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Giardia duodenalis Infection in Dairy Cattle of Assam, India

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ABSTRACT

To determine the prevalence of *Giardia duodenalis* infection in dairy cattle present in Assam, India, a total of 1176 numbers of faecal samples of cattle comprising 535 numbers of faecal samples of calves and 641 numbers of faecal samples of heifers were screened for one year using Formol-Ether technique and zinc sulphate (33%) floatation method. The overall prevalence of infection in cattle was 17.94%. Age-wise infection rate was 13.45 and 21.68% in calves and heifers, respectively. Season-wise highest infection was recorded during monsoon (30.90%) followed by pre-monsoon (21.97%), post-monsoon (5.50%) and winter (4.45%). Infection was higher among the diarrhoeic (83.41%) than non-diarrhoeic (16.58%) animals. The prevalence of *G. duodenalis* infection in cattle of Assam has significance because it infects a wide range of hosts, including humans worldwide and responsible for causing diarrhoea.

Key words: *Giardia duodenalis*, prevalence, dairy cattle, giardiasis, gastrointestinal protozoan

INTRODUCTION

Giardia is a ubiquitous enteric protozoan of class-Mastigophora and family-Hexamitidae. Amongst the six currently accepted species of *Giardia*, *G. duodenalis* (syn. intestinalis/lamblia) has the broadest host range and is the species with the greatest public and animal health significance in terms of gastrointestinal diseases. This parasite has a wide host range, including mammals, birds and amphibians (Minetti *et al*., 2014). *Giardia duodenalis* is detected frequently in many mammals (Feng and Xiao, 2011) and is one of the most common intestinal parasites in pets like dogs (Batchelor *et al*., 2008) and in livestock (Thompson *et al*., 2008). Because of the impact on socio-economic development, especially in developing countries, it was included in the "Neglected Disease Initiative" of the World Health Organization (Savioli *et al*., 2006). The parasite occurs in two morphologically distinct forms one being vegetative trophozoite and the other is thin walled cyst. Giardiosis in cattle is of particular concern because of the reported high prevalence of infection combined with the large output of faeces, potentially leading to contamination of water. They may act as a reservoir of infection with the potential to cause disease in humans either through direct contact or by contamination of food and water supplies. Transmission may occur through either direct contact in the case of farmers, veterinarians and petting zoo, or through indirect routes such as contaminated surface water or foods (Dixon, 2009). The infections are usually self-limiting in people with normal immune systems but can be severe in immuno-compromised individuals (Hunter and Thompson, 2005). The clinical signs associated with *G. duodenalis* infections in cattle may vary. Subclinical infections often reported; however, infection can result in the onset of diarrhoea, ill thrift and decreased weight gain in young calves (O'Handley *et al*., 1999). Morphological alterations in the intestinal epithelium of scouring calves with *Giardia*sis has been

observed (Barigye *et al*., 2008) and a significant improvement in weight gain was noticed in calves that were treated for *Giardia*sis with fenbendazole compared with untreated infected animals (Geurden *et al*., 2010).

In India, Deshpande and Shastri (1981) from Maharastra reported the first incidence of *Giardia* infection in calves. Thereafter, Singh *et al*. (2008), Khan *et al*. (2011) and Sabu *et al*. (2011) reported *G. duodenalis* infections in cattle from three states of India viz. Punjab, West Bengal and Kerala, respectively. The state Assam situated in the North Eastern region of India and is the gateway of other six north-eastern states of India. It also shares international borders with Bhutan and Bangladesh, thus having importance in transmission of transboundary parasitic diseases. However, from Assam and also from other six North Eastern states of India, there is no report on prevalence of *G. duodenalis* infection in dairy cattle. Thus, the present study was undertaken to determine the prevalence of *G. duodenalis* infection in dairy cattle present in Assam, India.

MATERIALS AND METHODS

Study area: The present study was carried out in Assam, India located South of the Eastern Himalayas. It lies within the latitude of 24°8 to 28°2' N and longitude of 89°42' to 96°E. Assam comprises of the Brahmaputra valley and the Barak river valleys along with the Karbi Anglong and the North Cachar Hills with an area of 30,285 square miles (78,438 km^2). With the 'Tropical Monsoon Rainforest Climate', Assam is a temperate region and experiences heavy rainfall and humidity (https://en.wikipedia.org/wiki/Assam). The maximum and minimum temperature ranges from 35-38 and 6-8°C, respectively.

Study period: The study was conducted for one calendar year from August 2012 to July 2013 and divided into four seasons viz. Pre-monsoon (March, April, May), monsoon (June, July, August, September), post-monsoon (October, November) and winter (December, January, February).

Faecal sample examination: A total of 1176 numbers of faecal samples were collected per rectum from 535 calves (<1 year) and 641 heifers (1-3 years) randomly. The faecal samples were screened by using Formol-Ether technique (Ruprah, 1985) and zinc sulphate (33%, sp. gr. 1.18) flotation technique (Georgi and Georgi, 1990) for detection of *Giardia* cyst. Direct wet mount method was used to observe motile trophozoites in diarrhoeic samples as per standard method (Rajurkar *et al*., 2012). Faecal samples were collected directly from the rectum of individual animal and kept in marked plastic pouch/vials. Precautions were taken to avoid contamination from one specimen to the other. Samples not being examined on the same day were preserved and stored at refrigerated temperature (4°C) for next day examination.

Statistical analysis: Data was statistically analyzed by Chi-square tests for significance using SPSS 15 version.

RESULTS

The results of the faecal examination are summarized in Table 1. The overall prevalence of *G. duodenalis* infection in cattle was 17.94%. However, age-wise the infection rate in calves and heifer was 13.45 and 21.68%, respectively. In zinc sulphate floatation, *G. duodenalis* appeared as oblique cyst having ventral concavity (Fig. 1). However, when stained with iodine solution, two prominent nuclei occupying most of the anterior portion of the cyst was observed (Fig. 2).

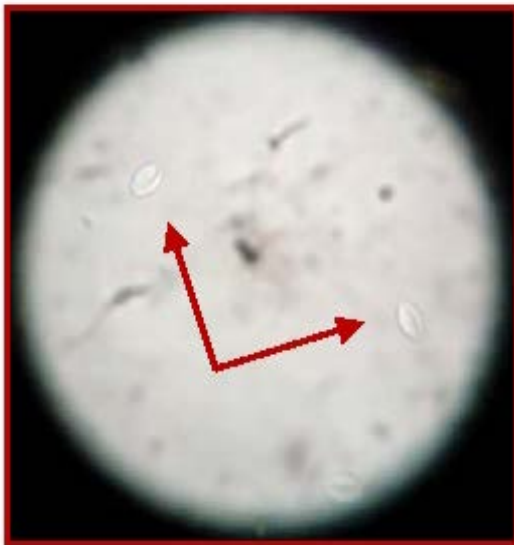

Fig. 1: Unstained *G. duodenalis* cyst in 33% zinc sulphate solution (400X)

Fig. 2: Stained *G. duodenalis* cyst (400X) showing two nuclei

Season-wise highest infection was recorded during monsoon (30.90%) followed by pre-monsoon (21.97%), post-monsoon (5.50%) and winter (4.45%) (Table 1). In calves, highest infection was recorded during monsoon (20.39%) followed by pre-monsoon (18.01%), winter (5.64%) and post-monsoon (4.04%). However, infection pattern in heifer was comparatively higher during monsoon (40.95%) followed by pre-monsoon (24.69%), post-monsoon (6.93%) and winter (3.57%). Though, there were apparent differences in infection rate according to season yet, no statistical significance could be drawn upon applying Chi-quare test. However, significant difference ($p<0.05$)

Table 1: Seasonal prevalence of giardiosis in cattle of Assam

Seasons	Sample screened	Number positive	Sample consistency	
			Diarrhoeic	Non-diarrhoeic
Pre-monsoon	Calves (111)	20 (18.01)	17	3
	Heifer (162)	40 (24.69)	28	12
	273	60 (21.97)	45 (75.00)	15 (25.00)
Monsoon	Calves (201)	41 (20.39)	39	2
	Heifer (210)	86 (40.95)	73	13
	411	127 (30.90)	112 (88.18)	15 (11.81)
Post-monsoon	Calves (99)	4 (4.04)	3	1
	Heifer (101)	7 (6.93)	7	-
	200	11 (5.50)	10 (90.90)	1 (9.09)
Winter	Calves (124)	7 (5.64)	3	4
	Heifer (168)	6 (3.57)	6	-
	292	13 (4.45)	9 (69.23)	4 (30.76)
Overall	Calves (535)	72 (13.45)	62	10
	Heifer (641)	139 (21.68)	114	25
	1176	211 (17.94)	176 (83.41)	35 (16.58)
χ^2 value, df 6		11.36 ^{NS}	113.86**	

**p<0.01, NS: Non-significant, -: Negative, Value in parentheses are percent positivity

existed according to the nature of sample consistency i.e., infection was higher among the diarrhoeic (83.41%) than non-diarrhoeic (16.58%) animals.

DISCUSSION

The prevalence of *G. duodenalis* infection in cattle ranges from 3 to 64% world-wide (Geurden *et al*., 2008). In the present study, the prevalence of *G. duodenalis* infection in cattle was comparable to that of Wade *et al.* (2000) and Singh *et al.* (2008), who reported 21.68 and 34.78% infection in heifer and young calves, respectively. In a recent study from Al-Qadisiya, Iraq, Ahmed and A'aiz (2015) reported 85.71% infection in calves (≥ 1year) with a significant difference ($p \leq 0.05$) with calves (< 6 months) and calves (6 months to 1 year). Higher prevalence in younger animals is also in accordance with the findings of Ehsan *et al.* (2015) and Wang *et al.* (2014) from Bangladesh and China, respectively who reported 22 and 22.7% infections in calves, respectively. Due to decreased level of acquired immunity in younger animals they become more susceptible to infections (Reinemeyer, 1995). Ralston *et al.* (2003) observed that the infection rate (15%) and the number of *Giardia* cysts in the cows faeces (38.49 cysts/g) numerically increased at 1 week post calving compared to levels at calving and thus they act as a carrier of infections for calves. Higher infection among the diarrhoeic (83.41%) animals in the present findings was in accordance with the findings of Singh *et al.* (2008). Giardiosis in cattle with variation have been reported from different geographical areas viz. 5.0% from Thailand (Inpankaew *et al.*, 2015), 7.2% from Germany (Gillhuber *et al.*, 2014), 14% from Canada (Budu-Amoako *et al*., 2012) and 34.5% from Argentina (Tiranti *et al*., 2011). The variation in different geographical localities may be due to differences in the levels of management practices employed at farm level, housing-related factors and nature of the study (Swai and Schoonman, 2010). As compared to other countries and other studies of India, a moderate percentage of animals (17.94%) were found to be infected with *G. duodenalis* in Assam. The climate of Assam is characterized by heavy monsoon downpours; the cycle/flow of water may be responsible for transmission of infections from place to place.

In the present study, there is seasonal variation in the prevalence of infection and highest infection was recorded during monsoon (30.90%) season. Ayaz *et al.* (2012) also observed seasonal variation of infection in Pakistan. They observed highest infection (36.66%) in autumn (August,

September, October) followed by 34.58% infections during summer (May, June, July), spring (30.83%) and winter (25%). The lowest percentage of infections during winter as observed in the present study was similar as observed in neighbouring country Pakistan, although the rate of infections varied. A lowest percentage of infection during winter might be due to less availability of water thereby less organisms in contaminated water. Similarly, Castro-Hermida *et al.* (2009) in Spain detected more *G. duodenalis* cysts in faecal samples of cows during spring (16.0%) and summer (6.9%). High temperature and humidity along with frequent rains in the monsoon season enabled the transmission of cysts faster by contaminating feed and water of the animals. Thus, the warm and humid monsoon season was observed to be the most amicable season for the propagation of the disease than other seasons.

The present finding has significance because *G. duodenalis* is zoonotic and has public health importance in terms of gastrointestinal protozoan disease. Moreover, the infectious dose for susceptible humans may be as low as 10 cysts of *G. duodenalis* (Rendtorff, 1954). The prevalence of *Giardia*sis was significantly higher among children who had close contact with cattle (18.7%) compared to children who had no contact with cattle (9.6%) (Wegayehu *et al*., 2013). In Assam, Devi *et al*. (2011) reported 1.5% *Giardia* cysts in indigenous people of Dibrugarh district during a community-based study. Thus, it is important to minimize contact between faecal materials containing infectious cysts and water supplies. So far our knowledge is concerned, there is no report of *G. duodenalis* infection in cattle of North East region of India and this may be considered as the first report of *G. duodenalis* in cattle from North East region of India, particularly from the state Assam.

CONCLUSION

The present study revealed that there is the prevalence of *G. duodenalis* in dairy cattle of Guwahati, Assam and infection rate was higher in heifers than calves. Season-wise highest infection was recorded during monsoon and recorded higher among the diarrhoeic animals.

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