

Prevalence Of Gastrointestinal Helminth Parasites In Domestic Ruminants From Srikakulam District, Andhra Pradesh, India.

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Abstract

Coprological studies on the prevalence of gastrointestinal helminth (GI) parasites in domestic ruminants from Srikakulam district of Andhra Pradesh, India, were carried out for a period of one year from January 2019 to December 2019. Fecal examination was done using direct smear, sedimentation and floatation methods. Altogether 3,527 fecal samples were examined including 595 from cows, 485 from buffaloes, 1342 from sheep and 1105 from goat. Out of 3,527 fecal samples examined, 1084 were found to be positive with three groups of gastrointestinal parasites (GI) showing an overall prevalence of 30.7%. Maximum infection was noted with nematodes (39.1%) and trematodes (37.3%), least infection was noted with cestodes (3.5%) and mixed infections were found to be moderate (20.01%). Host wise prevalence of parasitic infection has shown highest in the case of cattle recording 43.03%, followed by 40.8% in buffaloes, 29.4% in sheep, and 21.4% in goats. Total six varieties of parasites were recorded, the predominant being *Haemonchus* (Strongyle group) (29.25%), followed by *Paramphistomum* (25.5%), *Fasciola* (11.9%), *Strongyloides* (7.6%), *Moniezia* (3.5%) and *Trichuris* (2.2%). Season wise data on prevalence showed, high rate of infection in summer season (32.0%) when compared to winter (30.2%) and rainy (29.9%) seasons. Further studies are needed to design a rational for sustainable management of GI parasite infections in domestic animals of local regions.

Introduction

India possesses a rapidly growing animal husbandry sector which is striving hard to attain self-sufficiency in the production of livestock products (Dhama et al., 2013). The census report of livestock population for the year 2019, has shown an increase in the livestock population in India by 4.6% from 512 million in 2012 to about 536 million in 2019 (DAHD Report, 2019). Parasitic infections have been a serious constrain to health and productivity of livestock including cattle, sheep and goats (Mahusoon, et al., 2004). The frequent contamination of aquatic and terrestrial bodies with parasite eggs and larvae has made the task of controlling these infections in veterinary animals a big challenge both in developing and developed countries. These infections are also responsible for considerable economic loss by way of decreased milk yield, reduced weight, severe debilitation and morbidity in livestock, besides causing major health problems in domestic animals (Swarnakar et.al.,2015). GI helminth infections with various groups of parasites viz. nematodes, trematodes and cestodes were reported from ruminants (Ntonifor, et al., 2013).

Investigations dealing with loss of livestock productivity, morbidity and mortality in ruminants due to helminth infections are receiving considerable attention in recent years at global level (Biu et al., 2009; Swarnakar et. al., 2015), and also from India (Samanta & Kumar, 2007; Haque et al., 2011; Singh et. al., 2012; Rahman et al., 2012; Krishnamurthy and D'souza 2014;; Rafiullah et al., 2011; Laha et al., 2013; Mir et al., 2013 a & 2013 b; Swarnakar et al., 2014). However, such rigorous studies are still lacking from the state of Andhra Pradesh and require more serious attention from scientists and researchers (Sreedhar et al., 2009; Sreedevi and Hafiz,, 2014; Sivajyothi and Reddy 2014; Preethi et al., 2020). The present investigation is undertaken to study the prevalence of GI helminth infections in domestic ruminants

(cows, buffaloes, sheep and goat) from Srikakulam district of Andhra Pradesh, India. In the study area selected i.e. Srikakulam district, though agriculture is the main source of income for majority of the people, rearing of domestic animals and poultry as an important component of mixed farming and as an alternative source of income, is also very common.

Materials & Methods

Study area (Fig. 1):

The study was carried out in the vicinity of Srikakulam district, Andhra Pradesh (coordinates of 18°- 20' and 19°-10' N latitude and 83°-50' and 84°-50' E longitude). It has an area of 5,837 square kilometers with a rural area constituting 5,650.96 sq km. It is bounded on the north by Odhisa state, on the west and south by Vizianagaram district and on the east by Bay of Bengal. Srikakulam has the longest coastal line of 193kms extending from Ranasthalam mandal to Itchapuram mandal and has a tropical savanna climate.

Animal species and sampling:

The study was conducted from January 2019 to December 2019 covering different locations in Srikakulam district. Fecal samples of *Bos taurus* (cow), *Bubalus bubalis* (buffalo), *Ovis aries* (sheep) and *Capra hircus* (goat) were collected and examined for GI helminth parasite infections. A total of 3,527 fecal samples were examined, including 595 from cows, 485 from buffaloes, 1342 from sheep and 1105 from goat. Analysis of fecal samples was done by employing methods like direct smear, sedimentation and floatation techniques (Soulsby 1982; Coles 1986,). In direct smear method, saline wet mounts were made by mixing a small volume of fecal sample with a drop of saline on a glass slide and placing a cover slip over the mixture. In the floatation method, each fecal sample was suspended in a solution of high specific gravity, which make parasite eggs to float and get concentrated at the surface. In sedimentation method, a small fecal sample was suspended in a low specific gravity solution so that the eggs form a sediment at the bottom either spontaneously or by centrifugation. Identification of type of parasite infection was done based on the morphology of parasite ova/egg (Soulsby 1982; MAFF 1984; Coles 1986) using low and high-power microscopes.

Statistical analysis:

The monthly data collected on prevalence of infection with GI helminth parasites of domesticated animals for one year period was analyzed and compared. Statistical analysis was performed using one way ANOVA and Student's 't' test to understand the significant differences in infection between different hosts and seasons ($P < 0.05$). The data was analyzed using MS Excel of Microsoft office version 2010.

Results

i. Overall Prevalence of Infection:

Prevalence of infection with GI helminth parasites in all four groups of domestic ruminants from Srikakulam district is presented (**Table – 1**). A total of 3,527 fecal samples were collected from cows (595), buffalos (485), sheep (1342) and goat (1105) and, out of which 1084 were found positive recording a prevalence of 30.73%. The prevalence of infection was found to be highest in cows with 43.03%, followed by buffaloes with 40.82%, sheep with 29.35% and goat with 21.35% (**Table – 1**). Between the two groups of large and small ruminants, large ruminants (cows & buffaloes) harbored much higher infection with GIHs, when compared to small ruminants (sheep & goat). Similarly, among the four groups of ruminant's cows and sheep harbored higher infection when compared to buffaloes and goat. One-way analysis of the data carried out to understand the differences in the level of significance with prevalence of infection between different hosts revealed the differences to be statistically significant at 5% probability level ($p < 0.05$). Results of "t" test analysis showed the differences in prevalence of infection between large ruminants (cows & buffaloes) and small ruminants (sheep & goat) to be statistically significant at 5% probability level ($p < 0.05$). No significant differences were noted in prevalence of infection between cows and buffaloes, however, the differences were found to be significant between sheep and goat ($p < 0.05$).

Table 1: Overall prevalence of infection with GI helminth parasites in domestic ruminants

Domestic ruminants	Number of fecal samples examined	Number found infected	Prevalence of infection
Cow (<i>Bos taurus</i>)	595	256	43.03 %
Buffalo (<i>Bubalus bubalis</i>)	485	198	40.82%
Sheep (<i>Ovis aries</i>)	1342	394	29.35%
Goat (<i>Capra hircus</i>)	1105	236	21.35%
Total samples	3,527	1,084	30.73%

ii Prevalence of infections with GI helminth parasites:

The prevalence of infection with individual species of GI helminth parasites collected from fecal samples of ruminants is shown in Fig. 1. Highest infection was found to be with nematodes (39.12%), followed by trematodes (37.37%) and cestodes (3.51%), whereas mixed infections were found to be 20.01% (**Fig-1**).

Altogether six species of helminth parasites were identified in fecal samples viz. three species of nematodes (*Haemonchus*, (*Strongyle* group), *Strongyloides* and *Trichuris*), two species of trematodes

(*Fasciola* & *Paramphistomum*) and one species of cestode (*Moniezia*). Overall prevalence with each individual helminth parasites was found to be 29.25% for *Haemonchus (Strongyle)*, 25.47% for *Paramphistomum* 11.91% for *Fasciola*, 7.66% for *Strongyloides*, 3.51% for *Moniezia*, and 2.22% for *Trichuris*. The data revealed *Haemonchus (Strongyle)* with 29.25% as the most frequently occurring infection and *Trichuris* with only 2.22% prevalence is the least represented infection. Host wise analysis of fecal samples for prevalence of infection with helminth parasites was carried out and the data is presented (Table 2 & Fig. 2). Cow samples showed a prevalence of 30.47% for *Paramphistomum*, 16.41% for *Fasciola*, 9.38% for *Trichuris*, 7.04% for *Haemonchus (Strongyle)*, 1.96% for *Strongyloides* and 3.52% for *Monezia*. Fecal samples from buffaloes showed a prevalence of 46.97% for *Paramphistomum*, 22.23% for *Fasciola*, 3.04% for *Haemonchus (Strongyle)*, 2.03% and for *Strongyloides*. Fecal samples from sheep showed *Haemonchus (Strongyle)* with a prevalence of 48.74%, *Paramphistomum* with 15.49%, *Strongyloides* with 13.19%, *Fasciola* with 5.59% and *Moniezia* with 5.33% prevalence. Fecal samples from goat showed a prevalence of 42.79% with *Haemonchus (Strongyle)*, 18.65 with *Paramphistomum* 9.33% with of *Strongyloides*, 8.89% with *Fasciola* and 3.39% with *Moniezia* (Table – 2 & Fig – 2).

Table 2: Prevalence of infection with various GI helminth parasites in cows, buffaloes, sheep and goat

Gastrointestinal Helminth Parasites		Cow (n=256)		Buffalo (n=198)		Sheep (n=394)		Goat (n=236)		Total (n=1084)	
		Number infected	Prevalence	Total number	Prevalence						
NEMATODES	<i>Haemonchus (Strongyle)</i>	18	7.04%	6	3.04%	192	48.74%	101	42.79%	317	29.25%
	<i>Strongyloides</i>	5	1.96%	4	2.03%	52	13.19%	22	9.33%	83	7.66%
	<i>Trichuris</i>	24	9.38%	0	0.00%	0	0.00%	0	0.00%	24	2.22%
	Total	47	18.35%	10	5.06%	244	61.93%	123	52.12%	424	39.12%
TREMATODES	<i>Fasciola</i>	42	16.41%	44	22.23%	22	5.59%	21	8.89%	129	11.91%
	<i>Paramphistomum</i>	78	30.47%	93	46.97%	61	15.49%	44	18.65%	276	25.47%
	Total	120	46.88%	137	69.19%	83	21.07%	65	27.55%	405	37.37%
CESTODES	<i>Moniezia</i>	9	3.52%	0	0.00%	21	5.33%	8	3.39%	38	3.51%
	Total	9	3.52%	0	0.00%	21	5.33%	8	3.39%	38	3.51%
MIXED INFECTION	PA + HC	26	10.16%	29	14.65%	12	3.04%	9	3.82%	75	6.92%
	FS + HC	21	8.21%	22	11.12%	4	1.02%	6	2.55%	54	4.99%
	HC + SD	15	5.86%	0	0%	24	6.09%	21	8.89%	60	5.54%
	FS + SD	18	7.04%	0	0%	6	1.53%	4	1.69%	28	2.59%
	TOTAL	80	31.26%	51	25.76%	46	11.68%	40	16.95%	217	20.01%

n = No. of infected samples - *FS = *Fasciola*; * HC = *Haemonchus (Strongyle)*; *SD = *Strongyloides*; *PA = *Paramphistomum*

Seasonal prevalence:

Data on the overall prevalence of infection during different seasons indicated maximum during summer (32.0%), followed by winter (30.20%) and rainy seasons (29.9%) (Table 3 & Fig. 3). Whereas slight

variations were noted in seasonal prevalence among different parasite groups, with nematodes, trematodes and cestodes showing highest prevalence of 13.33, 13.77 and 1.20 respectively during winter season, and mixed infections recording a high prevalence of 8.25 during summer. On the other hand, data on host wise distribution of prevalence indicted more positive cases of infection during winter in cows and buffaloes and during rainy season in sheep and goats. (Table 4) ($p < 0.05$)

Table 3: Seasonal prevalence of infection with GI helminth parasites in domestic ruminants

Season	Host	Overall Infection			Number infected and Prevalence of infection with different groups of Parasites							
		NE	NI	PI	NEMATODES		TREMATODES		CESTODES		MIXED INFECTION	
					No. infected	Prevalence of Infection	No. infected	Prevalence of Infection	No. infected	Prevalence of Infection	No. infected	Prevalence of Infection
RAINY	Cow	186	53	28.49	9	4.84	25	13.44	1	0.54	18	9.68
	Buffalo	162	57	35.15	6	3.70	46	28.395	0	0.00	5	3.09
	Sheep	415	140	33.73	92	22.17	24	5.78	6	1.45	18	4.34
	Goat	426	106	24.88	50	11.74	30	7.04	4	0.94	22	5.16
	TOTAL	1189	356	29.94	157	13.20	125	10.51	11	0.93	63	5.30
WINTER	Cow	192	103	53.64	15	7.81	58	30.20	6	3.13	24	12.50
	Buffalo	158	69	43.67	3	1.90	50	31.65	0	0.00	16	10.13
	Sheep	475	120	25.26	70	14.74	32	6.74	7	1.47	11	2.32
	Goat	337	59	17.51	32	9.50	20	5.93	1	0.30	6	1.78
	TOTAL	1162	351	30.21	120	10.33	160	13.77	14	1.20	57	4.90
SUMMER	Cow	217	100	46.09	23	10.60	37	17.05	2	0.92	38	17.51
	Buffalo	165	72	43.64	1	0.60	41	24.85	0	0.00	30	18.18
	Sheep	452	134	29.65	82	18.14	27	5.97	8	1.77	17	3.76
	Goat	342	71	20.77	41	11.99	15	4.36	3	0.88	12	3.51
	TOTAL	1176	377	32.06	147	12.5	120	10.20	13	1.11	97	8.25

NE = Number of animals examined; NI = Number of animals infected; PI = Prevalence of infection

Table 4: One way ANOVA table showing the level of significance ($p > 0.0$) in prevalence of infection between different seasons and hosts.

Table 4: Prevalence of infection during different seasons

SEASONS	HOSTS (+ve %)			
	COWS	BUFFALOES	SHEEP	GOAT
RAINY	28.49	35.15	33.73	24.88
WINTER	53.64	43.67	25.26	17.51
SUMMER	46.09	43.64	29.65	20.77

One way analysis (ANOVA) between hosts and Seasons

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	928.5059	3	309.502	5.570538	0.023254	4.066181
Within Groups	444.4841	8	55.56052			
Total	1372.99	11				

$p < 0.05$ (5% Probability level)

Discussion

The present study revealed moderate infections with GI helminth parasites in domestic ruminants from Srikakulam district of Andhra Pradesh with an overall prevalence of 30.73% (Table 1). Infections were mainly due to three species of nematode, two species of trematode and a single species of cestode parasites. Among the 1,084 infected samples, 39.12% showed infections with nematode eggs, 37.37% with trematodes eggs and 3.51% with cestode eggs. Mixed infections with two or three varieties of parasite eggs were also noted (20.01%) (Table 2 & Fig. 1).

The study recorded infections with six species of helminth parasite eggs in domestic ruminants from Srikakulam district. A review of the available literature revealed similar infections in most of the domestic ruminants i.e. from Bovines (cow and buffalo), Ovine (sheep) and Caprine (goat) hosts from different geographical regions of India (Muraleedharan 2005; Pant et al., 2009; Bilal, et. al., 2009; Haque, et al., 2011; Singh et al., 2012; Mir et. al., 2013 a & 2013 b; Sreedevi and Hafeez, 2014; Jamra, et al., 2014). However, no such concrete reports are available from Andhra Pradesh, particularly from the present study area.

During the present study highest overall prevalence of infection was recorded with nematode parasites followed by trematodes, whereas cestodes were found to be the least represented group. A similar observation was made by Almalaik et al., (2008) and Besier et al., (2016) where they noted high

prevalence with the nematode parasite *Haemonchus (Strongyle)* in all domestic ruminants. In accordance with the present observations, previous studies have also recorded greater prevalence of infection in buffaloes and sheep when compared to cattle and goat (Mamun et al., 2011; Gupta & Singla 2012; Singh et al., 2013; Patel et al., 2015; Varadharajan & Vijayalakshmi 2015; Singh, et al., 2015). This was mainly attributed to their grazing behavior (Lathamani et al., 2016). In the present study, prevalence of the trematode parasite *Paramphistomum* commonly called as rumen fluke is found to be higher than *Fasciola* (liver fluke) particularly in bovines (cattle and buffalo). A similar observation was made in different studies on ruminants by Pfukenyi et al., (2006); Swarnakar and Kumawat (2013); Swarnakar et al., (2014) and Swarnakar et al., (2015).

The nematode parasite *Haemonchus (Strongyle)* was found to be the most common and predominant parasite compared to other parasitic infections, especially in sheep and goat (Biu et al., 2009; Wani et al., 2011; Kuchai et al., 2013; Singh et al 2013). The higher prevalence of *Haemonchus (Strongyle)* could be due to its relatively short generation interval and the ability to take advantage of the favorable environmental conditions (Grant, 1981). The only cestode parasite recorded during the present study was *Moniezia*. Raza et al., (2014) also noted low prevalence of cestode species when compared to other helminth parasite groups.

Analysis of overall seasonal data indicated relatively higher infections during summer (32.06%), followed by winter (30.20%) and rainy seasons (29.94%). This is in accordance with the findings recorded by Makhdoomi et al., (1995) and Khajuria and Kapoor (2003). In the present study, the seasonal fluctuations with in different groups of GI helminth parasites revealed high infection with nematodes, trematodes and cestodes during winter followed by rainy season and least during summer season (Table 3), However, Rangel – Ruiz et. al., (2003) and EL – Shazley et al. (2002) stated higher infection during autumn and summer and lowest during winter, contrary to the present observation. Infection with cestode parasite *Moniezia* was low throughout the year without much variation. Belem et al., (2001), recorded highest infection with *Moniezia* eggs during rainy seasons. The variations recorded in prevalence of infection during different studies could be due to environmental conditions that can be specific to each geographical location (Chavan et al., 2008; ; Sharma et al., 2009; Singh et al., 2015 and Thakuria et al., 2015).

Table 5 shows reports on the work done so far on GI helminth parasites from the Indian region. It shows that most of the study areas are under tropical places and the most common helminth parasites responsible for causing infection in domestic ruminants are *Haemonchus (Strongyle)*, *Strongyloides* and *Trichuris* (nematodes), *Fasciola* and *Paramphistomum* (Trematodes) and the only cestode found is *Moniezia* (Table 3). Even during the present study the same species of GI helminth parasites were recorded, however, they differ significantly in their geographical location and prevalence of infection.

Table 5: Reports on Prevalence of infections with GI helminth parasites in domestic ruminants from India

S. No	Author	Year	Area	Host – Species	% of Infection	GI H Parasites Identified
1.	Sreedhar S, Mohan EM, Babu DS	2009	Anantapur dist., Andhra Pradesh	Cattle & Buffalo	42.00	<i>Paramphistomum</i> , <i>Coccidia</i> and <i>Strongyle</i>
2.	Murthy GSS, Rao PV	2014	Karimnagar district, Telangana	Cattle & Buffalo	40.00	<i>Fasciola</i> , <i>Paramphistomum</i> , <i>Eimeria</i> & <i>Toxocara</i>
3.	Murthy GSS, Rao P V	2014	Karimnagar district, Telangana	Sheep & Goat	38.70	<i>Strongyle</i> , <i>Eimeria</i> , <i>Paramphistomum</i> & <i>Moniezia</i> .
4.	Muzaffar Rasool Mir et al.	2013	Jammu, Jammu & Kashmir	Cattle & Buffalo	51.21	<i>Strongyle</i> , <i>Strongyloid</i> , <i>Trichuris</i> , <i>Toxocara</i> , <i>Fasciolap</i> , <i>Paramphistomum</i> <i>Moniezia</i> and <i>Eimera</i>
5.	Swarnakar & Kumawat	2014	Udaipur, Rajasthan	Buffalo	75.63	<i>Paramphisomum</i> & mixed infections with <i>Fasciola</i> & <i>Gigantocotyle</i>
6.	Jamra et al.	2014	Madhya Pradesh	Buffalo	15.57	<i>Strongyle</i> , <i>Haemonchus</i> , <i>Trichostrongylus</i> , <i>Bunostomum</i> and <i>Oesophagostomum</i> .
7.	Sridevi et. al.	2014	Tirupati, Andhra Pradesh	Buffaloes	40.20	<i>Paramphistomum</i> , <i>Fasciola</i> <i>Strongyle</i> , <i>Strongyloid</i> , <i>Toxocara</i> , <i>Trichuris</i> and <i>Moniezia</i>
8.	*Shiva Jyoti S and Reddy S. B.	2018	YSR Kadapa district, Andhra Pradesh	Sheep & Goats	91.27	<i>Haemonchus</i> , <i>Strongyle</i> , <i>Paramphistomum</i> , <i>Fasciola</i> , <i>Trichuris</i> , <i>Strongyloid</i> and <i>Moniezia</i>
9.	Present study	2020	Srikakulam dist., Andhra Pradesh	Cattle, Buffalo, Sheep & Goat	30.73	<i>Strongyle</i> , <i>Strongyloid</i> , <i>Trichuris</i> , <i>Fasciola</i> , <i>Paramphistomum</i> and <i>Moniezia</i>

* Reference not available

Conclusion

Present study revealed that infections with both nematode and trematode parasites are high, whereas cestode parasites are least represented. The prevalence of infection with helminth parasites is reported host wise, parasite wise and seasonal wise during the present study in order to understand the distribution and recruitment of parasites and the factors affecting their intensity of infection. Generally deworming will be done to all domestic ruminants in dairy farms during the month of July in order to overcome sudden outburst of infection. This could be one of the reasons for low prevalence of GI helminth infection during rainy season in the present study, however, more intense studies are required to evaluate thoroughly the factors influencing their prevalence of infection during different seasons. Studies of this type could be of great help in understanding the strategies necessary for the health management of domestic ruminants, thereby safeguarding the economic impact.

Declarations

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Consent to Participate: We attest to the fact that all Authors listed on the title page have contributed significantly to the work, have read the manuscript, attest to the validity and legitimacy of the data and its interpretation, and agree to its submission to the Journal of Parasitic Diseases.

Consent to Publication: On behalf of the Co-Author and myself, we give our consent for publication in JOPD.

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Coded Availability: Not Applicable

Authors Contribution: We attest to the fact that all Authors listed on the title page have contributed significantly to the work, have read the manuscript, attest to the validity and legitimacy of the data and its interpretation

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Figures

Overall prevalence of infection with GI helminth parasites in domestic ruminants

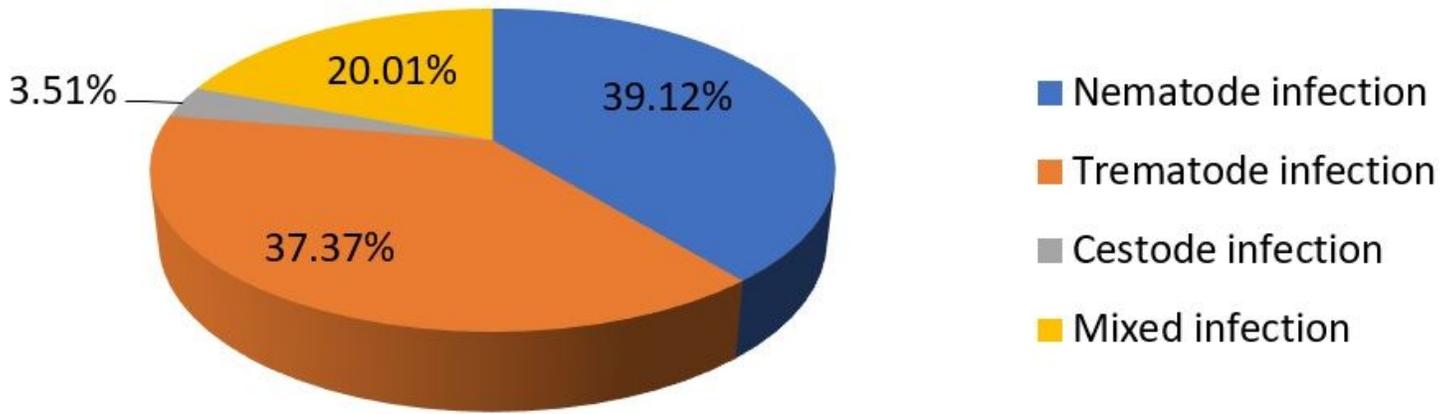


Figure 1

Overall prevalence infection with GI helminth parasites in domestic ruminants

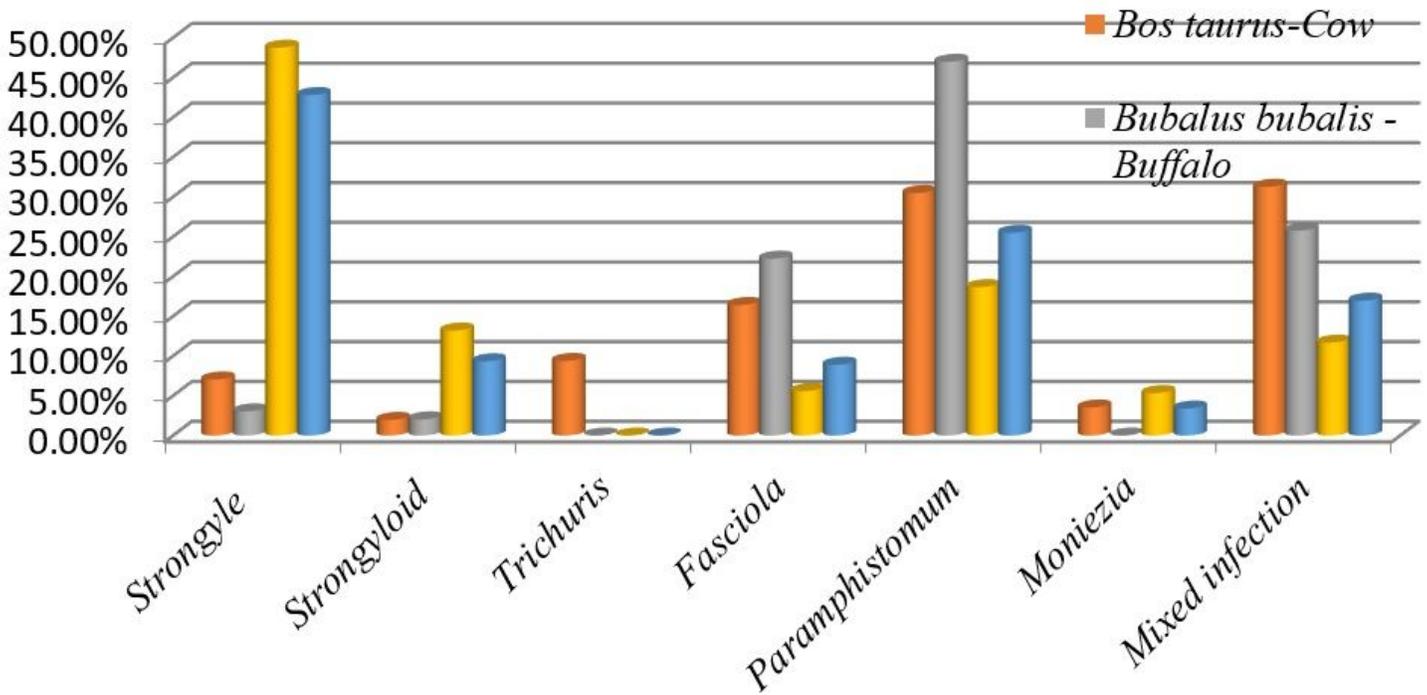


Figure 2

Prevalence of infection with GI helminth parasites in domestic ruminants

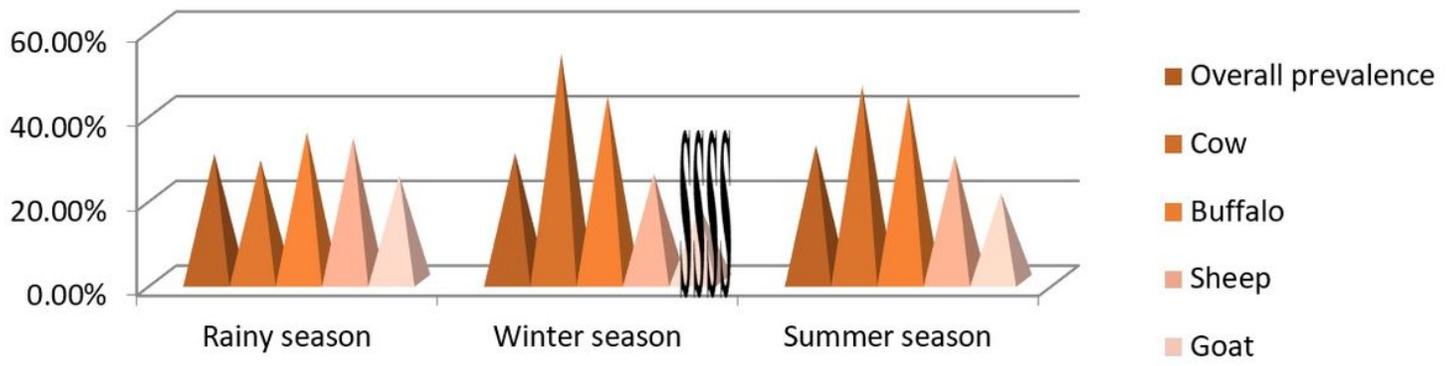


Figure 3

Seasonal variation in prevalence of infection with GIH parasites in domestic ruminants