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Original Article

Epidemiology of Gastro-intestinal Nematode Infections in Indigenous Chickens of Bangladesh

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ABSTRACT

Gastro-intestinal nematodes are common in chickens and have a negative impact on health and productivity, resulting in significant economic losses. Here, we examined the gastro-intestinal tract (GIT) of 500 indigenous chickens (*Gallus gallus domisticus*) from November 2011 to November 2014 to determine the prevalence and epidemiological factors of common nematodes that affect GIT. In addition, we conducted a structured questionnaire survey to gather demographic information and poultry raising practices. We detected *Ascaridia galli* (56%, n=282) and *Heterakis gallinarum* (25%, n=126) from GIT of chickens using morphologic and morphometric analyses. The prevalence of *A. galli* (61%) and *H. gallinarum* (31%) was higher in hens kept in mud floor and when chickens of different age groups were reared together. The prevalence of *A. galli* was considerably (P0.01) higher (64%) during the rainy season, whereas seasons had no effect on *H. gallinarum* prevalence. Though there were no significant differences in prevalence, anthelmintic-treated chickens recovered a lower number of parasites (*A. galli* 38% and *H. gallinarum* 14%). On the other hand, in a group of litters changed within seven days, the lowest prevalence (*A. galli* 44% and *H. gallinarum* 25%) was detected, with essentially no difference in chickens reared in scavenging and semi-scavenging systems. Seasons, housing materials, raising practices, and litter changing frequency all had an impact on the prevalence of *A. galli* and *H. gallinarum*.Key word: Chicken, *Ascaridia galli*, *Heterakis gallinarum*, epidemiology.

Introduction

In Bangladesh, indigenous chickens are mostly of non-descript type and are widely reared by rural people since time immemorial. Due to lower nutritional demand and higher resistance to diseases and heat stress, indigenous chickens are more acceptable to rural people as an important source of meat and eggs (Barua and Howlider, 1990). Additionally, 80 % of indigenous chickens in villages are reared under a scavenging system and live on offal; insects, leftovers from the kitchen, and grains from the environment. (Kabatange and Katule, 1989; Minga et al., 1989).

Due to this free range and scavenging habits, indigenous village chickens are exposed to different parasitic infections. Helminths are widely acknowledged to be a major impediment to livestock and poultry production throughout the tropics. (Githiori et al., 2004; Ibrahim et al., 1984). These helminths disrupt metabolism, cause poor feed utilization, and reduce growth rate and productivity (Gauly et al., 2007; Phiri et al., 2007). Helminth parasites also make diseases more vulnerable and weaken the immune response to vaccination. (Kunchara Na Ayudthaya and Sangvaranond, 1997; Pleidrup et al., 2014). Furthermore, gastrointestinal helminths can transmit pathogenic agents such as *Histomonas meleagridis*, which is transmitted by *H. gallinarum* and can cause up to 20% mortality in chickens (McDougald, 2005).

The most common gastrointestinal parasites of poultry are comprised of three main genera of nematodes causing infection in chickens, which are *Ascaridia*, *Heterakis* and *Capillaria* (Pattison et al., 2007). *Ascaridia*

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is the most common nematode and causes the most serious parasitic infections in poultry (Luka and Ndams, 2007; Pam, 2006). The use of modern anthelmintics is uncommon among rural poultry farmers in Bangladesh. The purpose of this study was to determine the prevalence of nematodes affecting the GIT of indigenous chickens in Bangladesh, as well as the factors influencing parasite infection.

Materials and Methods

Study areas and sampling

The study was conducted at Dinajpur sadar and Biral Upazila from November 2011 to November 2014. The calendar years were divided into three seasons for the convenience of the study: summer (March to June), winter (November to February), and rainy (July to October) (Samad, 2001). Five hundred chickens (*Gallus gallus domisticus*) of both sexes were randomly selected and purchased directly from households of the study sites.

Post mortem examination, parasite collection and identifications

After sacrificing the birds, we conducted systemic necropsy examinations and we collected different parts of gastro-intestinal tract (GIT) and kept into jars separately in an adequate amount of PBS. Each part was opened through longitudinal incision and mucosal surface was exposed, and examined to detect parasites, if any. Thereafter, GIT and their contents were washed in PBS until the washing became clear. Worms were collected and preserved in labeled vials of 70% glycerol-alcohol. Parasites were examined under a microscope at 10X magnification using temporary slides prepared with one drop of lukewarm lectophenol. Helminths were identified using Soulsby's keys and description (1982).

Questioner survey

Management practices such as chicken rearing system, feed types, bio-security measures, disease outbreaks, clinical information, vaccination, microscopic examination of feces, postmortem examinations, dumping and disposal of chicken excreta, use of anthelmintic, feeding, type of farming; and problems, challenges and opinions of the farmers were investigated and all information was compiled.

Statistical Analysis

The results were presented as percentage. All statistical analyses were conducted using SPSS 20.0 software (SPSS, Inc., Chicago, IL, USA). The differences were considered statistically significant at $P < 0.05$.

Results

Overall prevalence of nematodes affecting GIT of indigenous chickens

By morphologic and morphometric analysis, we identified *A. galli* and *H. gallinarum* from indigenous chickens in the study areas. The overall prevalence of the nematode worms was 61%, with *A. galli* (282, 56%) being significantly (p0.01) higher than *H. gallinarum* (126, 25%). In 20 percent of the chickens, both parasites were present. (Fig. 1).

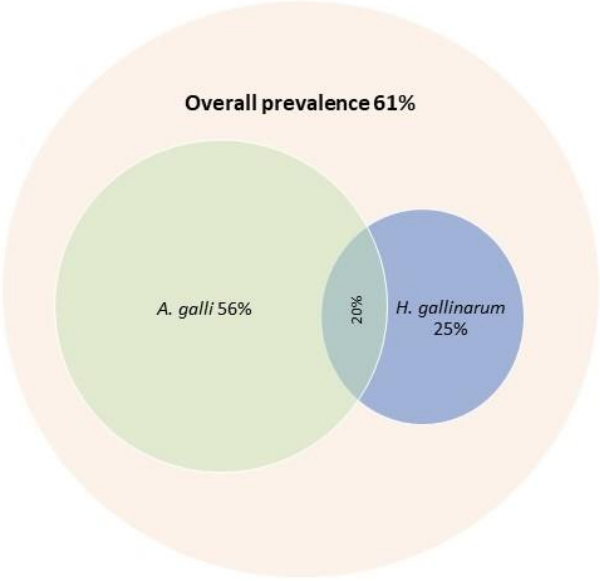

Figure 1. Overall prevalence and mixed prevalence of *A. galli* and *H. gallinarum*

Host factors and impact of seasons on the prevalence of GIT nematodes

Prevalence of the helminths isolated in relation to sex, body weight, age of chickens and impact of the seasons have been presented in the Table 1. This study revealed a significant ($p<0.01$) impact of the seasons on the prevalence of *A. galli*. Rainy season appeared as the most prevalent time ($P<0.01$) where 64% infectivity was seen. During the winter and summer, the prevalence was 61% and 45%, respectively. Season, on the other hand, had no significant ($p>0.05$) impact on the prevalence of *H. gallinarum*, though the prevalence of that worm was slightly higher in the summer (31 %). Sex, body weight and age of the birds had no significant impact on the prevalence of the worms.

Table 1. Prevalence of helminths in relation to season, sex, body weight, age and study site of chicken

Parameters	*Ascaridia galli*	*Heterakis gallinarum*

	(number, %)	(number, %)
Season		
Summer (n=170)	76 (45)	52 (31)
Winter (n=165)	100 (61)	35 (21)
Rainy (n=165)	106 (64)	39 (24)
Total (N=500)	282 (56)	126 (25)
P-value	<0.01	>0.05
Sex		
Male (n=392)	211 (54)	102 (26)
Female (n=108)	71 (66)	24 (22)
Total (N=500)	282 (56)	126 (25)
P-value	>0.05	>0.05
Body weight		
300-400gm (n=166)	93 (56)	42 (25)
400-500gm (n=244)	133 (55)	59 (24)
500gm> (n=90)	56 (62)	25 (28)
Total (N=500)	282 (56)	126 (25)
P-value	>0.05	>0.05
Age of chicken		
3 months (n=216)	117 (54)	54 (25)
4 months (n=284)	165 (58)	72 (25)
Total (N=500)	282 (56)	126 (25)
P-value	>0.05	>0.05
Study site		
Sadar, Dinajpur (n=250)	136 (54)	56 (22)
Birol, Dinajpur (n=250)	146 (58)	70 (28)
Total (N=500)	282 (56)	126 (25)
P-value	>0.05	>0.05

Management factors affecting infection of the worms

Management factors influencing the prevalence of *A. galli* and *H. gallinarum* infection in indigenous chicken have been presented in Table 2. In the present study, we investigated the effects of several management factors such as farming patterns, housing, feed sources and type, deworming, rearing patterns and litter changing frequency on the prevalence of the worms. Rearing systems had no significant (p<0.05) effect on the prevalence of the worms and the prevalence of scavenging systems (57 %) was nearly equal to that of semi-scavenging systems (55 %). Overall, the prevalence was lower (*A. galli* 38% and *H. gallinarum* 14%) in chickens treated with anthelmintics. Feed source and feed type did not have any significant effects on the prevalence of the helminths. On the other hand, housing, rearing pattern and litter types significantly (p<0.05) influenced the prevalence of the helminth infections. Prevalence was higher in chickens (*A. galli* 61% and *H. gallinarum* 31%) reared in mud made floor than bamboo and brick houses. When chickens of different ages were reared together, the prevalence was significantly (p<0.01) higher (*A. gall*i 62% and *H. gallinarum* 32 %) than when chickens of the same age group were reared together (*A. gall*i 48 % and *H. gallinarum* 15%). Significantly (p<0.01) lowest prevalence (*A. galli* 44% and *H. gallinarum* 25%) was observed in poultry if litter was changed within seven days.

Table 2. Factors influencing the prevalence of *Ascaridia galli* and *Heterakis gallinarum* infestation in indigenous chicken

Parameters	*Ascaridia galli* number (%)	*Heterakis gallinarum* number (%)
Farming pattern		
Scavenging (n=340)	194 (57)	94 (28)
Semi-Scavenging (n=160)	88 (55)	32 (20)
Total (N=500)	282 (56)	126 (25)
P-value	>0.05	>0.05
Anthelmintic used		
No (n=479)	274 (52)	123 (26)
Yes (n=21)	8 (38)	3 (14)
Total (N=500)	282 (56)	126 (25)
P-value	>0.05	>0.05
Feed source		
House origin (n=199)	114 (57)	45 (23)
Collect from nature (n=70)	38 (54)	22 (31)
Market (n=32)	18 (56)	10 (31)
Mixed type (n=199)	112 (56)	49 (25)
Total (N=500)	282 (56)	126 (25)
P-value	>0.05	>0.05
Feed type		
Handmade (n=333)	179 (54)	83 (25)
Raw item (n=149)	93 (62)	38 (26)
Readymade (n=18)	10 (56)	5 (28)
Total (N=500)	282 (56)	126 (25)
P-value	>0.05	>0.05
Housing material		
Bamboo (n=130)	61 (47)	23 (18)
Mud (n=290)	177 (61)	89 (31)
Brick (n=80)	44 (55)	14 (18)
Total (N=500)	282 (56)	126 (25)
P-value	<0.05	<0.01
Rearing pattern		
Keeping single age group together (n=195)	94 (48)	29 (15)
Keeping different age group together (n=305)	188 (62)	97 (32)
Total (N=500)	282 (56)	126 (25)
P-value	<0.01	<0.01
Litter changing frequency		
Litter changed within 7days (n=81)	36 (44)	20 (25)
Litter changed within 30 days (n=235)	118 (50)	45 (19)
Litter changed within 180 days (n=184)	128 (70)	61 (33)
Total (N=500)	282 (56)	126 (25)
P-value	<0.01	<0.01

Discussion

Raising indigenous chickens in scavenging/semi-scavenging system is mostly hampered by helminth infections. Of the GIT-dwelling helminths, *A. galli*, the

largest nematodes of poultry, is the most harmful. Here, we studied the prevalence and several important epidemiological factors of GIT-dwelling nematodes in indigenous chickens in Bangladesh. Cross-sectional prevalence study of helminth infection in different production systems indicated that gastro intestinal nematodes are very common in indigenous chickens (Permin et al., 1997).

In this study, we found that *A. galli* was the most prevalent nematode which agrees with the previous findings from different countries (Calnek et al., 1997; Gary and Richard, 2012; Hassouini and Belghyti, 2006; Heyradin et al., 2012; Rabbi et al., 2006). In Bangladesh, *A. galli* is the most commonly occurring nematode parasite of domestic fowl and frequently reported from both rural and farm conditions (Alam et al., 2014; Haq, 1986) that cause of noticeable economic losses in modern poultry farming (Permin and Raving, 2001). The majority of studies described regular and common ascarid infectivity in chickens, regardless of whether the ecology was local (Begum et al., 2010), regional (Akhtar, 1987), or international (Permin, et al., 1997). Penetration of the parasite into the duodenal or jejunal mucosa may cause hemorrhagic enteritis, anemia often associated with severe diarrhea as well as loss of appetite, weakness, decreased activity, ruffled feathers and dirty cloacal region (Adang et al., 2010; Ikeme, 1971a). *H. gallinarum*, the cecal nematode of poultry, is also common among the poultry all over the world (Madsen, 1950). Though *H. gallinarum* can cause weight loss during heavy infection only (Ikeme, 1971b; Kaushik and Deorani, 1969) and in most cases this parasite remain unnoticed (Kaushik and Deorani, 1969; Tyzzer, 1934). Management of *H. gallinarum* is vital as it is the only known vector for the protozoa *Histomonas meleagridis*, which causes histomonosis in poultry (Homer and Butcher, 1991; Smith, 1895; Tyzzer, 1926; Tyzzer and Fabyan, 1920). *H. gallinarum* is important for scavenging chickens as earthworms act as transport hosts of this helminth and backyard chicken frequently feed on earthworms. Due longevity of the eggs in the soil and availability of earthworm in the nature, it is very difficult to eliminate *Heterakis* from chicken flock.

The prevalence of *A. galli* was the highest during the rainy season. This study differed slightly from the findings of Mondal and Qadir (Mondal and Qadir, 1991), who reported higher prevalence of ascariasis in chicken during post monsoon (October-November) followed by monsoon (July-September) and then winter (December-February); with a lowest prevalence was reported in summer (March-June) (Asma, 1999). Possibly, high humidity and temperature during rainy season favor development of L3 larvae and hence increasing the prevalence of *A. galli.* However, it is puzzling why seasons had no effect on the prevalence of *H. gallinarum*, given that they have a similar lifecycle pattern. The prevalence of both *A. galli* and *H. gallinarum* was higher in scavenging system than semi-scavenging system. This was due to higher chance of chickens for picking up the infective eggs compared to those reared in semi-scavenging system.

The prevalence of both parasites was significantly higher in mud made houses. Probably, in the mud made houses different stages of parasites can survive well compared to houses made by different other materials. Additionally, mud-made houses are bit difficult to clean properly. The prevalence of *A. galli* and *H. gallinarum* was the highest in poultry flock having different age group. Young birds are more susceptible to the infection with the worms, especially with *A. galli* but it does not mean that adult birds are refractory to the infections. When birds of different age group are reared together then it is quite natural that continuous and massive egg shading by the most vulnerable age-group will cause more infections to the flock, resulting high prevalence. The prevalence of *A. galli* and *H. gallinarum* was the lowest in poultry flock having litter change within seven days. In weekly litter clearing group the fecal materials containing eggs were removed very often. In contrast to monthly litter clearing groups of chickens, the eggs accumulate in nature, consequently the chickens pick up more eggs from nature. It is quite surprising that anthelmintic medication had no significant effects on the prevalence, which is possibly due to the improper dose or choice of incorrect anthelmintic. However, development of resistance cannot be ruled out. In Bangladesh, anthelmintic resistance in GIT nematodes of ruminants has already been reported (Islam et al., 2018).

Conclusion

Collectively, our data suggest that GIT nematodes, especially, *A. galli* and *H. gallinarum* are still big problem in indigenous chickens in Bangladesh. Seasons, housing materials, rearing patterns and litter changing frequency had significant effect on the prevalence of the worms. in indigenous chickens. Regular litter change, avoiding mud made house and treating the chicken with anthelmintics may reduce the burden of these parasites.

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