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DOES FEEDING SYSTEM INFLUENCE PARASITISM IN BLACK BENGAL GOATS IN BANGLADESH?

A. K. M. A. Rabbi*, A. Islam, Anisuzzaman, S. Majumder[1] and M. H. Rahman
Department of Parasitology, Bangladesh Agricultural University
Mymensingh-2202, Bangladesh

ABSTRACT

To study the parasitism in goats in relation to different feeding systems, 1110 goats from different areas of Jaypurhat, Tangail, Netrakona and Mymensingh districts were examined. By fecal sample examination, 76.5% goats were found to be infected with one or more species of endoparasites. In this study, 9 types of helminths' ova were identified such as *Fasciola gigantica* (14.8%), *Paramphistomum* sp. (28.5%), *Schistosoma indicum* (3.2%), strongyles (35%), *Strongyloides* sp. (17.4%), *Toxocara* spp. (1.5%), *Trichuris* sp. (4.6%), *Capillaria* sp. (1.2%) and *Moniezia* sp. (3.7%). Two types of protozoa were also detected, namely, *Eimeria* sp. (7.1%) and *Balantidium coli* (5.5%). Along with these, five species of ectoparasites were found: two species were lice such as *Damilinia caprae* (13.9 %) and *Linognathus vitulli* (4.2%), and two species were ticks namely, *Haemophysalis bispinosa* (21.2%), *Rhipicaphalus (Boophilus) microplus* (3.6%) and one species was mite, namely, *Demodex* sp. (2.9%). Mean parasitic burden of *Paramphistomum* sp. (259.81 ± 3.35) was the highest followed by *Eimeria* sp. (224.1 ± 16.9) and *Moniezia* sp. (204.9 ± 19.7). Prevalence of helminths and protozoa was significantly ($P<0.01$) highest in extensive system (86.1%) followed by semi-intensive (76.3%) and intensive system (57.5%). Ova of *Schistosoma indicum* was absent in the fecal sample of goats of intensive system. Goats of extensive and semi-intensive systems were 4.6 and 2.4 times more susceptible to helminth infection than those of intensive system. Ectoparasitic infestation was the highest in semi-intensive system (59.7%) followed by extensive system (33.5%) and intensive system (8.2%). In conclusion, the present study suggests that feeding system has a great impact on the prevalence of parasites in Black Bengal goats. Further study can be carried out to determine the effect of parasitism in the production performance of Black Bengal goats.

Key Words : Black Bengal Goat, Ectoparasites, Helminths, Feeding system

INTRODUCTION

The Black Bengal goat is the most common and popular livestock of Bangladesh (Amin *et al*., 2000). Among the Asian countries, Bangladesh has third highest population of goats

[1] Department of Agricultural Statistics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
* Eskayef Bangladesh Ltd., 158/E Kamal Ataturk Avenue, Banani, Dhaka-1213, Bangladesh

(Amin *et al*., 2000). Small land requirement and adaptability to harsh climate have made goats more suitable for rearing in our country (Singh *et al*., 2006). Three types of feeding systems are generally practiced for goat rearing in our country such as extensive (tethering/ free range), intensive (stall feeding), and semi intensive /semi scavenging system. Though goat rearing is very profitable in our country but it is hindered by various problems of which, parasitism is the major one (Jabber and Green, 1983). Mortality of 25% kids and 43.5% adult goats occur due to gastrointestinal parasitism in Bangladesh (Rahman *et al*., 1975). Losses occur due to death of young animals, retarded growth, reduced meat and milk production and delayed maturity (Rahman, 1988). Ectoparasites also contribute to such losses either by sucking blood and/or by causing irritation and discomfort. Additionally, ticks are important vectors and can transmit many pathogens like protozoa, rickettsiae, spirochaets, and viruses to goats (Ghosh *et al.,* 2007).

A wealth of literatures is available on the prevalence, pathophysiological, hematological and immunological aspects of gastrointestinal parasitism in Black Bengal goats (Qadir, 1967; Huq and Shaikh, 1968). But unfortunately, no studies have been conducted to determine the relationship between parasitic infections and different feeding systems in Bangladesh. By considering these points, this study was undertaken to determine the prevalence of parasitic infection in Black Bengal goats under different feeding systems.

MATERIALS AND METHODS

The study was conducted in four districts such as Jaypurhat, Tangail, Netrakona and Mymensingh. Fecal samples were examined in the Department of Parasitology, Bangladesh Agricultural University, Mymensingh. Only female goats were selected randomly from extensive (n = 534), semi-intensive (n = 308) and intensive (n = 268) systems. The collected fecal samples were brought to the laboratory using 10 percent formal saline in labeled polythene bags. Fecal samples were examined by Stoll's ova counting technique (Colebrook and Wall, 2007). Eggs were identified according to the description given by Soulsby (1982) and Margaret *et al.* (1994).

Ticks and lice were collected from different parts of the body of individual goat by hand picking. We used small camel hairbrush dipped in ethanol to smear the point of attachment of ticks to preserve the mouthparts and appendages during collection. Ticks and lice were preserved in 70% alcohol in labelled glass vials after collection. In mite infestations, skin scrapings were collected from the suspected goats and examined under microscope treating with 10% potassium hydroxide for 20 minutes to dissolve tissue debris. Ticks, lice and mites were identified following descriptions of Hoogostraal (1956) and Soulsby (1982) by preparing permanent slides (Cable, 1957).

Prevalence of parasites was computed according to the method described by Thrusfield (1995). We used the chi-square test for comparing the prevalence of different feeding systems. Odds ratio were computed for comparing the risk of developing parasitic infection in different feeding systems and the confidence intervals were estimated by

Woolf's method for identifying whether an odds ratio was significant or not (Schlesselman, 1982). F-ratio was used to test the significant difference among the means of parasitic load in various feeding systems (Petrie and Watson, 1999).

RESULTS

Overall prevalence

In this study, we found that 76.5% goats were infected with one or more species of helminthes. Nine types of helminth ova were identified, among them three were trematodes such as *Paramphistomum* sp. (28.5%), *Fasciola gigantica* (14.8%), *Schistosoma indicum* (3.2%), five were nematodes, namely, strongyles (35.0%), *Strongyloides* sp. (17.4%), *Trichuris* sp. (4.6%), *Toxocara* sp. (1.5%) and *Capillaria* spp. (1.2%), and one was cestode, namely, *Moniezia* sp. (3.7%). On the other hand, two types of protozoan parasites were identified such as *Eimeria* sp. (7.1%) and *Balantidium coli* (5.5%) (Table 6). It is evident from Table 1 that the mean parasitic burden of *Paramphistomum* sp. was the highest (259.81±3.35) and *Capillaria* sp. was the lowest (1.2%).

Table 1. Prevalence and mean burden of helminths and protozoa of Black Bengal goats

Name of parasites	No. of positive cases	Parasitic load (epg)	Mean ± SE
Strongyles	389(35%)	100-400	173.26 ± 3.80
S. papillosus	193(17.4%)	100-400	146.63 ± 4.65
T. vitulorum	17(1.5%)	100-500	82.35 ± 24.61
T. ovis	51(4.6%)	100-300	52.94 ± 8.56
Capillaria sp.	13(1.2%)	100-200	138.46 ± 14.04
F. gigantica	164(14.8%)	100-300	131.10 ± 3.83
Paramphistomum sp.	316(28.5%)	100-300	259.81 ± 3.35
S. indicum	36(3.2%)	100-300	125 ± 9.24
M. expansa	41(3.7%)	100-700	204.88 ± 19.74
Eimeria sp.	79(7.1%)	100-1000	224.05 ± 16.92
B. coli	61(5.5%)	100-400	195.08 ± 9.18

Total Number: 1110

We also found that 34.7% goats were infested with ectoparasites (Table 5). Five species of ectoparasites were identified of which two species were ticks- *Haemophysalis bispinosa, Rhipicephalus (Boophilus) microplus,* two species were lice- *Damilinia caprae, Linognathus vitulli* and one specie belonged to mite, namely, *Demodex* sp. The prevalence of tick infestation in goats was 22.7%, whereas the mite and lice infestation were 2.9% and 16%, respectively (Table 5). In case of ticks, *H. bispinosa* was predominant (21.2%), meanwhile in the regard to lice *D. caprae* was the most common (12.9%).

Parasitic infection in goats reared in different feeding system

There was a significant (P<0.01) association among the prevalence of helminths and different feeding system at each of the regions. Helminth and protozoan infections were recorded as the highest in extensive system (86.1%) followed by semi-intensive (76.3%) and intensive (57.5%) systems (Table 2). It is evident from Table 3 that goats reared under extensive and semi-intensive systems were 4.6 and 2.4 times, respectively more likely to be infected by different helminth parasites than goats reared in intensive system. In extensive system, goats were 1.9 times more susceptible to helminth infection than those of semi-intensive system.

Table 2. Prevalence of helminth infections along with their comparison corresponding to various feeding systems at different regions

Name of region	Name of feeding system	Number of goats		Prevalence (%)	Chi-square value
		Examined	Infected		
Durgapur	Extensive	111	92	82.88	12.25**
	Semi-intensive	61	47	77.05	
	Intensive	52	30	57.69	
Madhupur	Extensive	122	101	82.79	15.67**
	Semi-intensive	61	43	70.49	
	Intensive	55	30	54.55	
Mymensingh	Extensive	99	91	91.92	20.89**
	Semi-intensive	60	49	81.67	
	Intensive	52	32	61.54	
Netrokona	Extensive	101	88	87.13	18.41**
	Semi-intensive	61	45	73.77	
	Intensive	55	31	56.36	
Jaypurhat	Extensive	101	88	87.13	17.77**
	Semi-intensive	65	51	78.46	
	Intensive	54	31	57.41	
Overall	Extensive	534	460	86.14	81.61**
	Semi-intensive	308	235	76.30	
	Intensive	268	154	57.46	

**Indicates significant (P<0.01)

Trematode, cestode and protozoan infection were relatively higher in extensive system (44% 58.4% and 15.2%, respectively) (Table 4). The ectoparasitic infestation was significantly (P<0.01) higher in semi-intensive system (59.7%) followed by extensive (33.5%) and intensive (8.2%) system. The prevalence of strongyles, *F. gigantica* and *S. indicum* were significantly (P<0.01) associated with the feeding systems. A significant

(P<0.05) association was also observed between the prevalence of *Paramphistomum* sp. and the feeding system. The highest prevalence of strongyles (40.1%), *Paramphistomum* sp (31.8%), *F.* gigantica (20.6%), and *S. indicum* (5.4%) was recorded for extensive system. Prevalence of *S. indicum* was the highest in extensive system (5.4%) but it was completely absent in intensive system (Table 6).

Table 3. Computation of odds ratio with 95% confidence interval for comparing the feeding systems with one another at different regions

Name of region	Pairs of comparison of feeding systems	Odds ratio	95% Confidence interval
Durgapur	E x Vs SI	1.44	0.66-3.12
	E x Vs I	3.55*	1.69-7.44
	SI Vs I	2.46*	1.09-5.54
Madhupur	E x Vs SI	2.01	0.97-4.14
	E x Vs I	4.01*	1.97-8.15
	SI Vs I	1.99	0.93-4.27
Mymensingh	E x Vs SI	2.55	0.96-6.76
	E x Vs I	7.11*	2.85-17.73
	SI Vs I	2.78*	1.18-6.57
Netrokona	E x Vs SI	2.41*	1.07-5.45
	E x Vs I	5.24*	2.38-11.54
	SI Vs I	2.18*	1.00-4.76
Jaypurhat	E x Vs SI	1.86	0.81-4.27
	E x Vs I	5.02*	2.27-11.10
	SI Vs I	2.70*	1.21-6.01
Overall	E x Vs SI	1.93*	1.35-2.76
	E x Vs I	4.60*	3.26-6.49
	SI Vs I	2.38*	1.67-3.40

*Indicates significant (P<0.05), Vs = Versus, Ex = Extensive system, SI = Semi-intensive system, I = Intensive system

The goats under extensive system and semi-intensive system were about 2 times and 1.5 times, respectively more likely to be infected by strongyles than the goats of intensive system. Goats of extensive system were 1.7 times more susceptible to *F. gigantica* infection than that of a semi-intensive system. Extensive and semi-intensive systems were 4.7 and 2.7 times respectively more risky for the goats of being infected by *F. gigantica* than those of intensive system. Under extensive system, the risk of being infected with *Paramphistomum* sp. was 1.6 times more than that of under intensive system. *S. indicim* was 2.5 times more likely to infect the goats under extensive feeding system than those of semi-intensive system (Table. 7). In extensive system, mean epg was the highest 289.1 ± 8.5 followed by semi-intensive 244.7 ± 7.7 and intensive system 221.4 ± 10.1. There existed a

significant (P<0.01) difference among the mean values of parasitic burden in term of epg. The individual mean parasitic burden of *Paramphistomum* sp. was highest in all three systems (Table 8).

Table 4. Endo parasitic infestation in Black Bengal goat in different feeding systems

Type of parasites	Prevalence % (number of positive cases)		
	Extensive	Semi-intensive	Intensive
Trematodes	44(235)	39.30(121)	26.90(72)
Cestodes	3.60(19)	4.50(14)	3(8)
Nematode	58.40(312)	50(154)	39.20(105)
Protozoa	15.20(81)	12.70(39)	7.10(19)

Table 5. Prevalence of ectoparasitic infestation in different feeding systems

Type of parasites	Prevalence % in different systems				Chi-square value
	Extensive	Semi-intensive	Intensive	Prevalence	
Tick	20	42.50	5.2	22.7	117.834**
Mite	2.10	6.80	0	2.9	26.284**
Lice	15.20	28.90	3	16	72.032**
Overall	33.50	59.70	8.2	34.70	200.193**

**Indicates significant (P<0.01)

Table 6. Parasite wise (helminths and protozoa) prevalence (%) in different feeding systems

Name of parasites	Prevalence (%)				Chi-square value
	Ex (n = 534)	SI (n = 308)	I (n = 268)	Prevalence	
Strongyles	40.07(214)	34.09(105)	26.12(70)	35	15.44**
S. papillosus	20.04(107)	15.26(47)	14.55(39)	17.40	5.08
T. vitulorum	1.69(9)	1.62(5)	1.12(3)	1.50	0.40
T. ovis	5.24(28)	4.87(15)	2.99(8)	4.60	2.15
Capillaria sp.	1.12(6)	0.65(2)	1.87(5)	1.20	1.85
F. gigantica	20.60(110)	12.99(40)	5.22(14)	14.80	34.58**
Paramphistomum sp.	31.84(170)	27.27(84)	23.13(62)	28.50	6.93*
S. indicum	5.43(29)	2.27(7)	0	3.20	18.05**
M. expansa	3.56(19)	4.55(14)	2.99(8)	3.70	1.03
Eimeria sp.	8.61(46)	6.82(21)	4.48(12)	7.10	4.68
B. coli	6.55(35)	5.84(18)	2.99(8)	5.50	4.48

**Indicates significant (P<0.01), *indicates significant (P<0.05, n = number of goats examined

Table 7. Computation of odds ratio for the parasitic infections that exhibit significance chi-square value at different feeding systems

Name of parasites	Pairs of comparison of the feeding systems	Odds ratio	95% confidence interval
Strongyles	E x Vs SI	1.29	0.96-1.73
	E x Vs I	1.89*	1.37-2.61
	SI Vs I	1.46*	1.02-2.09
F. gigantica	E x Vs SI	1.74*	1.17-2.58
	E x Vs I	4.71*	2.64-8.39
	SI Vs I	2.71*	1.44-5.10
Paramphistomum sp.	E x Vs SI	1.25	0.92-1.70
	E x Vs I	1.55*	1.11-2.17
	SI Vs I	1.25	0.86-1.83
S. indicum	E x Vs SI	2.47*	1.07-5.71
	E x Vs I	30.78*	1.87-505.95
	SI Vs I	12.47	0.70-220.79

*Indicates significant (P<0.05)

Table 8. Computation of F-ratio for comparing the mean parasitic burden in goats at different feeding systems

Name of parasites	Parasitic burden			
	Extensive	Semi-intensive	Intensive	F-ratio
Strongyles	183.64 ± 5.49	170.48 ± 6.89	145.71 ± 6.65	7.06**
S. papillosus	155.14 ± 7.18	140.43 ± 7.24	130.77 ± 7.49	2.36
T. vitulorum	255.56 ± 29.40	320 ± 58.31	300 ± 57.74	0.68
T. ovis	150 ± 13.11	160 ± 13.09	150 ± 18.90	0.14
Capillaria sp.	133.33 ± 21.08	200 ± 0	120 ± 20	2.21
F. gigantica	130.91 ± 4.79	135 ± 7.64	121.43 ± 11.38	0.40
Paramphistomum sp.	167.65 ± 4.91	155.95 ± 5.71	143.55 ± 6.75	4.03*
S. indicum	131.03 ± 11.21	100 ± 0	00	1.81
M. expansa	242.11 ± 29.23	164.29 ± 16.93	187.50 ± 12.50	1.68
Eimeria sp.	243.48 ± 27.04	180.95 ± 11.17	225 ± 32.86	1.25
B. coli	208.57 ± 11.86	183.33 ± 18.52	162.50 ± 18.30	1.73
Overall	289.13 ± 8.45	244.68 ± 7.86	221.43 ± 10.13	13.31**

**Indicates significant (P<0.01), *indicates significant (P<0.05)

DISCUSSION

Results of the study indicate that Black Bengal goats of Bangladesh are very much susceptible to ecto and endo parasitic infection. Ndao *et al*. (1995) and Faye (1988) recorded 100% parasitic infection in the goat in Senegal and Mauritania, respectively. Huq and Shaikh (1968) examined viscera of sheep and goats and found 90% infection with gastrointestinal helminth in Bangladesh. Rahman and Mondal (1985) recorded 74% infestation with *H. bispinosa* and 1% with *R. microplus* in the goat in Bangladesh. Mondal and Qadir (1978) found that 37.0% goats were infected with one or more species of *Eimeria* sp. Kader and Huq (1973) reported 76.6% of goat's infestated with *R. microplus* in Bangladesh. These discrepancies among the result of present and earlier studies may be due to the variation in the geographical differences among the experimental niches, metrological differences, sample size, breeds of goats and variation in the husbandry practices. Geo-climatic condition of Bangladesh is favorable for the development and survival of various parasites (Faye *et al*., 2003; Datta *et al*., 2004 and Sharkhuu, 2001). In developing countries like Bangladesh, goats are mainly reared by poor people who are not aware of the harmful effects of the parasites (Sertsea and Wossene, 2007). They usually do not follow regular deworming practice. Besides, most of the goats are usually malnourished. The nutritional status of the host can influence the pathogenesis of parasitic infection and it is expected that well-nourished animals withstand parasitism better (Whitlock, 1949). Probably it predominantly plays a vital role in the high parasitic infection rate in Black Bengal goats in Bangladesh.

Findings of the present study suggest that goats reared in extensive system are more susceptible to helminth parasitic infection (86.1%). Islam and Taimur (2008) examined 224 scavenging Black Bengal goats of Bangladesh for one year and found that 74.50% goats are infected with helminths. Pandit *et al.* (2003) had reported higher nematode infections in the field managed sheep (88.4%) than the farm managed sheep (75.9%) in India. Jagatheesan *et al.* (2003) conducted a study in India and found that sheep reared in extensive system had higher parasitic load than sheep reared in intensive system. In extensive system, goats are allowed to graze freely in the fields. In our country, there is scarcity of pasture and goats usually graze in the side of cultivable land, by the side of roads and some other fallow lands. So, there is no scope of modern pasture management like alternative grazing, creep grazing and pasture treatment etc. On the other hand, extensive system of the goat rearing is usually practiced in rural areas among poor people (BBS, 1986). They have no idea about the strategic treatment against helminth infections. In fact, deworming is seldom done in village goats in Bangladesh reared under extensive system. In this system, animals are usually malnourished with poor vigor. Malnourished animals are more susceptible to any infection as they are immunocompromised (Lapage 1962). All foresaid factors possibly contribute to the higher parasitic infection in extensive system (Mohanta *et al*., 2007). In contrast, semi-intensive system of goats rearing is usually practiced in organized farm and some medium holder farmers in peri-urban areas. In this system, goats are not allowed to graze freely in the field rather they are kept in a confined area in which they are provided with restricted grazing in a selective grass field. There is a chance of gaining infection from pasture but obviously, the risk is lower than the extensive

system. Moreover, deworming was more or less in regular pattern in semi-intensive system. May be due to all these reasons helminth infection was relatively lower in semi-intensive system than the extensive system. However, intensive type of the goat rearing is not a common practice, which is mainly seen among more aware and rich people. In this system, goats are not allowed to graze in the field. They are provided with stall feeding. Deworming is regularly practiced that help them in keeping healthy. That is why, the chance of gaining parasitic infection under intensive system was lower than those reared under extensive and semi-intensive system.

An interesting finding was that, infection with *S. indicum* was absent in goats reared under intensive system but it was prevalent other two systems. This result cannot be compared due to paucity of relevant literature. It is well known that Schistosome infection occurs by the skin penetration of cercaria when susceptible animal come in contact with the infected water bodies. Goats reared under extensive and semi-intensive systems may come in contact with open water bodies like ponds, cannels, marshy land. They might got the infection but in intensive system goats are not allowed to forage outside. Therefore, there is a very little chance of coming in contact with the contaminated water bodies with Schistosome cercaria.

On the other hand, ectoparasitic infestation was relatively higher in goats reared under semi-intensive system but these results could not be compared due to unavailability of relevant literatures. However, it can be assumed that in this system, relatively larger numbers of goats are kept in a small confined area which increases the chance of transmission of ectoparasites by direct contact. Contemporarily, in extensive system goats spent most of the time in free-range condition. They roam freely in the fields and usually do not huddle together. Chances of infestation with ectoparasites are relatively lower in extensive system than semi-intensive system. In intensive system, the goats are not allowed to graze freely in the field. They are fully stall fed, well nourished and usually with good health and vigor. Owner of these types of goats are conscious about the health and management practices, even frequently remove ectoparasites from their goats by hand. Therefore, the prevalence of ectoparasitic infestation was lower in intensive system. In conclusion, the present study suggests that feeding system has a great impact on the prevalence of parasites. Their regular deworming and health management are essential.

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