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ORIGINAL ARTICLE

Prevalence of gastrointestinal parasites in bovines in and around Junagadh (Gujarat)

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Abstract Coprological examination of 416 bovine faecal samples revealed the presence of parasitic stages of *Toxocara vitulorum*, strongyles, *Strongyloides* spp., *Fasciola* spp., amphistomes, coccidia (*Eimeria* spp. and *Cryptosporidium* spp.) and *Buxtonella sulcata*. About 42 % (n = 302) faecal samples from cattle and 36 % (n = 114) samples from buffaloes were positive for gastrointestinal (GI) parasitic infections. Both cattle (14.57 %) and buffalo (15.79 %) had the highest incidence of *Buxtonella sulcata*, respectively. The overall incidence of GI parasitic infections in young animals (below 1 year) was higher followed by older (more than 5 years) and adult animals (1–5 years) and the difference was statistically significant ($p < 0.05$). Non descriptive breeds of bovines showed more parasitic infections than pure breeds, the difference being statistically non-significant ($p > 0.05$). Season wise GI parasitic infections were recorded to be non-significantly ($p > 0.05$) higher in monsoon (48.38 %) followed by summer (39 %) and winter (34.61 %) in cattle. There was no significant variation of GI infections in buffaloes in relation to season though highest prevalence was documented in monsoon (44.89 %) followed by winter (35.71 %) and summer (24.32 %). Similarly, sex wise females recorded higher infection rates than males in bovines and the difference being statistically non-significant ($p > 0.05$).

Keywords Cattle · Buffaloes · Gastrointestinal parasites · Gir · Jaffrabadi · Junagadh · Prevalence

Introduction

Gastrointestinal (GI) parasitism is a major constraint for livestock production causing heavy economic losses to the livestock producers. It plays a crucial role in reducing animal production by lowering the working capacity, growth, body weight and milk yield (Choubisa and Jaroli 2013; Panigrahi et al. 2014). In the recent years, various epidemiological surveys of GI parasitic infections in domesticated animals have been carried out in different parts of India (Samanta and Santra 2007; Jyoti et al. 2011; Singh et al. 2102a; Rahman et al. 2012; Krishnamurthy and D'souza 2014). The epidemiology of GI parasites in livestock varies depending on the prevailing climatic conditions and managemental practices followed locally. Therefore, the parasitic fauna of each and every species, when mapped out accurately in different agro-climatic zones of the area, elucidates fundamental information, depending upon which further control measures can be chalked out.

In this regard, scanty information is available on the prevalence of GI parasitic infections in bovines of Junagadh (Gujarat), India. As this district has rich source of livestock with breeds like Gir, Jaffrabadi etc., it is the need of the hour, to conduct a thorough study regarding the occurrence of various GI parasitic infections and its co-

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relation with various risk factors like season, age, breed type and sex. Therefore, the present study was conducted to investigate the occurrence of GI parasitic infections in bovines with the objective of determining their incidence and obtaining a baseline data in order to develop package of practices for timely treatment, control and prevention of economic losses due to these parasites.

Materials and methods

A total of 416 bovine (302 cattle and 114 buffaloes) faecal samples were collected from Teaching Veterinary Clinical Complex (TVCC), Veterinary College, Junagadh; Cattle Breeding Farm (CBF), Junagadh; Veterinary Polyclinic, Junagadh and various animal camps organized by Veterinary College in the villages around district Junagadh. Faecal samples were collected pre-rectally from the animals manually and kept in separate faecal containers. During collection various parameters viz. animal species, place of collection, breed, age and sex were recorded. Samples were kept in moist and cool environment until they were examined. The whole study period was divided into three seasons viz. summer, monsoon and winter.

After collection and transport, the samples were processed in Helminthology Laboratory, Department of Veterinary Parasitology, Veterinary College, J.A.U., Junagadh The samples were examined individually for GI parasites first qualitatively by centrifugal sedimentation and flotation techniques (Soulsby 1982). Thereafter randomly selected positive faecal samples (15 %) were examined quantitatively in each season by Stoll's dilution method to estimate the parasitic load i.e. eggs per gram of faeces.

Statistical analysis

Data obtained were compiled and tabulated for frequency and finally converted into percentage to draw inferences. Chi square (χ^2) test was used to see differences in parasitic infections among age, sex, breeds and season. The difference was considered as statistically significant if $P < 0.05$. Data were analyzed using Sigmaplot version 11.0, Systat Software Inc., USA.

Results

Microscopic examination revealed that about 42 and 36 % faecal samples from cattle and buffaloes, respectively were positive for GI parasitic infections. The incidence of various GI parasites encountered in the current study in cattle and buffaloes are summarized in Table 1. The faecal samples were found positive for the presence of eggs of *Toxocara vitulorum*, strongyles, *Strongyloides* spp., *Fasciola* spp., amphistomes, coccidian oocysts (*Eimeria* spp. and *Cryptosporidium* spp.) and cysts and trophozoites of *Buxtonella sulcata*.

As far as association of various risk factors on the prevalence of GI parasites is concerned, age wise prevalence of GI parasitic infection (except *Fasciola* spp. and amphistomes) was highest in young cattle (below 1 year) (94.28 %), than old (more than 5 years) (45 %) and adults (1–5 years) (16.45 %) and data was statistically significant ($p < 0.05$). The study also revealed the prevalence of GI parasites (except *Fasciola* spp., amphistomes and strongyles) significantly higher in old buffaloes (more than 5 years) (48 %), than young ones (<1 year) (47.36 %) and adults (1–5 years) (21.56 %) The infection rates of various parasites are presented in Table 2. Among all parasitic infections, *Buxtonella sulcata* was recorded to be highest in all age groups (Table 2).

Regarding sex-wise prevalence, though infection in female cattle was higher than male (45.41 vs 34.73 %) and a similar trend was observed for buffaloes (41.33 vs 25.64 %), the data did not differ significantly ($p > 0.05$). Further, *Buxtonella sulcata* infection was higher in both male and female (Table 2).

Breed wise prevalence of GI parasitic infection is presented in Table 3. The data was statistically non-significant

Table 1 Incidence (%) of GI parasitic infections in cattle and buffalo

S. no.	Parasite	No. of faecal samples found positive (%) Cattle (n = 302)	No. of faecal samples found positive (%) Buffaloes (n = 114)
1	*Toxocara vitulorum*	15 (4.97)	6 (5.26)
2	Strongyles type	25 (8.29)	4 (3.51)
3	*Strongyloides* spp.	20 (6.62)	0 (0.00)
4	*Fasciola* spp.	5 (1.66)	3 (2.63)
5	Amphistomes	6 (1.99)	4 (3.51)
6	Coccidia	12 (3.97)	6 (5.26)
7	*Buxtonella sulcata*	44 (14.57)	18 (15.79)
Total		127 (42.00)	41 (36.00)
$\chi^2 = 1.034$ (P = 0.309)			

Table 2 Incidence (%) of GI parasitic infections according to age and sex of the animals

Parameters	Category	Parasitic infections (%) Parenthesis represent number of positive samples							Over all incidence
		Strongyle type	*Strongyloides* spp.	*Toxocara vitulorum*	*Fasciola* spp.	Amphistomes	Coccidia	*Buxtonella sulcata*	
Age									
Cattle	Young (70)	17.14 (12)	24.28 (17)	21.42 (15)	0.00 (0)	0.00 (0)	15.71 (11)	15.71 (11)	94.28 (66)
	Adult (152)	2.63 (4)	1.3 (2)	0.00 (0)	1.31 (2)	1.31 (2)	0.65 (1)	9.20 (14)	16.45 (25)
	Old (80)	11.25 (9)	1.25 (1)	0.00 (0)	3.75 (3)	5.00 (4)	0.00 (0)	23.75 (19)	45.00 (36)
χ^2 value		14.55***	45.97***	52.31***	3.44	5.50	32.97***	8.99***	
Buffalo	Young (38)	7.80 (3)	0.00 (0)	15.78 (6)	0.00 (0)	0.00 (0)	13.15 (5)	10.52 (4)	47.36 (18)
	Adult (51)	1.96 (1)	0.00 (0)	0.00 (0)	1.96 (1)	3.92 (2)	1.96 (1)	11.76 (6)	21.56 (11)
	Old (25)	0.00 (0)	0.00 (0)	0.00 (0)	8.00 (2)	8.00 (2)	0.00 (0)	32.00 (8)	48.00 (12)
χ^2 value		3.42	–	12.66***	3.92	2.89	7.25*	6.35*	
Over all Incidence (%)		6.97	4.80	5.05	1.92	2.40	4.32	14.90	
Sex									
Cattle	Male (95)	5.26 (5)	6.32 (6)	4.21 (4)	1.05 (1)	0.00 (0)	2.10 (2)	15.79 (15)	34.73 (33)
	Female (207)	9.66 (20)	6.76 (14)	5.31 (11)	1.93 (4)	2.89 (6)	4.83 (10)	14.01 (29)	45.41 (94)
χ^2 value		1.13	0.01	0.01	0.005	1.51	0.65	0.05	
Buffalo	Male (39)	2.56 (1)	0.00 (0)	2.56 (1)	2.56 (1)	0.00 (0)	5.13 (2)	12.82 (5)	25.64 (10)
	Female (75)	4.00 (3)	0.00 (0)	6.67 (5)	2.67 (2)	5.33 (4)	5.33 (4)	17.33 (13)	41.33 (31)
χ^2 value		0.01	–	0.23	0.34	0.86	0.15	0.12	
Over all Incidence (%)		6.97	4.80	5.05	1.92	2.40	4.32	14.90	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 Incidence (%) of GI parasitic infections according to breed of the animals

Animal breeds (Total sample)	Parasitic infections (%) Parenthesis represent number of positive samples							Over all incidence
	Strongyle type	*Strongyloides* spp.	*Toxocara vitulorum*	*Fasciola* spp.	Amphistomes	Coccidia	*Buxtonella sulcata*	
Gir cattle (106)	7.54 (8)	5.66 (6)	3.77 (4)	0.94 (1)	1.88 (2)	4.71 (5)	10.37 (11)	34.90 (37)
ND cattle (196)	8.67 (17)	7.14 (14)	5.61 (11)	2.04 (4)	2.04 (4)	3.57 (7)	16.83 (33)	45.92 (90)
χ^2 value	0.01	0.06	0.18	0.05	0.11	0.03	1.81	–
Juffarabadi buffalo (56)	3.57 (2)	0.00 (0)	3.57 (2)	1.78 (1)	3.57 (2)	3.57 (2)	14.24 (8)	30.36 (17)
ND buffalo (58)	3.44 (2)	0.00 (0)	6.09 (4)	3.44 (2)	3.44 (2)	6.89 (4)	17.24 (10)	41.38 (24)
χ^2 value	0.22	–	0.14	0.0009	0.22	0.14	0.03	–

($p > 0.05$) but higher infection rates were recorded in non-descript breeds than pure breeds for both cattle (45.92 vs 34.90 %) and buffaloes (41.38 vs 30.36 %). Among all the recorded GI parasitic infections, *Buxtonella sulcata* was in higher proportion in all the breeds (Table 3).

Season wise prevalence of GI parasitic infection is presented in Table 4. Overall, the prevalence was highest in monsoon followed by summer and winter but statistically the data did not differ. Among all parasitic infections, *Buxtonella sulcata* was in higher proportion throughout the year (details in Table 4).

Further quantitative examination of faeces by Stoll's dilution technique determines the parasitic load i.e. eggs per gram (EPG) which ranged from 0 to 1,200 with highest value recorded in monsoon followed by summer and winter.

Discussion

Coprological examination of faecal samples revealed that incidence of GI parasitic infections is more in young animals, females, monsoon season and non-descript breeds of

cattle and buffaloes. Results indicated that strongyles (8.29 %) were the most prevalent GI nematodes followed by *Strongyloides papillosus* (6.62 %) and *Toxocara vitulorum* (4.97 %) in cattle. Among trematodes, prevalence of amphistomes (1.99 %) was highest followed by *Fasciola* spp. (1.66 %). *Buxtonella sulcata* (14.57 %) and coccidia (3.97) were the most prevalent GI protozoa recorded in cattle. Similar results with higher prevalence rates have been reported in buffaloes showing that *Toxocara vitulorum* (5.26 %) was the most frequent GI parasite followed by strongyles (3.51 %), amphistomes (3.51 %) and *Fasciola* spp (2.63 %). Among all parasitic infections, *Buxtonella sulcata* was observed higher proportion in all age groups, seasons, sex and breeds. Both cattle and buffaloes had the highest incidence of infection of ciliated protozoa, *Buxtonella sulcata* which is closely related to *Balantidium coli* (particularly found in swine and man) differentiated on the basis of morphometry of trophozoites, cysts and managemental history. Though, *Buxtonella sulcata* is considered non-pathogenic protozoa, in recent times many researchers reported its pathogenicity leading to diarrhoea (AI-Saffar et al. 2010). We observed 45 % of diarrhoeic animals had severe infection of *Buxtonella sulcata*.

Our observations of 42 and 36 % GI parasitic infections in cattle and buffaloes, respectively is relatively similar to the earlier reports from Andhra Pradesh, Rajasthan, Meghalaya and Punjab (Sreedhar et al. 2009; Godara and Sharma 2010, Wadhwa et al. 2011; Bandyopadhyay et al. 2010; Singh et al. 2012b). Hirani et al. (2006) reported 44.2 % prevalence of GI parasites in adult cattle in central Gujarat, which is in array with present study conducted in south western part of Gujarat. However, more than 50 % incidence of parasitic infections in cattle and buffaloes has also been recorded from Gujarat (Pethkar and Hiregoudar 1972), Karnataka (Krishnamurthy and D'souza 2014) and Rajasthan (Choubisa and Jaroli 2013).

In this study, it was revealed that *Buxtonella sulcata* and strongyles were the most prevalent GI protozoa and helminth, respectively. Similar results with higher prevalence rates had been reported recently by several workers from different parts of India showing that strongyles were the most frequent helminths prevalent in cattle (Jyoti et al. 2011; Laha et al. 2013; Krishnamurthy and D'souza 2014). Higher prevalence of strongyles may be due to more conducive environment for the development of the pre-parasites stages in the hot and humid environmental conditions prevalent in this region (Singh et al. 2012a).

The lower prevalence of trematodal infections (amphistomosis and fasciolosis) recorded is mainly due to the fact that the animals of Junagadh region are mostly stall fed thus decreasing the chances of exposure to the infective intermediate host present on the vegetation in the vicinity of water bodies. It is, however, apparent that the prevalence of fasciolosis in a tropical country like India is largely determined by rainfall and production systems (Copeman and Copland 2008). Perhaps dry climate of Junagadh with very high temperature and low rainfall might have produced the unfavorable conditions for the development of the parasites and contributed for keeping low profile of parasitic infection in this area. Parasitic load in terms of EPG was found highest in monsoon followed by summer and winter seasons. The findings of high EPG in monsoon correlates with the agroclimatic conditions of this region.

In case of cattle population under study, highest prevalence of GI parasites was observed in monsoon (48.38 %) followed by summer (39 %) and winter (34.61 %), the difference being non-significant ($p > 0.05$). But in case of buffaloes, highest prevalence rate was documented in monsoon followed by winter and summer (35.71 and 24.32 %, respectively), the difference being non-significant ($p > 0.05$). High moisture content along with temperature prevailed during rainy season favors the growth and

Table 4 Incidence (%) of GI parasitic infections according to season

Season (Total samples)	Parasitic infections (%) parenthesis contains number of positive samples							Over all incidence
	Strongyle type	*Strongyloides* spp.	*Toxocara vitulorum*	*Fasciola* spp.	Amphistomes	Coccidia	*Buxtonella sulcata*	
Cattle								
Summer (100)	8 (8)	5 (5)	5 (5)	0.00 (0)	1 (1)	2 (2)	18 (18)	39 (39)
Monsoon (124)	7.04 (10)	8.87 (11)	7.25 (9)	1.61 (2)	2.41 (3)	4.03 (5)	16.12 (20)	48.38 (60)
Winter (78)	8.97 (7)	5.12 (4)	1.28 (1)	2.56 (2)	2.56 (2)	6.41 (5)	7.69 (6)	34.61 (27)
χ^2 value	0.06	1.72	3.62	2.33	0.75	2.23	4.15	
Buffalo								
Summer (37)	2.70 (1)	0.00 (0)	5.40 (2)	2.70 (1)	2.70 (1)	2.70 (1)	8.11 (3)	24.32 (9)
Monsoon (49)	4.08 (2)	0.00 (0)	6.12 (3)	2.04 (1)	4.08 (2)	6.12 (3)	22.45 (11)	44.89 (22)
Winter (28)	3.57 (1)	0.00 (0)	3.57 (1)	3.57 (1)	3.57 (1)	7.14 (2)	14.28 (4)	35.71 (10)
χ^2 value	0.11	–	0.23	0.16	0.11	0.75	3.32	

development of larvae is the reason behind highest prevalence of GI parasitic infections during monsoon as also observed in earlier studies carried by various workers (Laha et al. 2013; Chattopadhyay and Bandyopadhyay 2013). Devoid of optimum moisture and temperature for development of larvae in the pasture during hot and cold season, could be the reason of lower and lowest prevalence during summer and winter seasons, respectively.

Breed wise prevalence of GI parasitic infection was higher in non-descript breeds than pure breeds for cattle and buffaloes, the difference being statistically non-significant ($p > 0.05$). Animal husbandry and pasture management practices adopted by the farmers, indiscriminate feeding habits, little or absence of deworming practices pave the way for more worm load in case of non-descript breeds of cattle and buffaloes.

The prevalence of parasitic infections in female and male cattle was almost comparable ($p > 0.05$). In case of cattle, 34.73 % males and 45.41 % females were found positive for GI parasites where as in buffaloes this was recorded to be 25.64 % males and 41.33 % females respectively, the variation being statistically non-significant ($p > 0.05$). This finding can be supported by the fact that this region of Gujarat usually shows common managemental practices that are adopted for animals of both sexes followed by deworming programme which is same for each that give reason of being no significant difference in prevalence of parasitic infections among males and females could be detected.

There was significant variation of infection of parasite in different age groups ($P < 0.05$) such as in young animals, *Toxocara* infection was higher but as the age increased, *Buxtonella* infection rose markedly (Table 2). Further coccidiosis was significantly higher in young ones than adults as the later exhibited cellular immunity against coccidiosis as a result of previous exposure to the oocysts.

In order to formulate effective control strategies against GI parasitic infections prevalent in any particular region, there is an urgent need to assess the actual status of these infections which is possible only by carrying out surveys as conducted in the present study. The current work emphasized that *Buxtonella sulcata*, strongyle group of worms, *Strongyloides*, *coccidia* and *Toxocara vitulorum* were the most prevalent GI parasites. Therefore strategic control and deworming programme to combat these GI parasites should be adopted.

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