Seasonal incidence of parasitic diseases in bovines of south western Gujarat (Junagadh), India

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Abstract The current study was conducted to investigate the incidence of parasitic diseases in bovines which were sick and brought at veterinary hospital for treatment. A total of 366 samples were investigated from cattle (n = 175) and buffaloes (n = 191) presented at Teaching Veterinary Clinical Complex (TVCC), Veterinary College, Junagadh, Gujarat during January to December 2014. Examination of Giemsa-stained peripheral blood smears exhibited that 58.6 % of cattle and 41.2 % of buffaloes were infected with haemoparasites comprising *Babesia bigemina*, *Theileria annulata*, and *Anaplasma marginale* @ of 54.0, 3.4 and 1.1 in cattle and 38.8, 1.2 and 1.2 percent in buffaloes, respectively. The incidence of total haemoparasites and *B. bigemina* infections was significantly higher ($p < 0.05$) in cattle whereas, incidence of haemoparasites were recorded significantly higher in the month of July to November (i.e., rainy and autumn) in both cattle and buffaloes, respectively ($p < 0.01$ and $p < 0.001$). Coprological examination revealed that the overall incidence of gastrointestinal (GI) parasitic infection was 45.5 % in cattle and 43.4 % in buffaloes. The incidence of individual parasite was 11.4, 1.1, 2.3, 4.5, 1.1, 3.4, 2.3 and 19.3 in cattle and 4.7, 0.9, 0.0, 2.8, 0.9, 5.7, 0.0 and 28.3 % in

buffaloes for *Eimeria* spp., *Trichuris* spp., *Toxocara vitulorum*, Strongyle, *Fasciola* spp., amphistomes, *Schistosoma indicum* and *Buxtonella sulcata*, respectively which differ insignificantly ($p > 0.05$). Seasonal prevalence of GI parasites was highest in summer in both cattle and buffaloes, the data being statistically non-significant ($p > 0.05$). However, the incidence of *B. sulcata* in both cattle (19.3 %) and buffaloes (28.3 %) was higher in comparisons to other GI parasites. The present investigation emphasized that *B. bigemina* and *B. sulcata* are the most important parasites of bovines of this region.

Keywords Incidence · Cattle · Buffalo · Junagadh · TVCC · Gujarat

Introduction

Parasitic infection is a serious constrain to health and productivity of the livestock in tropical and sub-tropical parts of the world including India. Among the various economically important bovine diseases, vector-borne haemoparasites infections such as babesiosis, theileriosis and anaplasmosis are recognized as a cause of severe clinical illness in cattle. Similarly, in buffaloes though considered as refractory host to various parasitic infections, frequently produce productivity loss and occasionally turn out as severe clinical disease. In the recent years, various epidemiological surveys of haemoprotozoan and gastrointestinal (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. 2012a; Rahman et al. 2012; Krishnamurthy and D'souza 2014; Krishnamurthy et al. 2014). The epidemiology of GI parasites and haemoparasite infections in livestock varies

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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, elucidates fundamental information, depending upon which further control measures can be followed.

In this regard, scanty information is available on the prevalence of haemoparasites and GI parasitic infections in bovines of Junagadh (Gujarat), India (Maharana et al. 2015). As this district has rich source of livestock with breeds like Gir cattle, Jaffrabadi buffaloes, it is the need of the hour, to conduct a thorough study regarding the occurrence of various haemoparasites and GI parasitic infections and its co-relation with climatic conditions. Therefore, the present study was conducted to investigate the incidence of haemoparasites and GI parasitic infections in bovines presented at Teaching Veterinary Clinical Complex (TVCC) with various ailments with an objective of determining their incidence and evolving the strategic and tactical methods of control.

Materials and methods

Sample collection and processing

The clinical samples of cattle and buffaloes were collected after accessing the clinical status of the animals by the clinician at TVCC. In general, faecal samples were collected from the rectum of animals having digestive disturbance and blood samples from Jugular vein and/ear vein of animals having general health problems like fever, anaemia, prolonged anorexia etc.

A total of 175 samples were collected from cattle (87 blood and 88 faecal) and 191 from buffaloes (85 blood and 106 faecal) during January–December 2014. Faecal and blood samples were processed using standard technique (Coles 1986, Soulsby 1982). In brief, faecal sample were subjected to floatation and sedimentation techniques and blood samples were screened through thin smeared Giemsa-stain method. Seasonal prevalence was studied throughout the year dividing into five seasons, winter (December–February), spring (March–April), summer (May–June), rainy (July–September) and autumn (October–November).

Statistical analysis

Data thus obtained were compiled and formulated for frequency and finally converted into percentage to draw interpretations. Statistical analysis was performed on data by SPSS 13.0 software by applying χ^2 test and statistical differences being considered significant when $p < 0.05$.

Results

The incidence of parasitic infections in cattle and buffaloes was recorded as 52 % (91/175) and 42.4 % (81/191), respectively whereas overall incidence of parasitic infections in bovines was 47 % (172/366).

Prevalence of haemoparasitic infections

Examination of Giemsa-stained thin blood smears revealed that 58.6 % (51/87) of cattle and 41.2 % (35/85) of buffaloes were infected with haemoparasites involving *Babesia bigemina*, *Theileria annulata*, and *Anaplasma marginale* @ of 54.0, 3.4 and 1.1 % in cattle and 38.8, 1.2 and 1.2 % in buffaloes, respectively (Table 1). The incidence of total haemoparasites and *B. bigemina* infections was significantly higher ($p < 0.05$) in cattle compare to buffaloes. Seasonal incidence of parasitic infection showed considerable increase from winter (December–February) to autumn (October–November). Data showed that infections of haemoparasites in month of July–November (i.e., rainy and autumn) were significantly higher ($p < 0.01$ and $p < 0.001$), in comparison of other season, in both cattle and buffaloes, respectively (Table 3).

Prevalence of GI parasitic infections

Coprological examination revealed that the overall incidence of GI parasitic infection was 45.5 % (40/88) in cattle and 43.4 % (46/106) in buffaloes. The incidence of individual parasite was 11.4, 1.1, 2.3, 4.5, 1.1, 3.4, 2.3 and 19.3 % in cattle and 4.7, 0.9, 0.0, 2.8, 0.9, 5.7, 0.0 and 28.3 % in buffaloes for *Eimeria* spp., *Trichuris* spp., *Toxocara vitulorum*, Strongyle, *Fasciola* spp., Amphistomes, *Schistosoma indicum* and *Buxtonella sulcata*, respectively with none significant difference ($p > 0.05$) (Table 2). Similarly, the incidence of GI parasite within season and between two animal species was not significant. However, the incidence of *B. sulcata* in both cattle (19.3 %) and buffaloes (28.3 %) was higher in comparisons to other GI parasites (Table 3).

Discussion

Haemoprotozoan diseases like babesiosis, theileriosis and anaplasmosis are the important tick-borne diseases of bovines caused by *B. bigemina*, *T. annulata* and *A. marginale*, respectively (Krishnamurthy et al. 2014). In the present study, the very high incidence of *B. bigemina* infections (46.5 %) were recorded mainly because of abundance of vector population i.e., *Rhipicephalus microplus* in Junagadh, Gujarat (unpublished data). Though, this is the

Table 1 Incidence of haemoparasite infections in bovines of south western Gujarat (Junagadh)

Animal	Total sample	Positive (%)	Parasite (%)		
			<i>Babesia bigemina</i>	<i>Theileria annulata</i>	<i>Anaplasma marginale</i>
Cattle	87	51 (58.6)	47 (54.0)	3 (3.4)	1 (1.1)
Buffalo	85	35 (41.2)	33 (38.8)	1 (1.2)	1 (1.2)
χ^2 value		5.233*	3.993*	0.977	0.000
Over all	172	86 (50.0)	80 (46.5)	4 (2.3)	2 (1.2)

* $p < 0.05$ **Table 2** Incidence of gastrointestinal parasitic infections in bovines of south western Gujarat (Junagadh)

Animal	Total sample	Positive (%)	Parasite (%)							
			<i>Eimeria</i> spp.	<i>Trichuris</i> spp.	<i>Toxocara vitulorum</i>	<i>Strongyle</i>	<i>Fasciola</i> spp.	<i>Amphistomes</i>	<i>Schistosoma indicum</i>	<i>Buxtonella sulcata</i>
Cattle	88	40 (45.5)	10 (11.4)	1 (1.1)	2 (2.3)	4 (4.5)	1 (1.1)	3 (3.4)	2 (2.3)	17 (19.3)
Buffalo	106	46 (43.4)	5 (4.7)	1 (0.9)	0 (0.0)	3 (2.8)	1 (0.9)	6 (5.7)	0 (0.0)	30 (28.3)
χ^2 value		0.083	2.978	0.018	2.243	0.407	0.018	0.551	2.434	2.114
Over all	194	86 (44.3)	15 (7.7)	2 (1.0)	2 (1.0)	7 (3.6)	2 (1.0)	9 (4.6)	2 (1.0)	47 (24.2)

Table 3 Seasonal incidence of parasitic infections in bovines of south western Gujarat (Junagadh)

Season		Gastrointestinal parasitic infections				Haemoprotozoan infections			
		Cattle		Buffalo		Cattle		Buffalo	
Name	Months	Total sample	Positive (%)	Total sample	Positive (%)	Total sample	Positive (%)	Total sample	Positive (%)
Winter	Dec–Feb	12	7 (8.0)	15	5 (4.7)	10	2 (20.0)	11	0 (0.0)
Spring	March–April	7	2 (2.3)	10	3 (2.8)	8	2 (25.0)	8	0 (0.0)
Summer	May–June	27	12 (13.6)	30	18 (17.0)	19	11 (57.9)	7	1 (14.3)
Rainy	July–Sept	20	9 (10.2)	21	11 (10.4)	35	25 (71.4)	31	16 (51.6)
Autumn	Oct–Nov	22	10 (11.4)	30	9 (8.5)	15	11 (73.3)	28	18 (64.3)
χ^2 value			1.620		7.598		13.587*		22.957**
Over all		88	40 (45.5)	106	46 (43.4)	87	51 (58.6)	85	35 (41.2)

* $p < 0.01$ ** $p < 0.001$

first report of *B. bigemina* infections in bovines of Saurashtra region of Junagadh district of Gujarat, a variable prevalence of bovine babesiosis were recorded from different parts of India viz. 1.56 and 3.84 % in Punjab (Singh et al. 2012b, c), 2.7 and 6.9 % in Karnataka (Muraleedharan et al. 2005; Krishnamurthy et al. 2014), and 0.76–18.50 % from various parts of the country (Yadav et al. 1985; Mallick et al. 1987; Sharma et al. 2000). One of the important reason for the higher incidence of the *Babesia* infections in bovines may be due to the collection of samples specifically from sick animals presented at hospital.

A very low incidence of *T. annulata* and *A. marginale* infections were recorded in both cattle and buffaloes. The reasons for the low incidence of *T. annulata* infections may be due to the low prevalence of vector i.e., *Hyalomma anatolicum anatolicum* (unpublished data) or less number of exotic breeds or cross breed animals in this geographical region of the country. A higher prevalence of *T. annulata* infections in bovines was recorded as 14.65 % Singh et al. (2012c) and 15.38 % (Haque et al. 2012) in Punjab where *H. a. anatolicum* is the major tick species and most of the dairy animals are either exotic breed or cross breed. Bovine anaplasmosis, caused by *A. marginale*, is an important

rickettsial disease, transmitted to cattle biologically by ticks and mechanically by biting flies and blood contaminated fomites causing significant economic losses in tropical and subtropical areas of world (Ruybal et al. 2009). However, the prevalence depends largely on the distribution and density of the reservoir hosts and tick vectors (Ogden et al. 2002). In the present study, examination of Giemsa stained peripheral thin blood smears revealed 1.2 % animals positive for the inclusion bodies of *A. marginale*. In similar studies from different states, variable incidence rates of bovine anaplasmosis ranging from 0.45 to 9.09 % had been reported (Singh and Gill 1977; Yadav et al. 1985; Mallick et al. 1987).

It was well established that incidence of vector borne diseases increases as population of vectors increases which depends upon the climatic conditions like temperature and humidity (Haque et al. 2011). In the present study, similar findings are once again established. The data shows that the infections are very high in summer, rainy and autumn when the temperature and humidity were very high and very low to nil during winter and spring when temperature and humidity both are very low.

Coprological examination of faecal samples revealed that incidence of GI parasitic infections is more in cattle than buffaloes. Results revealed that in cattle, strongyles (4.5 %) were the most prevalent helminths followed by amphistomes (3.4 %), *T. vitulorum*, (2.3 %), *S. indicum* (2.3 %), and *Fasciola* spp. (1.1 %) and in buffaloes, the amphistomes (5.7 %) were the most prevalent ones followed by strongyles (2.8 %), *Fasciola* spp. (0.9 %) and *Trichuris* spp. (0.9 %) whereas infection of *T. vitulorum* and *S. indicum* were not detected. *B. sulcata* and *Eimeria* spp. were the most prevalent GI protozoa recorded in cattle (19.3 and 11.4 %) and buffaloes (28.3 and 4.7 %), respectively. Both cattle and buffaloes had the highest incidence of infection of ciliated protozoa, *B. 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, *B. sulcata* is considered as a non-pathogenic protozoa, in recent times many researchers have reported its pathogenicity leading to diarrhoea (AI-Saffar et al. 2010). In the present study, 24.2 % of diarrhoeic animals had infection of *B. sulcata*, which is in conformity with the reports of earlier workers.

Our observations of 45.5 and 43.4 % 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, the most prevalent GI parasites in cattle and buffaloes were *B. sulcata* and *Eimeria* spp. and *B. sulcata* and amphistomes, respectively.

A highest incidence of GI parasites was observed in cattle in summer (13.6 %) followed by autumn (11.4 %) and rainy (10.2 %) and in case of buffaloes, the incidence was recorded highest in summer (17.0 %) followed by rainy (10.4 %) and autumn (8.5 %), but the data being statistically non-significant ($p > 0.05$). High moisture content along with temperature prevailed during rainy season favours the growth and development of larvae is the reason behind highest prevalence of GI parasitic infections during these season 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 spring and winter seasons, respectively.

The knowledge of pathogens in a particular regions is very much essential for the formulation of effective control strategies to prevalent these type of infections which is possible only by carrying out surveys as conducted in the present study. The current work emphasized that *B. bigemina* and *B. sulcata* were the most prevalent haemoprotozoa and GI parasite, respectively. Therefore, strategic control and management programme should be adopted to combat these GI parasites and haemoparasites.

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