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List of abbreviation

Abbreviation	Elaboration
<	less than
≤	Lesser or equal
≥	Greater or equal
%	Percentage
°	Degree celsius
GI	Gastrointestinal
BCS	Body condition score

Abstract

Parasite is one of the major obstacles to the way of maximum production in dairy industry of all over the world. This investigation was conducted to measure the prevalence of GI parasites of buffalo in Noakhali, Bangladesh and its associated risk factors (age, sex, nutrition status and deworming history). Total 100 fecal samples were collected from February 2022 to April 2022. A well-structured questionnaire was used to collect the information relevant to the objectives of the study. Then these samples were examined through flotation and sedimentation technique to pick up the positive samples. The overall prevalence found was 56%. About 13 species of parasite were found in these tests, among which 8 nematode, 3 trematode and 2 protozoa were found. The highest amount of egg found was of *Toxocara vitulorum*, nearly 32%. The calves tested more vulnerable to the helminths infection than young and adult animals. The prevalence was 72.2% in calves, 65.76% in young and 54.48% in adult buffaloes. Also, the males have higher prevalence than the female animals. Male buffaloes were 1.25 times more prone to GI parasitic infection than the female buffaloes. Moreover, the poor health animal also seems to be more prone to infection compared to moderate and good health animal. A significant difference was noticed in the prevalence of GI parasite in poor health and good health buffaloes. Further work can be done to confirm molecular identification of the helminth species and also the economic effect of parasitic infection in buffalo.

Keywords: Buffalo, gastro-intestinal, fecal sample, prevalence.

Chapter I

Introduction

Bangladesh is an agronomical country where about 70% of the total population is directly or indirectly dependent on agriculture. Livestock is a major part of the agriculture and contributes 1.47% of the Gross Domestic Product. Bangladesh is one of the highest densities of livestock population in the world and has 145 large ruminants per km² area (Amin et al., 2015). According to DLS annual report 2020, the total livestock population is 4122.44 lakh, which is 96.81 lakh more than the previous year. Livestock was identified as one of the key player of Poverty Reduction Strategy by Bangladesh government (DLS, 2014). Buffalo (*Bubalus bubalis*) is an important multi-purpose livestock in the aspect of Bangladesh; which not only assures the protein supply, but also serves milk, manure, hide and draft (Ghaffar et al., 1991). The Food and Agriculture Organization (FAO) termed buffalo “an asset undervalued” due to its merits.

Mostly, small farmers, who have not more than 2 hectares of land, has been seen to rear buffalo (Mudgal and Sharma, 1992). The present number of buffalo in Bangladesh is 14.93 lakh and this number is increasing day by day as people are being more interested in rearing buffalo since it can be reared in the available coastal areas in Bangladesh, that can't be used for cultivation or other animal rearing. Besides, buffalo can utilize low quality fibrous feed like drowned grasses, the coarse wheat straw. In rural areas, buffaloes are frequently used for draft and pulling purpose, also used for land preparation for cultivation, like ploughing and laddering. These are the reasons the buffaloes were designated as the living tractor of the East (Cockrill, 1968). Furthermore, less maintenance, more disease resistant, high fat percentage(7%) in milk, good quality healthy meat and numerous Govt. projects on buffalo are liable for making the buffalo popular to the farmers.

Disease is a barrier in getting the optimum production, further it can even cause death of the animals. Parasite is a significant disease causing organism in buffalo like all other livestock (Green and Jabber, 1983). It hampers the production, clog the reproduction,

even cause death of calves too. Also, the cost to take preventive and control measure for these parasites increase the production cost of the farm. Several types of parasites such as ectoparasite, endoparasite that includes haemoparasite and gastro-intestinal parasite are found in buffalos. Gastro-intestinal parasitism is a major concern for the world. Buffalo shelter a variety of parasites in its GIT that leads to cause clinical and subclinical parasitism. Grazing habit, nutritional status, climate, water source, the number of infective larvae and eggs in the environment are some of the major predisposing factors of parasitism (Blood et al., 1994)

It is important to recognize the common parasites available in the area, as well as the epidemiological pattern of the parasitism to make a compatible prevention and control procedure; which is well established in developed countries. But a matter of pity is that the developing countries are far behind from the developed countries in this case.

So this study was conducted to identify the common buffalo parasites found in Noakhali, Bangladesh area and also to measure their prevalence under current husbandry practices. There are very little work done so far on buffalo parasites at the geographic area this study was guided; moreover, the works found were not very significant. Therefore, the objectives of this investigation were to detect the prevalence and the associated risk factors of the common gastro-intestinal parasites found in the buffaloes of Kobirhat and Companiganj upazila of Noakhali, Bangladesh.

Chapter II

Materials and methods:

2.1 Study area

The study was conducted in two upazila of Noakhali district, Kabirhat and Companiganj over 2.5 month period (from 15th February 2022 to 30 April 2022). Noakhali district is located at 22.8246° N, 91.1017° E. The availability of the buffalo was the criterion to select the study area.

2.2 Selection of sample

The buffalo usually found in Noakhali district are mainly of indigenous breed and river type. Total 100 fecal samples of buffalo were collected using simple random sampling technique. Nearly 50% of the total buffalo sample was collected from an intensive farm of Kabirhat. Rest of the sample was collected from buffaloes that are reared in free range in Companiganj.

2.3 Data collection

A pre-designed questionnaire that was relevant to the study objective was prepared to collect the data. Face-to-face interviews and on-the-spot data computing were done about the age, sex, nutrition status, deworming history of the animals, water source, disease status and other management practices.

2.4 Sample collection, preservation and examination :

After completing the questionnaire, the fecal samples were collected from the freshly voided feces in plastic specimen container. Around 5-10 g feces was collected from each animal. Then the samples were preserved with 10% formalin solution at 4-5° c temperature for further analyses.

The parasite eggs were examined by using routine tests (floatation and sedimentation) and the parasite eggs and oocysts were identified according to the morphology (Soulsby, 1982). The floatation technique of fecal sample examination was performed

using saturated sugar solution to identify the Nematodes eggs, whereas, Trematodes eggs were recognized by the sedimentation technique.

In floatation technique, the fecal sample was kept in a test tube and the tube was filled up with floatation fluid, then the convex meniscus was covered by a cover slip. The cover slip was removed and placed on a glass slide for microscopic examination after 15 min. The sedimentation technique was done by keeping the fecal suspension stand by for about 15 min, then discarding the supernatant and a drop from the sediment was placed on a glass slide with a cover slip and examined under the microscope.

2.5 Statistical analysis

The collected data were entered in a Microsoft Excel worksheet, organized and processed for further analysis. The data were exported to STATA™ 15.1 (STATA Corporation College Station, Texas) for Chi-Square test. The result was considered significant at the level of 5%.

2.6 Ethical consideration

The study was conducted considering the ethical principle and oral consent were taken from each respondent after explaining the purpose of the study.

Chapter III

RESULTS

Overall prevalence of gastrointestinal parasite in buffalo:

Total 100 fecal samples were collected and examined, of which, 56 samples found positive for gastrointestinal helminthes. This study detected 8 nematode genera, 2 protozoa genera and 3 trematode genera. Among these, nematodes have the highest infection rate, followed by protozoa and trematode. The prevalence found in nematodes, treamtodes and protozoa were 67.8%, 12.5% and 19.64% respectively.

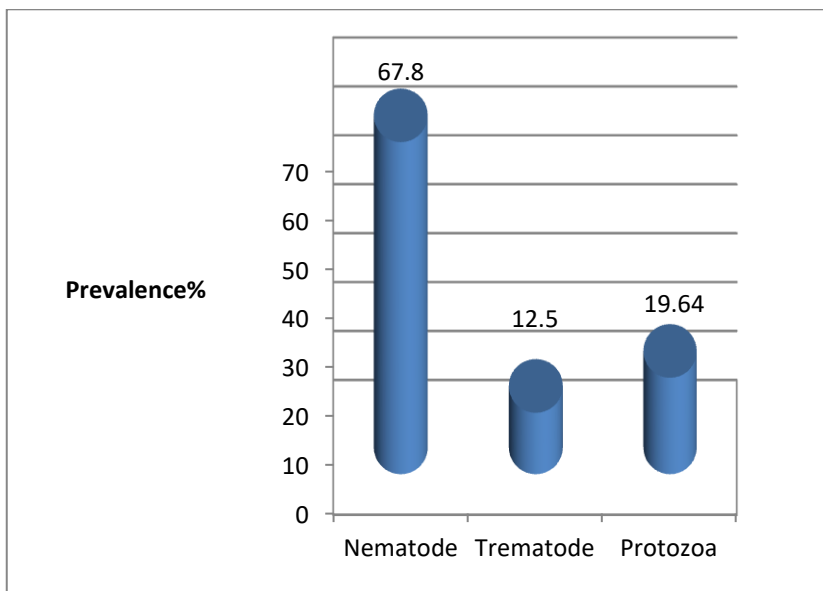


Figure 1: Prevalence of nematode, trematode and protozoa parasites in buffalo.

The nematodes found in the sample were *Toxocara vitulorum*, *Oesophagostomum sp*, *Strongyloides papillosus*, *Trichuris sp*, *Cooperia sp*, *Capilaria sp* and *Chlonorchis sp*. *Paramphistomum cervi*, *Schistosoma spindale* and *Fasciola gigantica* were found among all trematode species. Two species of protozoa found in the sample were *Balantidium coli* and *Eimeria zuernii*.

Toxocara vitulorum was the most prevalent one and have 32% prevalence. Among other parasites, *Balantidium coli* and *Paramphistomum cervi* were more frequent than the other ones, with 11% and 9% prevalence respectively. Mixed infection was also quite common in the buffaloes and the prevalence found was 26.78%.

Table 1: Overall prevalence of gastrointestinal parasites in buffalo in Noakhali

Name of parasites	No. of animals infected(N=100)	Percentage (%)
<i>Toxocara vitulorum</i>	32	32
<i>Balantidium coli</i>	11	11
<i>Eimeria zuernii</i>	5	5
<i>Paramphistomum cervi</i>	9	9
<i>Oesophagostomum sp</i>	2	2
<i>Haemonchus contortus</i>	3	3
<i>Strongyloides papillosus</i>	4	4
<i>Trichuris sp</i>	1	1
<i>Schistosoma spindale</i>	1	1
<i>Cooperia sp</i>	2	2
<i>Fasciola gigantica</i>	1	1
<i>Capilaria sp</i>	3	3
<i>Chlonorchis sp</i>	1	1

Age related prevalence of gastrointestinal parasites in buffalo:

The overall frequency of gastrointestinal helminths was more in calves (72.2%) compared to young (65.76%) and adults (54.48%). Within different species of parasites, *Toxocara vitulorum* was significantly more common in calves. *Balantidium coli* and *Paramphistomum cervi* were more prevalent in young animals.

Table 2: Age related prevalence of gastrointestinal parasites in buffalo in Noakhali

Name of parasites	Calves %(N= 33)	Young%(N=42)	Adult%(N=25)	P value
<i>Toxocara vitulorum</i>	33.33	33.33	28	0.02
<i>Balantidium coli</i>	6.06	21.43	0	0.12
<i>Eimeria zuernii</i>	3.03	4.76	4.76	0.29
<i>Paramphistomum cervi</i>	6.06	11.90	8	0.56
<i>Oesophagostomum</i>	6.06	0	0	0.47
<i>Haemonchus contortus</i>	6.06	2.38	0	0.67
<i>Strongyloides papillosus</i>	3.03	4.76	4	0.58
<i>Trichuris ovis</i>	0	2.38	0	0.10
<i>Schistosoma spindale</i>	0	2.38	0	0.73
<i>Cooperia sp</i>	3.03	0	4	0.42
<i>Fasciola gigantica</i>	3.03	0	0	0.38
<i>Capilaria sp</i>	3.03	2.38	4	0.64
<i>Chlonorchis sp</i>	0	2.38	0	0.57

Fasciola eggs were found in the fecal sample of calves under 2 years old. Adult animals were seen to be more prone to *Capilaria sp* infection.

Sex related prevalence of gastro-intestinal parasites in buffalo:

The result of the study shows that the male animals are more prone to infection than that of in female. The overall prevalence of disease occurrence in male found 54.55, where the prevalence found in female was 43.59. Although the species specific analysis shows that the female buffaloes are more infected by the helminths, except in case of *Toxocara* and *Oesophagostomum*.

Table 3: Sex related prevalence of gastro-intestinal parasites in buffalo in Noakhali

Name of parasites	Male%(N=22)	Female%(N=78)	P value
<i>Toxocara vitulorum</i>	45.45	28.21	0.03
<i>Balantidium coli</i>	11.53	9.09	0.36
<i>Eimeria zuernii</i>	4.55	5.12	0.75
<i>Paramphistomum sp</i>	4.55	10.26	0.04
<i>Oesophagostomum sp</i>	9.09	0	0.34
<i>Haemonchus contortus</i>	0	3.85	0.83
<i>Strongyloides papillosus</i>	4.55	3.85	0.002
<i>Trichuris ovis</i>	0	1.28	0.86
<i>Schistosoma spindale</i>	0	1.28	0.29
<i>Cooperia</i>	4.55	1.28	0.48
<i>Fasciola gigantica</i>	0	1.28	0.40
<i>Capilaria sp</i>	4.55	2.56	0.16
<i>Chlonorchis sp</i>	0	1.28	0.06

Toxocara vitulorum is significantly more prevalent in male buffaloes compared to the female buffaloes. The same trend was found in *Oesophagostomum sp*, though it did not seem statistically significant.

Health status related prevalence of gastrointestinal parasites in buffalo:

The animal with the poor BCS condition is seen to be more vulnerable to parasitic infection than that of in moderate and good health. Almost all helminths found in the fecal examination were more prevalent in poor health conditioned animals. Some of these were more prevalent in good health animal compared to the moderate health animal.

Table 4: Health status related prevalence of gastro-intestinal parasites in buffalo of Kobirhat and Companiganj upazilla, Noakhali, Bangladesh

Name of parasites	Poor%(N=35)	Moderate%(N=40)	Good%(N=25)	P value
<i>Toxocara vitulorum</i>	37.14	12.5	8	0.002
<i>Balantidium coli</i>	8.57	2.5	4	0.007
<i>Eimeria zuernii</i>	5.71	5	4	0.08
<i>Paramphistomum cervi</i>	5.71	2.5	0	0.14
<i>Oesophagostomum</i>	8.57	5	8	0.03
<i>Haemonchus contortus</i>	5.71	5	0	0.04
<i>Strongyloides papillosus</i>	8.57	0	4	0.19
<i>Trichuris ovis</i>	2.85	0	0	0.007
<i>Schistosoma spindale</i>	2.85	2.5	0	0.86
<i>Cooperia</i>	2.85	2.5	0	0.55
<i>Fasciola gigantica</i>	5.71	0	0	0.36
<i>Capilaria sp</i>	2.85	0	0	0.96
<i>Chlonorchis sp</i>	2.85	0	0	0.89

Chapter IV

Discussion

Overall prevalence of gastrointestinal parasite in buffalo:

GI parasitic infection hampers the health and production of the buffaloes. This study was conducted to exhibit the overall prevalence of GI parasites and its associated risk factors in two upazila of Noakhali. The overall prevalence found was 56%, which is similar to the prevalence(54%) reported in Mirsarai, Bangladesh (Nath et al., 2013).

However, a relatively higher prevalence were reported in (Biswas et al., 2014), that is 84.30%.(Mamun et al., 1970) and (Azam et al., 2002) also showed a higher prevalence than the current investigation, 61.02% and 64.41%. The variation might be due to difference in animal selection, sample collection, deworming history, health status and climate.

Age related prevalence of gastrointestinal parasites in buffalo:

Age has a significant ($p < 0.01$) effect on the prevalence of GI parasites in buffalo. In this study, younger animals were more vulnerable to parasitic infection compared to the older one. The overall frequency of gastrointestinal helminths was more in calves (72.2%) compared to young (65.76%) and adults (54.48%). Calves were 1.32 times more susceptible than the adult buffaloes. This findings supports the findings of (Raza et al., 2007)and (Maqbool et al., 2002), which shows that the prevalence of GI helminths in young buffaloes is higher than that in adult buffaloes. The results of (Mamun et al., 2011) and (Raza et al., 2007) also supports the findings of this study.

On the other hand, the findings did not support the results of (Alim, 1997) and (Biswas et al., 2014), where they found adult animals were more prone to infection compared to the younger one. (Alim et al., 2004) also noticed that the infection rate of fascioliasis increases with age. This is hard to identify and explain the cause of this variation, but it can occur due to management practice, immune status, climate condition.

Sex related prevalence of gastro-intestinal parasites in buffalo:

Male buffaloes were more vulnerable to infection compared to female buffaloes in the current investigation. Male buffaloes were 1.25 times more infected than the female ones. (Mamun et al., 2011) also reported that males were more prone to infection (about 1.08 times more) than females. But some noticed that buffaloes of either sex were equally infected with GI parasites, like (Maqbool et al., 2002). In contrast, (Alim et al., 2004), (Alam et al., 2016) reported that higher prevalence was found in female instead of male. The reason behind the contradiction could be the physiological state of the female buffaloes. As (Lloyd, 1983) reported, female animal may become more susceptible to infection with high level of prolactin and progesterone hormone.

Health status related prevalence of gastrointestinal parasites in buffalo:

Significantly ($p < 0.05$) higher infection were seen in poor condition animals. Moderate condition buffaloes were also more susceptible to infection than the good condition one. This result supports the findings of (Alim, 1997), (Biswas et al., 2014); they also noticed the disease occurrence increases as the health condition of the animal gets worse. The reason behind this could be due to the immunity of the malnourished animals being compromised compared to the good health one.

Limitation

This study was conducted for a short period of time and also the sample size was very small. So, the effect of climate did not considered in the current study. Also, the species of the GI parasites was not identified at the molecular level. So, these limitations can be aimed for further research.

Chapter V

Conclusion

This study exhibited the current status of GI parasites of buffalo in Noakhali, where the most prevalent parasite was nematode and trematode. This research also shows that a higher prevalence of GI helminths is found in male compared to female. Also, calves are more susceptible to infection than young and adults. Further, health status is also an important risk factor as the poor health animals has found to be more prone to infection that the moderate and good health animals.

This investigation gives us a scenario of the current status of the GI parasites of Noakhali region. The information found from this study can be used to design a proper preventive and control measure for GI parasite infection.

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Biography

I am, Tahmina Akter, DAUGHTER of Aminul Islam and Bilkis Akter. I passed Secondary School Certificate examination from Begumganj Government Pilot High School, Noakhali in 2014 (G.P.A-5.00) followed by Higher Secondary Certificate examination from Chowmuhoni Govt. S. A. College, Noakhali in 2016 (G.P.A-4.67). Now I am an intern veterinarian under the Faculty of Veterinary Medicine in Chattogram Veterinary and Animal Sciences University, Bangladesh. Bangladesh is a developing country in South Asia where livestock plays a very important role in our economy as well as the food chain. I expect to be a future researcher of life science to address the present challenges we have in this field.