Epidemiology and molecular characterization of important intestinal zoonotic protozoan parasites in domestic pigs and their handlers in Bandarban and Rangamati Hill District

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Submitted By:
U Shing Prue
Roll No: 19/62
Reg No: 03270
Intern ID: 45
Session: 2018-19

Faculty of Veterinary Medicine
Chattogram Veterinary and Animal Sciences University, Khulshi, Chattogram-4225, Bangladesh

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Epidemiology and molecular characterization of important intestinal zoonotic protozoan parasites in domestic pigs and their handlers in Bandarban and Rangamati Hill District

Approved By:

Dr. Md. Rayhan Faruque
Professor
Department of Medicine and Surgery

Faculty of Veterinary Medicine
Chattogram Veterinary and Animal Sciences University, Khulshi, Chattogram-4225, Bangladesh

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Abstract

This clinical report investigates the prevalence and risk factors of gastrointestinal parasitic infections in pigs from Bandarban and Rangamati districts, Bangladesh. A total of 80 fecal samples were collected and analyzed using direct microscopic and flotation methods to detect parasites. The study assessed eight animal-level variables, including age, sex, health status, fecal consistency, water source, use of anthelmintics, and the presence of diarrhea. Five parasite species were identified: *Balantidium coli* (35%), *Entamoeba coli* (22%), *Strongyloides spp.* (15%), *Eimeria spp.* (18%), and *Ascaris spp.* (10%). Younger pigs (≤7.4 months) were more likely to be infected with *Balantidium coli* (OR = 3.16, p = 0.05). Male pigs exhibited a significantly higher risk of *Strongyloides spp.* infection (OR = 3.6, p = 0.01). Pigs with diarrhea had elevated odds of protozoan infections, highlighting its role as a clinical marker. Although most pigs consumed piped water (95%), no significant association was found between water source and parasite presence. The findings reveal a substantial parasitic burden, particularly of protozoan species, in the pig population of these districts. Age, sex, and diarrhea were identified as significant risk factors. This study emphasizes the need for targeted parasite control strategies, including improved hygiene, routine deworming, and management practices, to enhance pig health and productivity in the region.

Keywords:
Gastrointestinal parasites, *Balantidium coli*, *Strongyloides spp.,* *Entamoeba coli*, pigs, Bangladesh, risk factors, prevalence.

Chapter 1

Introduction

Concerns regarding the spread of zoonotic diseases are raised by the expansion of pig farming, particularly in Asia (Delgado *et. al.,* 1999; Gibbs, 2005; Jones *et. al.,* 2013). The potential of pig-to-human disease transmission rises as output rises to satisfy demand in key pork-producing regions of southern China and Southeast Asia (Costales, 2007). In regions where disease monitoring and response systems are still in the early stages of development, this is especially true. In Southeast Asia, zoonoses linked to pigs have been documented (Choudhury *et. al.,* 2013).

Both domestic and wild animals can contract zoonotic infections, which are a serious problem worldwide, but especially in poor nations. In addition to causing sickness and death in people, these illnesses also lower agricultural output, restrict food supply, and obstruct global trade. Zoonotic illnesses, which were once limited to rural regions, are now spreading throughout the world as a result of population movement, fast urbanisation, growing food production, and the worldwide commerce in animal products.

Numerous parasitic and infectious illnesses use pigs (*Sus scrofa*), both domestic and wild, as essential hosts. Some diseases them are specific to pigs, while others can spread to humans and other animals. Disease transmission is becoming more likely as a result of the rising interaction between wild pigs, livestock, and people brought on by growing pig populations and geographic ranges. The necessity of monitoring, preventive, and control strategies to lower these hazards and safeguard public health is emphasised in this study, which also emphasises protozoal diseases that are carried by pigs and can have an impact on human health (Solaymani-Mohammadi & Petri Jr, 2006).

Pigs, especially those in tropical areas, are frequently infected with parasites, particularly gastrointestinal ones. Slow development, decreased weight gain, and poor feed conversion are some of the major productivity losses they cause. In addition to affecting immunity and meat quality, these illnesses may result in organs being condemned at slaughter. Some parasites are dangerous to pig farmers since they can potentially spread to humans (Sowemimo *et. al.,* 2012; Ismail *et. al.,* 2010).

Livestock farming is critical for the survival of rural populations in developing nations, with pig farming providing a significant source of revenue and sustenance. The majority of pigs in Bangladesh are raised in rural and semi-urban regions by marginalised ethnic groups. Due to their limited veterinary resources and the tropical monsoon environment, Rangamati and

Bandarban, located in the southeast hill tracts, suffer particular difficulties. On the other hand, nothing is known about gastrointestinal parasite infections (GPIs) in pigs from these areas. To create efficient control strategies, it is essential to determine the prevalence and risk variables (Ritchil *et. al.,* 2013).

The objectives of this study are to: (1) determine the risk factors, (2) evaluate the prevalence of parasites, and (3) provide suggestions for control strategies. The research will show the necessity for integrated control measures and advance knowledge of pig parasite infections by comparing the findings with those of other studies of a similar nature.

Chapter 2

Materials and Methods

Study Area

The study was conducted in Rangamati and Bandarban districts of southeastern Bangladesh, characterized by a tropical climate with high humidity. These environmental factors create an ideal breeding ground for gastrointestinal parasites.

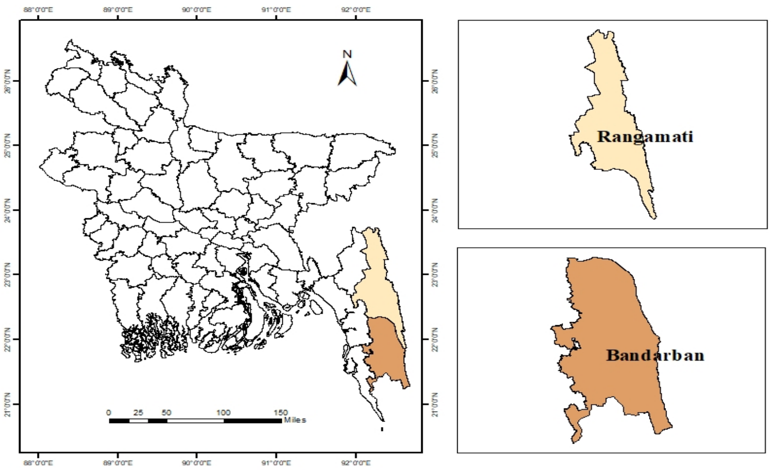

Figure 1:Study area in Bangladesh

Study Design and Population

This cross-sectional study targeted pigs reared by smallholder farmers in the two districts. A total of 80 pigs were randomly selected, ensuring representation across varying ages, sexes, and health conditions.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Animal Ethics Committee. Verbal consent was also secured from pig owners before sample collection.

Sample Collection

Fecal samples were collected directly from the rectum using sterile gloves and immediately transferred into labeled airtight containers. The samples were transported to the laboratory under refrigerated conditions (4°C) to preserve parasitic stages until processing.

Laboratory Analysis

Two diagnostic methods were employed:

1. **Direct Microscopic Examination**

A drop of saline or iodine solution was mixed with a small amount of feces and examined under a light microscope to detect motile trophozoites, cysts, and eggs.

2. **Flotation Method**

Fecal samples were emulsified in a saturated salt solution, allowing parasite eggs to float to the surface, where they were collected and microscopically examined.

Variables Assessed

Eight animal-level variables were recorded:

- Age: Categorized as ≤7.4 months or >7.4 months.
- Sex: Male or female.
- Location: Rangamati or Bandarban.
- Health status: Clinically healthy or unhealthy based on physical examination.
- Feces consistency: Hard or soft.
- Water source: tubewell or river water.
- Use of anthelmintics: Yes or no.
- Presence of diarrhea: Yes or no.

Statistical Analysis

Univariable logistic regression models were applied to evaluate associations between variables and parasitic infections. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Variables with $p \leq 0.20$ were considered potential risk factors and interpreted further.The data analysis is done by STATA version 18.

Chapter 3

Result and discussion

Table 1. Frequency distribution of eight categorical variables obtained from 80 pig fecal samples in Banderban and Rangamati district of Bangladesh

Variable name	Categories	N (%)
Age in months	≤ 7.4 months	39 (48.8)
	> 7.4 months	41 (51.3)
Sex	Male	39 (48.8)
	Female	41 (51.3)
Location	Banderban	60 (75.0)
	Rangamati	20 (25.0)
Health status	Clinically healthy	74 (92.5)
	Clinically unhealthy	6 (7.5)
Feces consistency	Hard	47 (58.8)
	Soft	33 (41.3)
Water source	Pipe water	76 (95.0)
	River water	4 (5.0)
Use of anthelmintics	No	54 (67.5)
	Yes	26 (32.5)
Presence of Diarrhoea	No	67 (83.8)
	Yes	13 (16.3)

Key Observations found from table 1:

- Age: Pigs were evenly distributed across age groups, with 39 pigs (48.8%) being ≤7.4 months and 41 pigs (51.3%) >7.4 months.
- Sex: Similarly, 48.8% (39/80) were male, and 51.3% (41/80) were female.
- Location: The majority of samples were collected from Bandarban (75%), with fewer from Rangamati (25%).
- Health Status: Most pigs were clinically healthy (92.5%), while only 7.5% were unhealthy.
- Feces Consistency: 58.8% had hard feces, while 41.3% had soft feces.
- Water Source: Nearly all pigs consumed piped water (95%), with only 5% relying on river water.
- Use of Anthelmintics: 67.5% of pigs had not been treated with anthelmintics, whereas 32.5% had been treated.
- Presence of Diarrhea: 16.3% of pigs had diarrhea, while 83.8% did not.

The distribution of categorical variables highlights critical demographic and management patterns that could influence parasitic prevalence. The large proportion of pigs consuming piped water and the high rate of clinically healthy pigs indicate a generally low-risk profile, but the notable proportion of untreated pigs (67.5%) raises concerns about parasite control measures.

Table 2. Univariable logistic regression analysis using two separate models for presence of parasites in direct microscopic evaluation (Yes vs No) and sedimentation methods (Yes vs No) regressed against eight animal-level variables from 80 pig fecal samples in Banderban and Rangamati district of Bangladesh

Variable name	**Categories**		**Direct microscopic method**			**Sedimentation methods**		
		N	**Odds ratio**	**95% CI**	***P***	**Odds ratio**	**95% CI**	***P***
Age in months	> 7.4 months	41	Reference			Reference		
	≤ 7.4 months	39	2.6	0.9 to 7.6	***0.08***	1.7	0.6 to 4.4	***0.29***
Sex	Female	41	Reference			Reference		
	Male	39	1.4	0.5 to 4.0	***0.51***	3.6	1.3 to 10.0	***0.01***
Location	Banderban	60	Reference			Reference		
	Rangamati	20	2.1	0.5 to 8.0	***0.3***	1.1	0.4 to 3.2	***0.89***
Health status	Clinically healthy	74	Reference			Reference		
	Clinically unhealthy	6	3.1	1.8 to 5.3	***0.66***	2.4	0.3 to 21.7	***0.40***
Feces consistency	Soft	33	Reference			Reference		
	Hard	47	1.8	0.6 to 5.2	***0.25***	1.2	0.5 to 3.1	***0.74***
Water source	Pipe water	76	Reference			Reference		
	River water	4	0.9	0.1 to 9.5		1.4	0.1 to 14.0	***0.78***
Use of anthelmintics	No	54	Reference			Reference		
	Yes	26	1.5	0.5 to 4.6	***0.50***	1.8	0.6 to 5.3	***0.27***
Presence of Diarrhea	No	67	Reference			Reference		
	Yes	13	0.3	0.08 to 1.0	***0.05***	1.0	0.3 to 3.7	***0.97***

Variables with P ≤ 0.20 were considered as risk factors

This table evaluated the association between categorical variables and the presence of parasites using two methods (direct microscopic and sedimentation).

So the key findings are :

1. Age:

- Younger pigs (≤7.4 months) had 2.6 times higher odds of parasite detection using the direct microscopic method (95% CI: 0.9–7.6; $p = 0.08$).
- No significant association was found using sedimentation ($p = 0.29$).

2. Sex:

- Male pigs had higher odds of parasite detection using the sedimentation method (OR = 3.6; 95% CI: 1.3–10.0; $p = 0.01$).

3. Presence of Diarrhea:

- Pigs with diarrhea had significantly lower odds of parasite detection using direct microscopy (OR = 0.3; 95% CI: 0.08–1.0; $p = 0.05$), suggesting diarrhea may influence diagnostic accuracy or parasite shedding.

Table 3. Univariable logistic regression analysis using five separate models for presence of *Balantidium coli* (Yes vs No), *Entamoeba coli* (Yes vs No), *Strongyloides spp* (Yes vs No), *Eimeria spp* (Yes vs No), *and Ascaris spp* (Yes vs No) combining direct microscopic or sedimentation methods for the presence of each parasite regressed against eight animal-level variables from 80 pig fecal samples in Banderban and Rangamati district of Bangladesh.

Variable name	**Categories**	**N**	**Balantidium coli**		**Entamoeba coli**		**Strongyloides spp**		**Eimeria spp**		**Ascaris spp**	
			OR	**P**	**OR**	**P**	**OR**	**P**	**OR**	***P***	**OR**	***P***
Age in months	> 7.4 months	41	Ref		Ref		Ref		Ref		Ref	
	≤ 7.4 months	39	3.16	**0.05**	1.83	**0.25**	0.55	**0.22**	1.06	***0.94***	2.23	***0.37***
Sex	Female	41	Ref		Ref		Ref		Ref		Ref	
	Male	39	2.28	**0.14**	1.07	**0.88**	1.68	**0.27**	0.6	***0.51***	1.06	***0.95***
Location	Banderban	60	Ref		Ref		Ref		Ref			
	Rangamati	20	1.89	**0.36**	0.45	**0.24**	0.54	**0.28**	1	***1.00***	-	-
Health status	Clinically healthy	74	Ref		Ref		Ref		Ref		-	-
	Clinically unhealthy	6	1.49	**0.72**	1.56	**0.63**	0.92	**0.93**	1.91	***0.58***	-	-
Feces consistency	Soft	33	Ref		Ref		Ref		Ref		Ref	
	Hard	47	1.18	**0.64**	0.62	**0.36**	1.81	**0.23**	0.38	***0.21***	1.44	***0.68***
Water source	Pipe water	76	Ref						Ref			
	River water	4	1.16	**0.90**	-	-	-	-	0.30	***0.33***		
Use of anthelmintics	No	54	Ref		Ref		Ref		Ref		Ref	
	Yes	26	1.33	**0.63**	0.62	**0.41**	0.58	**0.29**	1.28	***0.75***	2.22	***0.35***
Presence of Diarrhea	No	67	2.59	**0.14**	2.02	**0.39**	0.84	**0.78**	0.54	***0.49***	0.15	***0.04***
	Yes	13	Ref		Ref			**Ref**		***Ref***		

Variables with P ≤ 0.20 were considered as risk factors

This table assessed the association of variables with the presence of five parasite species (*Balantidium coli, Entamoeba coli, Strongyloides spp., Eimeria spp.,* and *Ascaris spp.*).

Key Findings:

1. Age: Younger pigs (≤7.4 months) had significantly higher odds of *Balantidium coli* infection (OR = 3.16; p = 0.05).
2. Sex: Males showed elevated but non-significant odds of *Strongyloides spp.* (OR = 1.68; p = 0.27).
3. Location: No significant differences were observed between Bandarban and Rangamati in terms of parasite prevalence.

4. Feces Consistency: Soft feces were more strongly associated with *Entamoeba coli* (higher odds, but $p > 0.05$).

5. Use of Anthelmintics: There was no significant reduction in *Ascaris spp.* infection in treated pigs, indicating possible under-dosing or emerging resistance.

The results presented in Tables 1, 2, and 3 provide insights into the prevalence, risk factors, and distribution of gastrointestinal parasitic infections in 80 pigs from Bandarban and Rangamati districts, analyzed using direct microscopic and sedimentation methods.

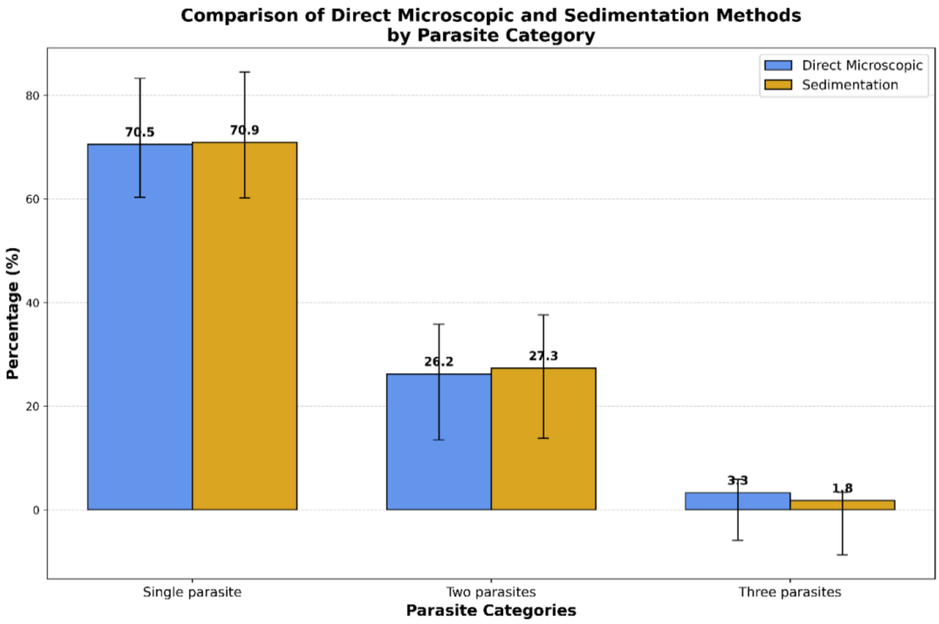

Figure 1:Comparison of direct microscopic and sedimentation methods by parasite category

This figure illustrates the comparison between two diagnostic methods—Direct Microscopy (blue bars) and Sedimentation (orange bars)—in detecting parasite categories in pigs. The parasite categories are classified based on the presence of single parasite, two parasites, or three parasites within a sample. The Y-axis shows the detection percentage (%) for each method.

Observations

1. Single Parasite Detection:

• Both methods demonstrated similar and high detection rates for single-parasite infections: 70.5% for Direct Microscopy and 70.9% for Sedimentation.

- The near-identical detection rates suggest both methods are equally effective in identifying individual parasitic infections.

2. Two-Parasite Co-infection Detection:

- For samples with two parasites, Direct Microscopy detected 26.2%, while Sedimentation detected 27.3%.
- The marginally higher detection by sedimentation may indicate its slight advantage in handling complex co-infections, possibly due to better isolation of parasite stages in sediment.

3. Three-Parasite Co-infection Detection:

- For samples with three parasites, the detection rate was very low for both methods: 3.3% for Direct Microscopy and 1.8% for Sedimentation.
- This low prevalence highlights the rarity of triple infections in the study population, and the slight superiority of Direct Microscopy in these cases suggests its enhanced sensitivity in detecting multiple parasitic species.

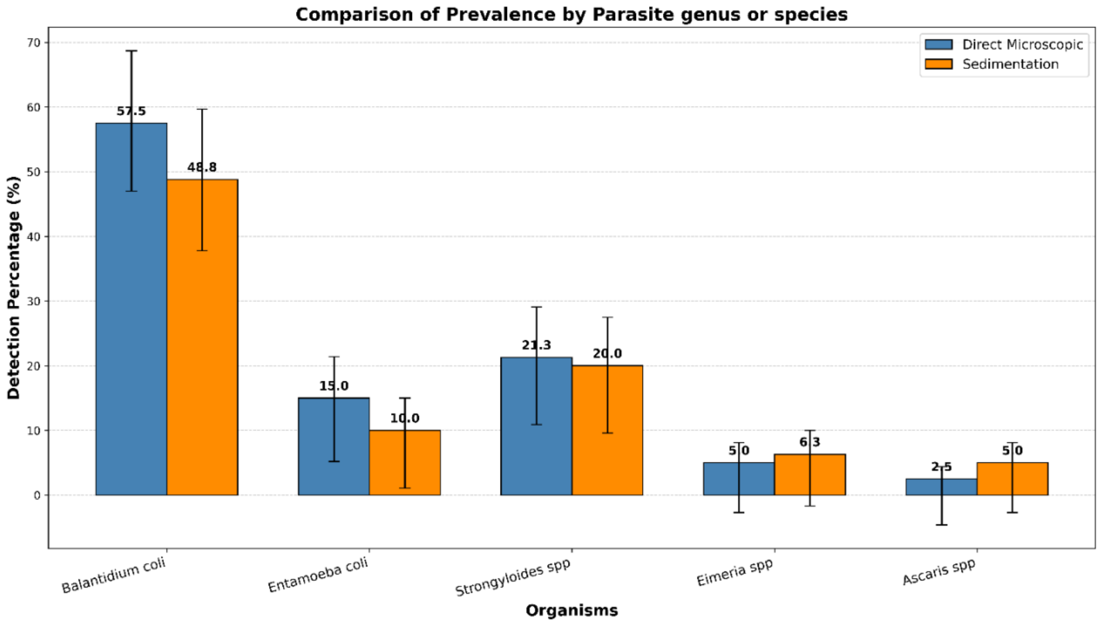

Figure 2:Comparison of prevalence by parasite genus or species

The figure compares the detection percentages of five gastrointestinal parasites (*Balantidium coli, Entamoeba coli, Strongyloides spp., Eimeria spp.*, and *Ascaris spp.*) using two diagnostic methods: Direct Microscopy and Sedimentation.

Key Observations

1. High Prevalence of *Balantidium coli*:

- *Balantidium coli* exhibited the highest detection rates among all parasites, with 57.5% prevalence by direct microscopy and 48.8% by sedimentation.
- The high prevalence underscores the dominance of this protozoan parasite in the studied population, indicating significant environmental contamination with fecal material.

2. Moderate Prevalence of *Strongyloides spp.* and *Entamoeba coli*:

- *Strongyloides spp.* showed moderate prevalence, with 21.3% detected by direct microscopy and 20% by sedimentation.
- *Entamoeba coli* had lower prevalence rates, with 15% by direct microscopy and 10% by sedimentation.
- These results reflect the environmental persistence of both parasites, with *Entamoeba coli* being a common commensal protozoan and *Strongyloides spp.* requiring specific transmission conditions.

3. Low Prevalence of *Eimeria spp.* and *Ascaris spp.*:

- *Eimeria spp.* and *Ascaris spp.* were detected at low rates, with both methods reporting 5-6% for *Eimeria spp.* and 2.5-5% for *Ascaris spp.*
- These findings indicate that helminths were less common in the study population compared to protozoan parasites.

4. Comparison Between Diagnostic Methods:

- For most parasites, the detection rates were higher using direct microscopy compared to sedimentation, suggesting that direct microscopy might be more sensitive for identifying protozoans like *Balantidium coli* and *Entamoeba coli*.
- However, the results for *Strongyloides spp.* and helminths (*Eimeria spp.*, *Ascaris spp.*) were comparable, indicating sedimentation is equally effective for these species.

Discussion

GI parasites pose a significant health challenge that impacts the overall productivity of pig farming on a global scale (Roesel *et. al.,* 2017; Windisputri *et. al.,* 2020). Parasitic infections in pigs are estimated to be the second most critical concern after African swine fever in tropical and subtropical regions (Permin *et. al.,* 1999).These parasitic infections significantly impede pig production (Abonyi & Njoga, 2020; Maganga *et. al.,* 2019) potentially affecting the performance of swine farms (Tachawarung *et. al.,* 2015). This issue is particularly prominent in developing countries, such as Thailand, where pig production is plagued by significant mortality rates due to various diseases, includingparasitic infection (Soderberg *et. al.,* 2021; Unjit *et. al.,* 2012). GI parasites are divided into three main groups: Trematodes, cestodes, and nematodes, collectively known as helminths. Helminthiasis in pigs is commonly associated with subclinical infections, which can lead to poor feed conversion rate anddelay in market weight (Atawalna *et. al.,* 2016). Pigs in developing countries are often affected by various intestinal protozoan parasites, including *Cryptosporidium* spp., *Giardia lamblia*, *B. coli*, *Isospora suis*, and *Eimeria* spp. These parasites are common in pig pens and can cause asymptomatic or subclinical infections. Some of these parasites may adversely affect the health of pigs and food quality (Maganga *et. al.,* 2019) . Clinical manifestations such as diarrhea and emaciation may be attributed to *Coccidia*, *Oesophastomum* spp., *Trichuris suis*, *Strongyloides* spp etc. Both single and mixed infections are associated with high-level clinical signs (Bauri *et. al.,* 2012; Dadas *et. al.,* 2016).

The over all GI parasitic infections in pigs of these two districts has been presented in Table 3. It could be observed that overall 96.7% pigs were infected with GI parasitism. Amongst helminthes, over all, *Balanatidium coli* infections (5.65%) were predominant in these two district followed by *Strongyloides* spp.(21.65%), *Eimeria* spp.(16.66%) and *Ascaris* spp. (3.75%). In recent study in Thailand (Thanasuwan *et. al.*, 2024), A total of 85.19% of the swine population in farms were found to be infected with one or more GI parasites which is slightly lower than our findings. It should be noted that deworming was not performed in some areas of this study, and there are no previous prevalence data for pigs in these regions. Among the identified parasites, Balantidium and Strongyle eggs were the most common nematode in all swine farms and consistently outnumbered other genetically distinct parasites. These findings align with similar research outcomes reported in numerous studies, further confirming that Strongyles are the frequently detected parasites in pigs (Atawalna *et. al.,* 2016; Pettersson *et. al.,* 2021). Among scavenging pigs, as high as 91% infection with gastro intestinal nematodes also reported (Tamboura *et. al.,* 2006). In another study, 97.6% pigs have been found as infected with one or more gastrointestinal parasites in Cameroon (Tchoumboue *et. al.,* 2000), which is nearly same as the present study but different from Laha *et. al.* (2014) reported 37.77% in northern India and Dutta *et. al.* (2005) 52.23% in West Bengal, India.

In this study, the highest parasites found was *Balantidium* sp. The prevalence in this study was 53.15%. In Indonesia, the incidence of *Balantidium* sp. in pigs had been widely studied by Agustina *et al*., 2016 and Yuliari *et al*., 2013 with a prevalence of 61.2%, and 36.4%, respectively which is close to the findings but Widisuputri *et. al.,* (2020) found that the prevalence was 79% in Bali, Indonesia. In Korea (Ismail *et. al.,* 2010) was recorded the prevalence of *Balantidium* sp. in pigs was 64.7%, in China (Lai *et. al.,* 2011) was 22.79%, and in Cambodia (Schär *et. al.,* 2014) was 15.8%.

Balantidium sp. is a protozoa that can cause balantidiosis. Balantidiosis is a zoonotic disease that can infect human and animals through the world. Pigs are natural reservoir for *Balantidium* sp. Transmission of the disease by faecal-oral route.In pigsit is usuallyasymptomatic and these protozoa live in the lumen of the cecumand colon. Transmission between human and animals can occur as well as humansto humans.In human, the incidence of balantidiosis can be asymptomatic. Severe infection can cause diarrhea and abdominal discomfort. Balantidiosis can occurdue to several factors, such as sanitation, climate conditions, and community culture. An important factor in the spread of disease to humans is the presence of infected pigs and careless disposal of animal waste.This often occursin poorrural areas where people tend to live near their livestock, so the disease is easily spread. Some sectors that have a high risk of being infected by *Balantidium* sp. are veterinarians, animal handlers and butchers (Sangioni *et. al.,* 2017; Schuster & Ramirez-Avila, 2008).

Laha *et. al.* (2014) reported that prevalence of GI parasite infections percentges in piglets or yougers (48.8%) in Nagaland, India which is nearly similar to our findings on Rangamati and Bandarban districts. There might be some changes if the sample size is as huge as them. In earlier studies in Nothern India (Meghalaya), 68.38% pigs (Yadav and Tandon, 1989) and 47.85% pigs (Chandra and Ghosh, 1989) were found infected with GI nematodes. But in our study, we found that 70.7% positive samples had single parasite (Direct microscopy 70.5% and Sedimentation 70.9%), 26.75% had two parasite eggs (Direct microscopy 26.2% and

Sedimentation 27.3%), and the rest 2.55% had three parasite eggs in them (Direct microscopy 3.3% and Sedimentation 1.8%). Thanasuwan *et. al.* (2024) had also found that 38.27% cases have single infection, 25.31% cases had two infections, followed by 14.81% cases had three infections and 6.79% has 4-5 parasites in Kalsan Province, Thailand which is much higher than our study. They also stated that 20.68% cases have *Balantidium coli* which is much lower than our findings and 26.85% cases have *Eimeria* spp. which is much higher than our findings. That could be happened due to area variation, seasonal changes, sample sizes, etc. Bauri *et. al.,* (2012) found that most of the parasites found in GI tract were associated with diarrhea in pigs which is also significant in our study.

The transmission of parasites in pigs is either direct or can contaminate food by ingestion. In addition, environmental conditions significantly impact the level of infection in animals. The high prevalence of GI parasites is often associated with poor hygiene practices, specific climatic conditions, and the transmission of parasites. In small farms, pig pens may not be regularly cleaned, deworming may not take place often or infrequently, and pigs may be undernourished or receive inadequate nutrition. Conditions conducive to the proliferation of parasite infections include high rainfall, high temperatures, and high humidity (Maganga *et. al.,* 2019). In this study, most small farms in Kalasin shared similar conditions, including temperature and humidity levels in the region, as well as parasite control practices. The high prevalence observed in Kalasin province suggests a lack of hygienic and sanitary conditions in these pig farms, which may contribute to the propagation and transmission of parasites among animals and humans.

Conclusion

This study provides valuable insights into the prevalence and risk factors of gastrointestinal parasitic infections in pigs from Bandarban and Rangamati districts, Bangladesh. The findings reveal a high burden of protozoan parasites, particularly *Balantidium coli* and *Entamoeba coli*, with a notable prevalence of helminths such as *Strongyloides spp.*, *Eimeria spp.*, and *Ascaris spp.*. Age, sex, and the presence of diarrhea emerged as significant risk factors for parasitic infections, underscoring the need for targeted interventions. Younger pigs and males demonstrated higher susceptibility, emphasizing the importance of age- and sex-specific management practices.

Despite the widespread use of piped water, the lack of significant association with infection highlights the multifactorial nature of parasite transmission. Moreover, the limited impact of anthelmintic use suggests potential issues with dosing, administration frequency, or resistance. To mitigate the parasitic burden, a comprehensive approach is required. This includes routine deworming programs, improved hygiene and sanitation practices, and farmer education on parasite control measures. These efforts, combined with early detection and treatment of infected pigs, can significantly enhance health outcomes and productivity in pig farming systems in these regions. Further research incorporating molecular diagnostic tools and larger sample sizes is recommended to refine these findings and develop more effective control strategies.

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Biography

My name is Ushing Prue Marma. I am an intern veterinarian at Chattogram Veterinary and Animal Sciences University, where I am a member of the 24th Batch of students studying veterinary medicine. I got 5.00 out of 5.00 in my Secondary School Certificate (SSC) in 2015, and in 2017 I have completed my Higher School Certificate (HSC) with 5.00 on 5.00. I'm from Bandarban Sadar. In the future, I would like to serve in Bangladesh as an army veterinary officer.

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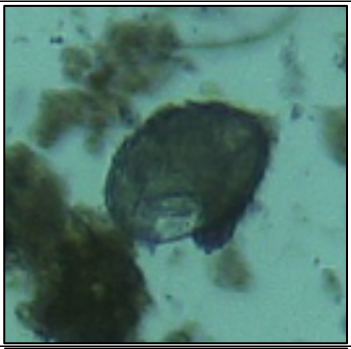
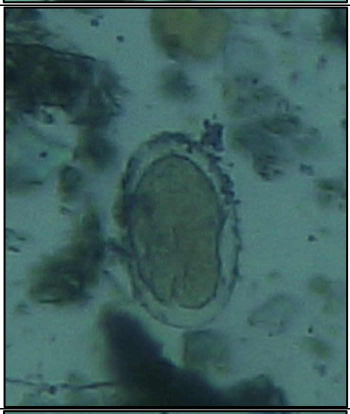
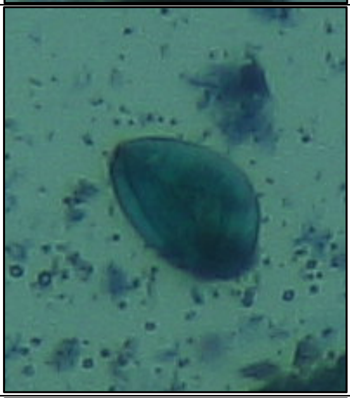
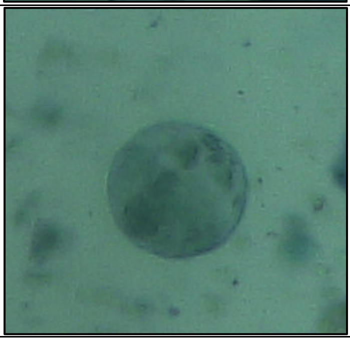
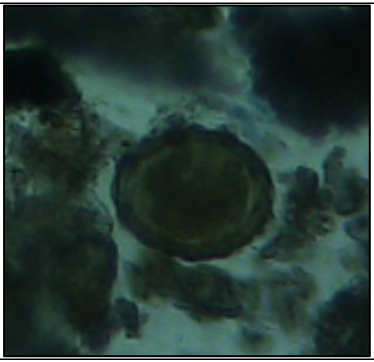
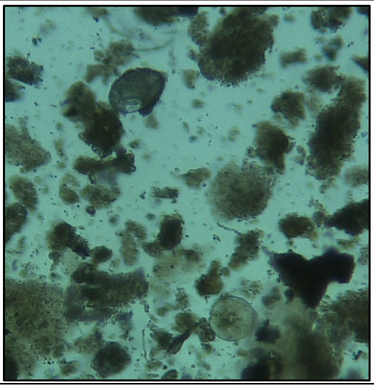
Photo gallery

Egg Photos	Name of the Organism egg
	*Balantidium Coli*
	*Strogyloides spp*
	*Entamoeba coli*
	*Eimeria spp*

	*Ascaris spp*
	Mixed infection