Similar prevalence was recorded in sheep and goats by the earlier researches [17]. The overall prevalence of gastrointestinal parasites was 74.66% recorded [18]. Several studies had previously reported the high prevalence of gastrointestinal parasites in goats from various regions of India. The overall prevalence of gastrointestinal parasite was recorded 94.48% in goats from Madhya Pradesh, India [19]. The overall prevalence of gastrointestinal parasite was recorded 85.22% in goats from Durg District, Chhattisgarh [20]. The probable reasons for variation in the prevalence of gastrointestinal parasites in goats due to the variations in number of goats faecal samples were examined, study period, climatic conditions such as humidity, rainfall temperature etc. of the area that boon the viability of infective stages of the parasites. The managemental practices, deworming schedule and accessibility of susceptible host [21], also the variations in goat husbandry practices and breed composition of goats from various parts have important role in regional disparity in occurrence of gastrointestinal parasites infection in goats [22].

The highest prevalence of gastrointestinal parasites was in Barbari breed of goat (39.97%) followed by Jamunapari (36.93%), Non-descript (12.18%) and lowest in Sirohi (10.91%). Overall Barbari goats were found comparatively more prone to the infection in comparison to Jamunapari, Sirohi and Non-descript in the current study. Various goat breeds were exhibited differences in the occurrence of gastrointestinal parasites infection [22]. The overall prevalence of gastrointestinal parasite in goats was recorded 48.93% in ND (Non-descript) and 52.89% in Osmanabadi goats from Marathwada region of Maharashtra [23]. The susceptibility of any breed to the gastrointestinal parasitic infection mostly is based on the genetic resistance of a specific breed and its adaptability with the existing environmental circumstances of the area [18]. The probable reasons in differences in prevalence of gastrointestinal parasitic infections in goats may be describes on the basis of breeds genetic differences and owing to variations in various management practices such as housing, feeding, watering, stocking rate, rearing

and adopted health control measures. Variations in climatic surroundings in a particular geographical area also play an important role [24].

The highest prevalence of gastrointestinal parasites reported in age group of 1-2 years (50.51%) followed by in age group of > 2 years (33.88%) and the lowest one was in < 1 year age group (15.61%). The current study revealed that the parasitic infections are highest in 1-2 years age group of goats in comparison to other age group. Similar findings were also observed by [25], reported a higher prevalence of gastrointestinal parasites infection in adult goats compared to young goats. The probable reasons for higher prevalence of gastrointestinal parasites infection in adult's goats may be due to big areas of grazing pastures accompanied by stress conditions such as transport, immune status and pregnancy. Young goats are less susceptible to parasitic infections for the reason that kids suckle their mothers till they attain adulthood, which check their exposure for grazing. This is in accordance with results reported [26].

In the present study, a higher prevalence of gastrointestinal parasites was observed in females (83.88%) in comparison to males (16.12%). Various researchers have reported prevalence of gastrointestinal parasites in goats in various breed and sex. Similar findings were reported various earlier researchers that prevalence of gastrointestinal parasites were higher in female goat in comparison to male goats [26-28]. The probable reasons for variations in susceptibility to infection of gastrointestinal parasites in goats between males and females may be due to several physio biochemical factors like gestation and lactation which may results into stress and reduction in immunity of body. Physiological conditions of female goats and lactating goat makes them deficient in nutrients, it makes them more susceptible against the infections due to lack of proper availability of sufficient and balanced nutrition against higher requirements. The prevalence of gastrointestinal parasites were reported same in both sex including males and females [29]. The probable reasons for this may be due provide same management systems for male and female goat. Some studies reported that there was no any effect of sex on the prevalence of gastrointestinal parasites in goats [30].

The highest prevalence rate of gastrointestinal parasites were observed during rainy season (47.59%) followed by in summer season (33.63%), and the lowest one during winter season (18.78%). Seasonal changes were highly affected the occurrence of intensity of parasites [31]. The present finding was in line with [32] who observed season wise prevalence of gastrointestinal parasitism in goats were highest during rainy season (34.92%) followed by cool (26.86%), hot (26.62%), and lowest in cold (20.39%) seasons.

The highest prevalence of gastrointestinal parasites in goat was in monsoon (94.60%), moderate in summer (87.50%) and minimum in winter (63.15%) [20]. Similar results were observed [3,19]. The highest prevalence gastrointestinal parasites were recorded in goats in monsoon season and minimum prevalence in summer season in their respective study area [33]. The probable reason for high occurrence of gastrointestinal parasites in goats during rainy season may be due to usefulness of this season for viability, growth and spreading of nematode larvae in the pasture, which results into occurrence of higher infection in the pasture during the grazing [19]. Incidence of intestinal parasitic infection was highest during rainy season can be correlated with the seasonal or climatic pattern and situations. This season gives the most favorable situations for herbage development in this area and the needed moisture is sustained on the grasslands. This may be reasons for higher occurrence of infections of gastrointestinal parasite in goat during the months of monsoon. The probable reason for the relatively decrease the prevalence of gastrointestinal parasites in goats during winter months can be due to low temperature and dry situations hamper the development and growth of eggs and larvae. Besides weather conditions, the self cure phenomenon was also responsible. Adverse environmental situations in winter seasons force mostly gastrointestinal parasites, like strongyles, to go through hypobiosis. Additionally, decreased grazing durations decrease the possibility of contact hours between the host and parasites, happen in a lower occurrence of parasites during winter seasons [24].

Current study observed that prevalence of Strongyle spp. was highest in comparison to other gastrointestinal parasites in goats. Various earlier researchers have found similar results [9,30]. The probably reasons for higher occurrence of Strongyle spp. may be due to that it consist of a enormous number of nematode species such as *Haemonchus*, *Trichostrongylus*, *Ostertagia*, *Oesophagostomum*, *Chabertia*, *Nematodirus* and *Cooperia*. The higher occurrence of strongyles, mostly *H. contortus*, can be due to its short generation interval and its capacity to reproduce rapidly if environmental situations are suitable.

In the current study the prevalence of *Eimeria* spp. was more. The similar findings were also reported by various previous researchers [34]. The reasons for higher prevalence of *Eimeria* spp. infections in goats may be owing to the distinct feature of the oocysts of *Eimeria* that may survive in utmost environmental situations in comparisons to helminth eggs [35]. This can be related with household, landholdings, which directly determine the level of management of livestock like hygiene proper available living space, and nutritional requirements [36].

In this study only one cestode, *Moniezia* spp. was found. The finding of this study was supported by earlier worker [37], who reported that *Moniezia* spp. was only cestodes observed in the goats. The prevalence this parasites varies 0.1- 40.34% in the goats reported by various earlier researchers [38,39]. The prevalence of *Moniezia* was recorded in all season but higher infections rates in rainy seasons (more than 50%) in goats in Benin [40].

In this study, only two species of trematode were found including *Amphistome* spp. and *Fasciola* spp. in goats. Several reports from various region of India in goats reported fasciolosis 9.25% in Maharashtra [3], 3.88-14.8% in Jammu and Kashmir [41]. The prevalence of fasciolosis in goats was highest during rainy season. They also observed that prevalence significantly higher in female goats in comparisons to males. The probable reasons for higher prevalence of *Fasciola* spp. prevalence in rainy season related to weather situations. This is due to that hatching of eggs of fluke and multiplication of snail, the intermediate host, needed suitable high rainfall and temperature (>10°C) [42].

The incidence of *Amphistome* spp. observed in several studies in India as high as 18.26 - 91% in goats [19,43]. Highest prevalence was reported during monsoon seasons and lowest during winter season in goats [19] and related it with most likely accessibility of intermediate host, the snails. One researchers reported higher prevalence of *Amphistome* spp. during summer in comparison to rainy season [44]. The prevalence of *Trichuris* spp. reported by various earlier researchers varies 0.6- 68.6% in goats [3,13,19]. The prevalence of *Trichuris* spp. was significantly higher in young animals in comparisons to adult's goat [45]. The prevalence of *Strongyloides* spp. in goats were observed 3.75-47% in India [3,43].

Cryptosporidium spp. prevalence in kids was recorded 3.5% [46]. In the present study, higher prevalence of *Cryptosporidium* spp. was recorded in females than males. The probable reason for higher prevalence of *Cryptosporidium* in kids may be due to the lower tolerance levels in kids due to their inexperienced immunological level. The low prevalence of infection with *Cryptosporidium* was probably due to that majority of samples was collected from adult goats [46]. The prevalence of *Giardia* spp. in goats globally ranges between 10 and 40%.

Conclusion

The present study revealed high prevalence of *Strongyles* spp. and *Eimeria* spp. are the most common gastrointestinal parasites among the goat. These parasites affect the goat in different age group, sex, breed and seasons. Parasitic infestations have adverse effects on goat productivity. Suitable farm management prac-

tices focus on prevention and control of gastrointestinal parasites among the goat rearing people. Knowledge related to prevalence of gastrointestinal parasites infection patterns caused by parasites is required in making a suitable control program and this is helpful in reduction in production losses.

Conflicts of Interest

The authors declare that there are no conflicts of interest among them.

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