

Cross sectional epidemiological investigation on the prevalence of gastrointestinal helminths in free range chickens in Narsingdi district, Bangladesh

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Abstract Rural poultry production in Bangladesh is mainly based on the free range or backyard poultry production system. This backyard poultry plays a vital tool for poverty alleviation as well as for empowerment of poor women of this country. However, this production system has disadvantage of susceptibility to many diseases including higher burden of parasitic infection. Therefore this cross sectional epidemiological investigation was done to determine the prevalence and distribution of gastrointestinal helminths in Narsingdi district, Bangladesh. To conduct this study a total of 150 chickens from three different villages of Narsingdi district, Bangladesh (50 chickens per village) were collected by random sampling method and killed by cervical disarticulation. Thereafter, all the chickens were necropsied and gastrointestinal tracts were examined macroscopically for the presence helminth infection. In total two nematode (*Ascaridia galli*, *Heterakis gallinarum*,) and one cestode (*Raillietina* spp.) were identified by post mortem examination. *Raillietina* spp. was detected as the most prevalent helminth species (86–92 %) followed by *A. galli* (70–86 %), and *H. gallinarum* (70–76 %) in studied villages. In some chickens petechial hemorrhage were observed in the small intestinal wall which was associated with the *A.*

galli infection and for some birds white tiny nodules were detected in case of *H. gallinarum* infection. No significant difference in parasite prevalence was observed between male and female bird as well as among three studied villages ($P > 0.05$). We observed that most of chickens were infected with more than one species of parasites. This finding suggests that the poultry production system in rural areas of Bangladesh and the environmental conditions are very favourable for the transmission and persistence of the parasite species in rural areas of Bangladesh.

Keywords Free range production system · Prevalence · Gastrointestinal helminth · Bangladesh

Introduction

Poultry production has increased constantly throughout the world over the last decades and according to FAO (FAO 2004) around 75 % of a total of 15 billion chickens are found in the developing countries. Bangladesh is one of the most poor and densely populated countries in the world with >40 % of the people living below the poverty line (Islam and Jabbar 2005) and 50 % of the households with poultry rearing have no land or have less than 0.5 acres (Saleque 2000). Therefore, poultry rearing plays a vital role for the generation of income of these people, as this requires minimum land, little capital and few skills. Besides being feasible for landless farmers, poultry rearing is also used as a tool for poverty alleviation as well as for empowerment of poor women. In Bangladesh, chickens are reared under different conditions, viz. backyard, semi-intensive and intensive systems. Backyard/semi-intensive systems are mainly practiced by smallholders in rural areas, whereas intensive systems are much more organised and

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are largely used for commercial production (Rabbi et al. 2006). In backyard systems, the birds are free-range during day time while they are confined at night. Therefore, chickens find most of their food by roaming around the households, where they eat a variety of food items like kitchen waste, leaves, grasses, insects, arthropod, earthworm, ants etc. many of which may act as intermediate or paratenic hosts for parasites (Soulsby 1982). Moreover, these birds can easily pick up free-living infective stages of parasites that require no intermediate hosts, while roaming around. For these reasons, backyard poultry are heavily exposed to helminth infection.

Recent studies have shown that almost all indigenous chickens in Bangladesh are infected with different helminths species the most dominant being *Ascaridia galli*, *Heterakis gallinarum*, *Capillaria* spp., *Raillietina* spp., *Hymenolepis* spp. Rabbi et al. (2006) found that 100 % of the backyard chicken and 49 % of layer birds in Mymensingh district, Bangladesh, were infected with gastrointestinal helminths.

In spite of this large prevalence and the potential economic importance very little research has been carried out on the presence of helminth infections in chickens in different regions of Bangladesh and no studies have been conducted to estimate the prevalence of helminth species in chickens in the very rural areas of Narsingdi district, Bangladesh. Therefore, this study was performed to get an information on the prevalence of helminth infections in chickens, thereby, to provide a practical guideline to the small holder farmer to reduce the level of infection and cost of treatments thereby improve their livelihood.

Materials and methods

Study area and study population

The chickens for the study were collected from three neighbouring villages rearing free range chickens namely Bawoshia, Nawabpur and Nazarpur belong to Narsingdi Sadar Upazilla of Narsingdi district, Bangladesh. Each of these villages consisted of between 100 and 150 households distributed scatteredly with short distance between each other. The study population were composed of the rural scavenging chickens which are normally roam free during the daytime and scavenge around in search for feed from the surroundings and kept indoor at night. The feed sometimes also supplemented with household wastes and grain.

Sample size calculation

The sample size was calculated by using the formula for estimating prevalence according to (Houe et al. 2004).

$$n = \frac{Z_{1-\alpha/2}^2 p(1-p)}{L^2}$$

Where n = required sample size, p = prevalence of the disease, L = allowable error of 5 %, and confidence level 95 %.

On the basis of information obtained through literature review the assumed prevalence of infection considered as 90 % for backyard chicken and the population size was considered as 2,000,000. We wanted to be 95 % sure to detect the infection if it present. Thus the required sample size was 138 birds therefore we considered 150 chickens. We collected 50 chickens from each of the village (10 household per village and five bird per household).

Parasitological examination

After collection the chickens were examined for clinical sign of infection and the sex of the bird were registered. There after the birds were killed by cervical disarticulation and the alimentary tract from the oesophagus to cloaca were removed and thoroughly checked for any gross pathological lesions. Thereafter the gastrointestinal tract was opened longitudinally to collect the macroscopically detectable parasite worms. All the collected worms were identified according Soulsby (Saleque 2000).

Considering the feasibility and availability of resources we only considered the macroscopically visible worms to get a quick overview on the helminth infection status in free range chickens of these very rural communities (Table 1).

Statistical analysis

Statistical analysis was performed by Logistic Regression procedure using SAS 9.2 and the level of significance was considered as ($P < 0.05$).

Results

Out of 150 examined chickens 127 (84.6 %) were found positive for helminth infection. A total of two nematodes (*A. galli*, *H. gallinarum*) and one tapeworm (*Raillietina* spp.) were identified. *Raillietina* spp. was diagnosed as the most prevalent helminth species (prevalence of infection in three villages were 82 % in Bawoshia, 80 % in Nawabpur and 96 % in Nazarpur areas) followed by *A. galli* (70–86 %), and *H. gallinarum* (70–76 %) in studied villages. Almost all the investigated chickens were harbouring all three species of the recovered parasite and the prevalence and distribution of the parasite was neither significantly different between male and female birds nor among the studied villages.

Table 1 No of infected birds, prevalence and range of helminth species found in 150 free range chickens in three different villages of Narsingdi district, Bangladesh

Village	Helminth spp	No of infected bird			Prevalence (%)	Min–Max
		Male (n = 20)	Female (n = 30)	Total (n = 50)		
Bawoshia	<i>A. galli</i>	15	28	43	86	3–48
	<i>H. gallinarum</i>	12	23	35	70	5–76
	<i>Raillietina</i> spp.	17	24	41	82	1–16
Nawabpur	<i>A. galli</i>	13	22	35	70	4–33
	<i>H. gallinarum</i>	11	20	31	66	7–58
	<i>Raillietina</i> spp.	16	24	40	80	1–08
Nazarpur	<i>A. galli</i>	18	23	41	80	2–23
	<i>H. gallinarum</i>	15	22	37	76	4–84
	<i>Raillietina</i> spp.	21	22	43	92	1–12

In some chickens petechial hemorrhage were observed in the small intestinal wall which was associated with the *A. galli* infection and for some birds white tiny nodules were detected in case of *H. gallinarum* infection.

Discussion

Our study for the first time reported the prevalence of helminth infection in scavenging chickens of very rural areas of Narsingdi district of Bangladesh. We found that the rural scavenging chickens of these areas are heavily affected by helminth infections and thus the health and productivity of these chickens are vulnerable. Among the parasite species detected *Raillietina* spp. was the most prevalent (91 %) which corresponds well with the findings of other researchers. Recent investigation (Rabbi et al. 2006) on backyard chickens (n = 80) in Mymensingh district of Bangladesh showed 100 % prevalence of this parasite in this chickens. *Raillietina* is mainly transmitted by the ingestion of intermediate host of the parasite (ant of the genera *Tetramorium*, *Pheidole*, housefly *Musca domestica*) containing cysticercoids. These intermediate hosts are highly available in Bangladesh specially in rural areas. The backyard poultry are used to scavenge around for feed and pick up various insect from the environment and this nature of the bird might be related with the high prevalence of this parasite. This tapeworm infection can be controlled by preventing access of the birds to the infective intermediate host but this measure is difficult to implement in rural scavenging chickens of Bangladesh. Although the pathogenic effect of *Raillietina* is less but this parasite cause decrease in weight gain thus economic loss for the small holder farmers.

The large poultry roundworm *A. galli* also showed higher prevalence in the examined birds. This parasite is normally

reside in the small intestine of chickens and is considered to be responsible for the substantial economic losses due to decrease in feed conversion, weight loss, reduced egg production and associated treatment cost (Ackert and Herrick 1928; Danicke et al. 2009; Phiri et al. 2007). Both the larval stage of the parasite and the adult worm are liable for the pathological consequences. The larvae can destroy the intestinal epithelium and necrosis of the mucosal layer. Heavy infection with adult worm can cause obstruction of the small intestine and death (Ackert and Herrick 1928; Ikeme 1971; Tugwell and Ackert 1952). *A. galli* may also transmits other infection such as *Salmonella* in chicken (Chadfield et al. 2001; Eigaard et al. 2006) and concurrent infection of *A. galli* with other pathogens produce more severe pathological condition than the single infection with this pathogen alone (Dahl et al. 2002).

High prevalence of this parasite in free range systems have been reported in many countries all over the world. In Bangladesh (Rabbi et al. 2006) reported (44–89 %) the prevalence of *A. galli* in commercial layer and backyard chickens in Bangladesh. In Bangalore, India (Puttalakshamma et al. 2008) found (91.4 %) prevalence *A. galli* in chickens. Higher prevalence (88 %) of *A. galli* was also reported in free range system in Germany (Kaufmann et al. 2011) and in Ethiopia (71.6 %) (Abede et al. 1997).

The caecal nematode *H. gallinarum* was also representing a higher prevalence in rural poultry of Narsingdi district. This parasite is normally considered as non-pathogenic to chickens. However, reduce weight gain, and pathological lesions such as congestion and haemorrhagic enteritis of the small intestine, nodules in the caecum as well as desquamation of the caecal epithelium were observed in the experimentally infected chickens (Choudury and Das 1993). In Bangladesh increased prevalence of this parasite was reported by (Rabbi et al. 2006), this parasite was also found

in 50 % of the free range chickens in Italy and 31 % in rural scavenging chickens in Ghana (Poulsen et al. 2000; Roberto and Eloi 2008).

Infection of both *A. galli* and *H. gallinarum* normally takes place when the chicken ingests the infective eggs of the parasite through contaminated water or feed. In certain circumstances earthworm can also transmit the infection (Augustine and LundSource 1974; Roberto and Eloi 2008). The eggs of these parasites are very resistant and can remain viable in the environment for longer period (Ackert 1931; Roberto and Eloi 2008). Therefore, the association of factors such as resistance nature of the eggs, possible transmission by the earthworm and high accessibility of birds to the eggs and earthworm while roaming freely in the nature are responsible for this higher prevalence of this parasite.

We found no significant difference in prevalence of parasitic infection in terms of sex of the host, and this results corresponds well with the findings of (Hassouni and Belghyti 2006; Poulsen et al. 2000) who also documented similar prevalence of helminth infection irrespective of the sex.

Limitation and strength of the study

In this study we were only able to conduct macroscopic post mortem examination because of lack most fundamental resources such as electricity which might underestimate the true prevalence of infection. Moreover, the number of male birds examined was fewer than their female counterparts as most of the farmers are interested to rear female birds due to production purposes. All three studied villages share the same geo-ecological conditions and the farming system is also similar to each other thus the parasite burden showed no significant differences among the villages. These results allowed us to envisage the over all condition of most of the rural villages in Bangladesh.

Conclusion

In our study multi-species infection of helminths were observed in most of the chickens which suggest that the environmental condition and the nature of the poultry rearing system are very favourable for the transmission and persistence of the parasite species in rural areas of Bangladesh.

This condition of high worm burdens can make the bird more prone to bacterial and viral infection as well more easily available to the predators as the bird become very much unthrifty and weak. Therefore, further large scale studies are needed to measure the impact of helminth infection on the health and productivity of the rural scavenging chickens in rural areas of Bangladesh.

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