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ORIGINAL ARTICLE

Balantidiasis, a zoonotic protozoan infection, in cattle and domestic pigs

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Abstract

Background: *Balantidium coli*, is a common -opportunistic protozoa of man and animals which causes gastroenteritis. A study was conducted to ascertain the prevalence of balantidiasis in cattle and pig irrespective of age and sex.

Methods: In total, 200 faecal samples (150 cattle and 50 pigs) were collected during July to December, 2016 in Mymensingh district, Bangladesh and Modified Stoll's Ova dilution technique was used to determine the *B. coli* under microscope from faecal samples. The cysts or trophozoites of *B. coli* were identified based on the morphological features using standard keys.

Results: *B. coli* cysts and/or trophozoites were detected in 103 samples (51.5%), where comparatively high prevalence was observed in cattle (54.7%) than pig (42.0%). Prevalence of balantidiasis was significantly high in adult cattle (70.4%) compared to that of young (40.5%) and calves (31.3%) while the piglet (65.0%) showed high prevalence than the grower (31.3%) and adult (21.4%). In cattle, high rate of infection was recorded in female (58.8%) than male cattle (45.8%) which was statistically insignificant. On the other hand, high rate of infections was recorded in male pigs (54.5%) than female pigs (32.1%).

Conclusion: In conclusion, the present study revealed high circulation of *B. coli* in cattle and pig in Mymensingh district, which poses potential threats to both animal and public health.

Key-words: *Balantidium coli*, prevalence, cattle, pig.

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Introduction

Balantidiasis, caused by *Balantidium coli*, is a parasitic zoonosis with a world-wide distribution among humans and animals (Schuster and Ramirez, 2008). It is capable of infecting a wide range of hosts including pigs (wild and domestic), cattle, camels, horse, non-human primates, rodents and humans (Taylor *et al.*, 2007). *B. coli*, is a notable pathogen that causes dysentery, especially in the immunocompromised people live near to the cattle and pigs farms (Parija and Giri, 2012). Human may easily get infection through faecal-oral route from reservoir pigs, although it is asymptomatic for them (Schuster and Ramirez, 2008).

Balantidiasis is more common in tropical and subtropical countries (Sampurna, 2007). The tropical climatic condition of Bangladesh is highly favorable for survival, development and reproduction of different parasites like *B. coli* (Sarker *et al.*, 2013). In cattle, the disease causes production losses through morbidity, reduced milk and meat production (Roy *et al.*, 2011). Simultaneously, balantidiasis, a sporadic swine associated zoonoses causes major economic losses to pig industry worldwide. It causes mortality and production loss in pigs, hampering trade sanctions on exporting animal products from an infected country or region, increasing public health concerns leading to pig culling operations and reduced pork consumption by people (Uddin *et al.*, 2013). As pigs are its reservoir hosts, humans directly or indirectly get infection from pigs (Nakauchi, 1999; Schuster and Ramirez, 2008).

Balantidium is often considered as a neglected pathogen. Information on balantidiasis of ruminants and pig are very sparse in Bangladesh. Zaman (1978) published an inclusive review on *Balantidium* almost four decades ago, but the organism has come to be known as an emerging pathogen in last decade (Garcia, 2008). The occurrence of *B. coli* infection in pig was 60.9% in Brazil (Sangioni *et al.*, 2017). Bauri *et al.* (2012) reported 93.0% prevalence in pig of India. Meanwhile, in Baghdad of Iraq, Hussin and Al-Samarai (2016) recorded 29.5% prevalence in cattle. In Bangladesh, 45.0% and 25.3% prevalence of *B. coli* was found in buffalo and cattle by Roy *et al.* (2011) and Rahman and Samad (2010), respectively. Therefore, the aim of the current study is to determine the prevalence of *B. coli* infection of cattle and pig in some selected areas of Mymensigh district of Bangladesh in relation to age and sex in the study area.

Materials and methods

Study area and period

The study was undertaken in Mymensingh sadar and Muktagacha upazilas of Mymensigh district during the period of July to December, 2016 (**Figure 1**).

Figure 1. Map of Mymensingh district, showing the study sites, Mymensingh sadar and Muktagacha upazila

Sample collection, processing and microscopic examination

A total of 200 faecal samples were randomly collected from 150 cattle and 50 pigs irrespective

of age and sex from the study area. The age of the cattle was confirmed by examining teeth and counting the numbers of ring of the horn (Rahman and Hossain 1997) whereas the age of pigs were determined by interrogating the farmers. Age of the cattle were categorized into three groups, namely, calf (≤ 1.5 years), young (>1.5 to ≤ 4 years) and adults (> 4 years) whereas pigs grouped into piglet (≤ 6 month), grower (6.5 to 12 months) and adults (>12 months).

After collection, samples were transported to the laboratory of the Department of Parasitology, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh for coprological examination to determine the presence of cysts or trophozoites of *B. coli* using Modified Stoll's ova dilution technique (Soulsby 1982, Chatterjee 1996). Briefly, 3g faeces was mixed with 42 ml of water to make 45 ml suspension, which is then sieved and 0.15ml suspension was spreaded on slides, covered with cover slips and examined under microscope and total number of cyst /trophozoites was counted. Cysts and trophozoites were determined on the basis of morphological characteristics along with the use of determination keys (Chatterjee 1996). The sample was considered to be positive when minimum one cyst (round shape) or ciliated trophozoite was detected in the microscopic field.

Statistical analysis

Statistical analyses were prosecuted by Statistical Package for Social Science (SPSS, version 20) using χ^2 test and z-test.

Results

Overall prevalence of balantidiasis in cattle and pig

During the research period, a total of 200 (150 cattle and 50 pigs) samples were examined, of which 103 (103/200, 51.5%) were found to be positive for *Balantidium coli* cyst or trophozoites (**Figure 2**). Prevalence of balantidiasis was recorded 54.7% (82/150) in cattle and 42.0% (21/50) in pigs, respectively. The cyst per gram of faeces (CPG) was found to 100- 4100 with the mean of CPG, 481.89±125 (**Table 1**).

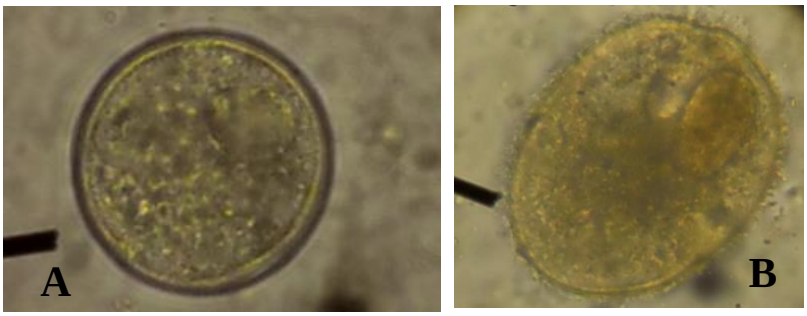

Figure 2. A, Cyst of *Balantidium coli* (400x); B, Trophozoite of *Balantidium coli* (400x). A bean-shaped macronucleus is visible in right-top of trophozoite.

Table 1. Overall prevalence of *Balantidium coli* infection in cattle and pig

Animals (N= 200)	**Prevalence (%)**	**CPG**	
		Range	**Mean ± SD**
Cattle (150)	82 (54.7)	100-4100	518.25±152.25
Pig (50)	21 (42)	100-900	345.52±98.12
Total	103 (51.5)	100-4100	481.89±125

Legend: CPG= Cyst per gram of faeces, SD= Standard deviation

Age- related prevalence of balantidiasis in cattle and pig

The present study showed that the prevalence of balantidiasis in cattle was significantly high (p= 0.000) in adult cattle (70.4 %) followed by young (40.5%) and calves (31.3%); whereas in pigs, high prevalence was found in piglet (65.0%) compared to that of the grower (31.3%) and adult pigs (21.4%) which was statistically significant (p= 0.023) (**Table 2**).

Table 2. Age related prevalence of *B. coli* infection in cattle and pig.

Animals	Age group	Prevalence (%)	CPG		OR	χ^2-value	p-value
			Range	Mean ± SD			
Cattle (150)	Calf (32)	10 (31.3)	100-600	198.47±85.25[a]	Young vs. calf = 1.5		
	Young (37)	15 (40.5)	100-1400	374.25±91.55[a]	Adult vs. Young = 3.5	18.12	0.000**
	Adult (81)	57 (70.4)	100-4100	511.27±161.23[b]	Adult vs. calf = 5.2		
Pig (50)	Piglet (20)	13 (65.0)	100-900	369.23±101.25[b]	Piglet vs. adult = 6.8		
	Grower (16)	5 (31.3)	100-700	201.88±95.25[a]	Piglet vs. grower = 4.1	7.53	0.023**
	Adult (14)	3 (21.4)	100-500	131.25±77.52[a]	Grower vs. adult = 1.67		
Total	200	103 (51.5)	100-4100	297.73±102.01			

Legend: **p<0.05, statistically significant; OR= Odds Ratio, SD= Standard deviation, CPG= Cyst per gram of faeces, [a,b] Each superscript letter denotes a subset of age categories whose row proportions differ significantly from each other at the 0.05 level.

Sex related prevalence of balantidiasis in cattle and pig

In the current study, high prevalence of balantidiasis was observed in female cattle (58.8%) than male cattle (45.8%). While, the male pigs also showed high prevalence of *B. coli* infection (54.5%) than the female pigs (32.1%) (**Table 3**).

Table 3. Sex related prevalence of *B. coli* infection in cattle and pig

Animals	Sex	Prevalence (%)	CPG		OR	χ^2-value	p-value
			Range	Mean ± SD			
Cattle (150)	Female (102)	60 (58.8)	100-4100	529.12±169.47	1.7	2.22	0.136NS
	Male (48)	22 (45.8)	100-2500	412.25±134.25			
Pig (50)	Female (28)	9 (32.1)	100-700	189.77±82.47	2.5	2.54	0.111NS
	Male (22)	12 (54.5)	100-900	211.64±93.27			
Total	200	103 (51.5)	100-4100	335.70±119.87			

Legend: NS = not significant, CPG= Cyst per gram of faeces, OR= Odds ratio, SD= Standard devaiation.

Discussion

Pigs harbour *B. coli* as a principal source of infection for humans and animals (Schuster *et al.*, 2008), although several reports suggest that cattle and buffaloes are also important host for the pathogen (Randhawa *et al.*, 2010; Tarrar *et al.*, 2008; Roy *et al.*, 2011). Here, we conducted a survey to determine the prevalence of balantidiasis in cattle and domestic pigs in some selected areas in Bangladesh.

The present study indicates that more than half of the cattle population was infected with *B. coli*. Our findings were a bit higher than some earlier findings. Roy *et al.* (2011) and Palanivel *et al.* (2005) recorded 45.0% and 45.5% prevalence in Bangladesh and India, respectively. However, Hussin and Al-Samarai (2016) in Iraq (29.5%), Rahman and Samad (2010) in Bangladesh (25.3%), Bilal *et al.* (2009) in Pakistan (25%) and Wisesa *et al.* (2015) in Bali, Indonesia (17.2%) reported low prevalence of the infection in cattle.

In contrast, very low prevalence was recorded by Singh *et al.* (2012) in Punjab, India (2.5%). On the other hand, findings regarding balantidiasis in pig conform to the previous findings reported by Mercy *et al.* (1989) in Australia (42.0%) and Hasan *et al.* (2015) in Bangladesh (34.6%). On the contrary, Dey *et al.* (2014) and Sarker *et al.* (2016) reported 96.4% and 52.3% prevalence of the infection in pigs of Mymensingh and Chittagong in Bangladesh, respectively. In contrast, lower prevalence of balantidiasis was reported by Tan *et al.* (2014) in Malaysia (22%), Solaymani-Mohammadi *et al.* (2004) in Western Iran (25%), and Permin *et al.* (1999) in Ghana (19.3%). The variations between the present and previous findings might be due to difference in the sample size, selection of samples, technique of sample examination, geographical locations/ topography, climatic condition, management and nutritional status of the animals (Roy *et al.*, 2011).

According to the present study, it was observed that the prevalence of balantidiasis was significantly ($p<0.05$) higher in adult cattle and lowest in calves, supporting the findings of Hussin and Al-Samarai (2016) and Raote *et al.* (1994). Although, our study suggest higher prevalence of balantidiasis in adult animals but it is not inverse age resistance because a larger number of calves also harbor the infection. Balantidiasis is a food and water borne disease. Possibly, adult animals consume a lot and get infection from the faulty management system. However, few reports suggest higher infection in very young calves (Haque *et al.*, 2000) indicating that age of the animal is not crucial factor for the disease. In our study, we also found contrasting results in pig. Our study revealed higher infection in piglet conforming to the findings of Hasan (2010) who reported higher prevalence in piglets (50.0%) than adult (23.3%). However, Morris *et al.* (1984) reported higher prevalence in adult swine (18.6%) than shoats (14.6%) and nursing pigs (5%). Similarly, Hayriye *et al.* (2009) recorded higher prevalence in adult (1.5%) than piglet (1.4%). Taken together, the results suggest that age of host does not influence the establishment of the infection in susceptible host. The pathogen can attack any age group.

We observed that *B. coli* was a bit higher in female cattle. Seemingly, Bachal *et al.* (2002) and Roy *et al.* (2011) found higher prevalence of balantidiasis in the female buffalo. In contrast, the present finding was differed from that of Hussin and Al-Samarai (2016) in Iraq and Wisesa *et al.* (2015) in Indonesia who reported higher infection in male. Mamun *et al.* (2011) also reported that the male buffaloes (37.1%) had more chance to get infection by *Balantidium* species. Although, the disparity between the present and prior findings cannot be explained exactly, but it is quite clear that sex of animal is also not a vital risk factor. Aside that, in present work, balantidiasis showed higher prevalence in male pig conforming to the findings of Giarratana *et al.* (2012) who reported higher prevalence in male pigs. The present finding is opposed to Dey *et al.* (2014) who recorded higher prevalence in female pigs, which ascertains further our hypothesis drawn from findings of balantidiasis in cattle.

Conclusions

The results of our present study demonstrated a high prevalence of balantidiasis in both cattle and pig. The environmentally resistant cysts could be widespread through animal faeces which may serve as a source of infection for human beings. Therefore, proper management of livestock farms must be needed to prevent wide spread human attack by *B. coli*.

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Competing Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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