

Original paper

Small-scale farmers' perception and practice on coccidiosis management in broiler farm at Gazipur, Bangladesh

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ABSTRACT. Farmers' knowledge and farm management practices can potentially help to mitigate the prevalence and severity of chicken coccidiosis, a devastating protozoan disease. Here, we assessed the farmers' perception and on-farm practices of coccidiosis management in small-scale broiler farms at Gazipur district, Bangladesh. A semi-structured questionnaire was used to obtain data from the randomly selected 119 small-scale broiler producers followed by detection of coccidiosis cases through gross and microscopic examination of 58 broilers. Overall bird-level prevalence of coccidiosis was 34.48% in this study. Survey data revealed that most of the farmers maintained all-in-all-out strategy (68.91%), good quality chicks (73.11%) and floor system rearing (96.63%) in their farms, and a mixture of old and new litter was used as bedding in all the study farms. Interval between flocks in 57.99% of farms was 8 to 14 days. Prevalence of coccidiosis was recorded in all surveyed farms, even though routine anticoccidial treatment. At the age of 15 to 18 days of broiler, 68.07% of farmers used chemoprophylaxis. Usage of amprolium was the highest (74.78%) followed by toltrazuril (55.46%), sulphaquinoxaline (23.52%), sulphaclozine (28.57%), sulphadimidine (24.36%) and sulphadimethoxine (24.36%). Traditional herbal medicines like extracts of bollygum (*Litsea glutinosa*), sal (*Shorea robusta*) and arjuna (*Terminalia arjuna*) bark and leaves were also in-use by 4.20% farmers during coccidiosis outbreak. In conclusions, this study explored the field scenario of coccidiosis, relevant farmers' knowledge and practices, and recommends the judicious use of drugs for safe broiler production.

Keywords: coccidiosis, farmer, perceptions, farm-practices, anticoccidials

Introduction

Small-scale commercial broiler farms, defined as the farms having <5,000 birds in each batch which comprise 81% of the commercial poultry sector and provide about 78% of the total poultry meat supply in Bangladesh [1]. According to the Department of Livestock Services, there are 53112 registered broiler farms in Bangladesh [2]. Most of these farms are small farms, usually suited with natural ventilation, manual feeding, open-sided walls, built near the homestead area with local low-cost raw materials and mostly family labor-based [1]. Infectious diseases are common obstacles in profitable broiler farming and coccidiosis is a major

parasitic disease with substantial production loss from malabsorption, poor growth, lower feed conversion rate, increased morbidity and mortality [3]. In addition, immunosuppression leading to secondary infections, costs of treatment with drug and/or vaccines and expense of operational managements like destocking, disinfection and restocking exacerbate the financial loss [4–6]. It was reported that coccidiosis incurred annual economic losses of 3 billion USD in the commercial poultry sector [6,7] and 95.6 to 98.1% of the total capital loss in the commercial broiler industry globally [8]. An average prevalence of coccidiosis (22.8%) in poultry industry results huge economic damage in commercial broiler production in Bangladesh [9].

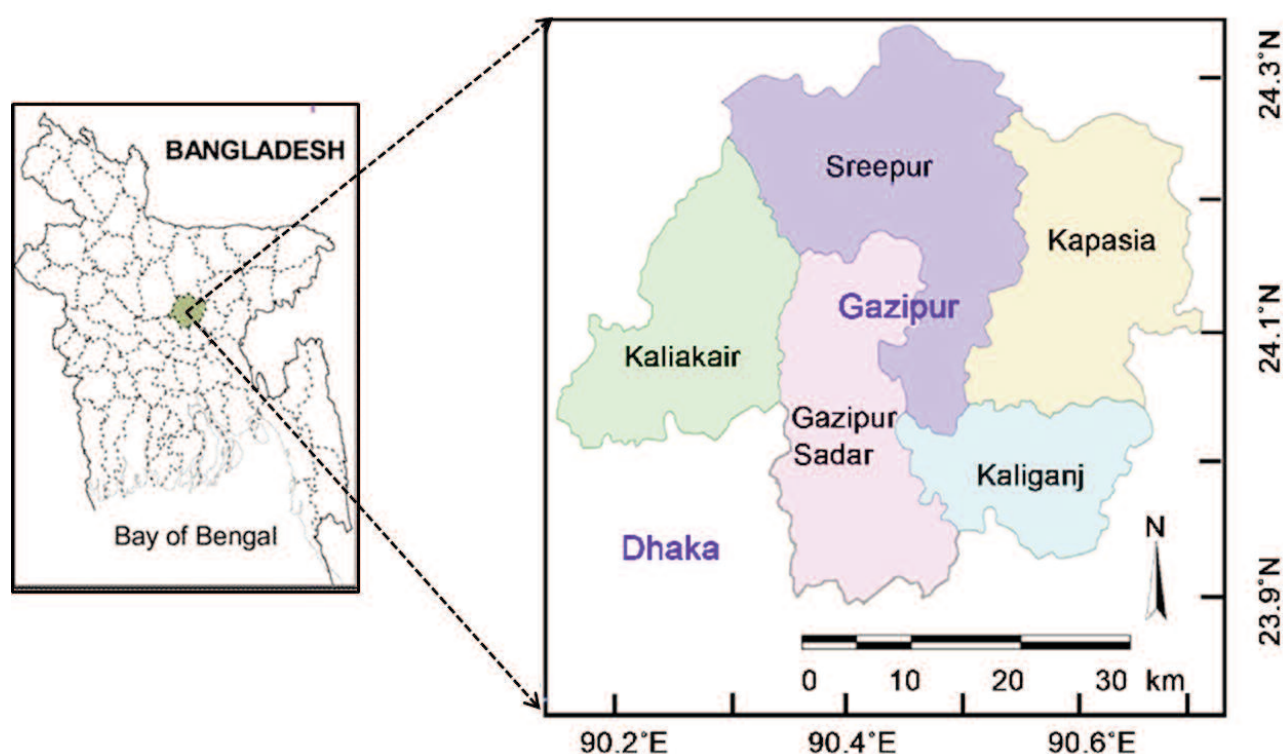


Figure 1. Location map of Gazipur district in the northern outskirts of Dhaka highlighted with individual Upazilas

Coccidiosis is caused by the genus *Eimeria* having seven species, of which *E. tenella*, *E. acervulina* and *E. maxima* are the most financially important [6]. *Eimeria* shows high degree of host-tissue specificity even an individual species affects the epithelia of a specific part of the intestinal tract [6]. Susceptible birds get infected by the ingestion of sporulated *Eimeria* oocysts and subsequently develop clinical disease. The recovered birds continue to shed oocysts in their droppings, which contaminate the neighboring litter, feed, water, and soil, and make an inoculum for the next susceptible host [10]. Clinical coccidiosis is often the outcome of complex interaction of host, pathogen and environmental determinants [4]. Host determinants (age, breed, immune status), pathogen factors (species, infective dose) and suitable environmental conditions may trigger infection [5]. Farm operational practices, such as short interval between flocks, high stocking density, absence of all-in-all-out approach, floor system rearing, contaminated or wet litter, inadequate cleaning of utensils, low level of biosecurity aggravate the clinical signs and causes extensive mortality of young birds [4,5,10].

In reality, total eradication of coccidian parasites from the farm is impractical. Hence, the control of coccidiosis is based mainly on chemotherapy with

anticoccidial drugs and/or vaccines along with improved farm management [6]. Extensive anticoccidial use led to development of drug resistance, which was described globally for all anticoccidial drugs and for all *Eimeria* species [11,12]. In this situation, farmers' perception, knowledge and practice on coccidiosis control critically determine the effect of farm-husbandry on the disease outcome and drug resistance [13]. Knowledge regarding the farm conditions is a prerequisite to formulate the best prevention program to reduce the possibility of disease incidence [8,10,14]. Moreover, information on currently prevailing anticoccidials and coccidiosis related hands-on practices in Bangladesh are very limited. Therefore, the current study examined on-host prevalence of coccidiosis and on-farm management practices in relation to coccidiosis control in broiler farms at Gazipur district, Bangladesh.

Materials and Methods

The present field study and laboratory procedures were conducted during the period of January to June 2019 considering the research ethics and animal welfare issues.

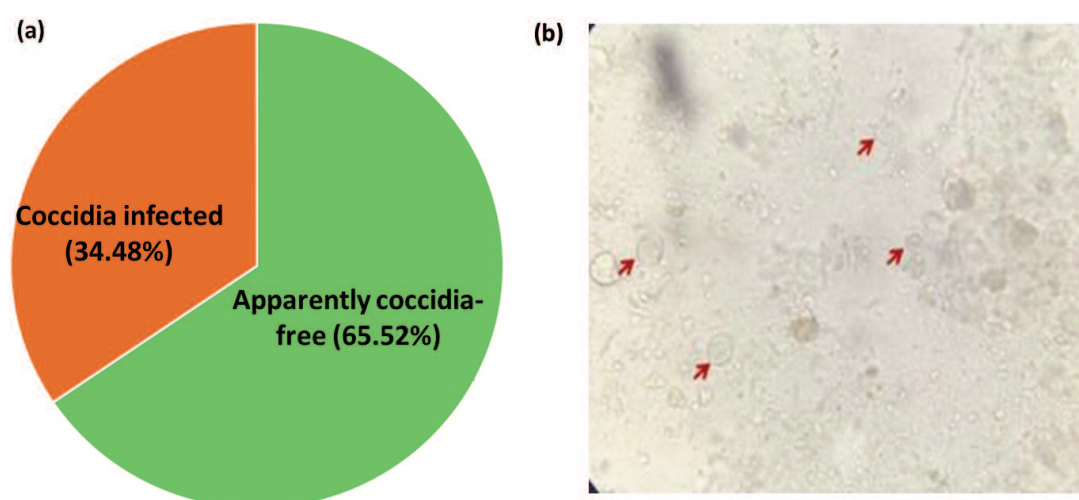


Figure 2. Bird-level prevalence of coccidiosis in broiler (a) and presence of *Eimeria* oocyst in intestinal contents indicated with arrows under 10× objective (b)

The research area is Gazipur (Figure 1) which is located in between 23°53'–24°2' north latitude and in between 90°09'–92°39' east longitude. Gazipur is situated in the Old Brahmaputra (floodplains) and Madhupur tract (terraces) and approximately 1741.53 sq. km. The annual average temperature varies from 13 to 36°C. There are five sub-districts (Upazilla) in Gazipur, namely, Gazipur Sadar, Kaliakair, Kaliganj, Kapasia and Sreepur. The concentration of poultry farms in this area is the highest in the country in the context of Geographic Information System (GIS) [15]. Hence, Gazipur is often called the poultry capital of Bangladesh. People of this area is quite familiarized with poultry farming especially small and large scale commercial broiler and layer farms.

Randomly selected 58 market-aged broilers purchased from local markets were sacrificed and were subjected to postmortem examination. Mucosal scrapings from small intestine and caeca were made and examined microscopically for the presence of oocysts. Faecal materials were taken directly from the intestine, which were processed through floatation centrifugation for the identification of *Eimeria* oocysts according to the protocol described by Soulsby [16].

For the primary data, 119 small-scale broiler farmers were randomly selected from the study area and interviewed directly to achieve the required information. One of the major inclusion criteria was the farmers who reared less than 5000 birds per batch. Prior verbal consent was also taken from the farmers to be interviewed. Information on shed number, flock size, rearing system and duration,

history of coccidiosis occurrence, vaccination, general and specific treatment of coccidiosis used in the farms were recorded. Since dysentery with or without haemorrhage is the main clinical sign of coccidiosis [10], farmers responding for history of dysentery were considered to have coccidiosis infection. Their regular farm operating schedule related to feeding, watering, bedding, vaccination, use of anticoccidial drugs, herbal treatment, use of probiotics and supplementary treatment were also recorded. Information of the usual storage facilities of medicines and vaccines, awareness of drug residual period were also considered to be collected. In several cases, farmers had forgotten or unable to report correctly about the medications they used for coccidiosis. In those cases, information from those farmers was traced back through the external packets of medicine they stored and/or from the specific medicine sellers linked with the farms. Some of the surveyed farmers were able to mention the trade name and other farmers only generic name, hence to maintain the uniformity, the generic names of anticoccidial drugs were used to categorize the practicing anticoccidial treatments.

The secondary data such as information on ingredients of drugs or vaccine preparations were retrieved from published books or the official websites of concerned pharmaceutical companies. The collected data were checked and cross checked for ensuring their reliability, accuracy, adequacy and thereby sensibility for the study objectives.

A semi-structured questionnaire in Bengali (the native language of the responder) was developed and pretested in a small group of responders to

Table 1. Farm description and farm husbandry related perception level and practices by the broiler producer farmers

Variables and categories	No. of respondents	% (95% CI)	Variables and categories	No. of respondents	% (95% CI)
Farm size			Duration of rearing		
500–2000	105	88.24 [81.22 to 92.86]	30–35 days	119	100 [96.87 to 100]
2001–4000	14	11.76 [7.14 to 18.78]	Others	0	00 [0 to 3.13]
No. of farm shed			All-in-all-out system		
1	101	84.87 [77.35 to 90.21]	Yes	82	68.91 [60.11 to 76.52]
2	15	12.61 [7.79 to 19.76]	No	31	26.05 [19.20 to 34.60]
4	2	1.68 [0.46 to 5.92]	Both	6	5.04 [2.33 to 10.56]
4	2	1.68 [0.46 to 5.92]	Watering frequency		
Rearing type			Every 2–3 hr		
Floor system	115	96.64 [91.68 to 98.69]	Every 2–3 hr	91	76.47 [68.10 to 83.19]
Cage system	4	3.36 [1.3 to 8.32]	Every 4–5 hr	16	13.45 [8.45 to 20.73]
			Every 6–8 hr	12	10.08 [5.86 to 16.80]
Grade of Day-old-chicks			Cleaning frequency of farm utensils		
A grade	87	73.11 [64.51 to 80.26]	Daily	109	91.60 [85.22 to 95.37]
B grade	19	15.97 [10.47 to 23.59]	Every two days	8	6.72 [3.45 to 12.71]
Both A and B grade	13	10.92 [6.50 to 17.80]	Every three days	2	1.68 [0.46 to 5.92]

gather information from the study group and modify the questionnaire. Data for the survey were collected from both primary and secondary sources.

The questionnaire data were entered performed into a Microsoft Excel 2010 (MS Excel) spreadsheet. Descriptive analysis was conducted to calculate the proportionate of each category according to dependent variable *Eimeria* positivity, and different independent variables such as farm size, shed number, rearing system, history of coccidiosis, vaccination, general and specific treatment of coccidiosis, probiotic use etc. Descriptive statistics was also performed on all the farm data, and the results were expressed as frequency numbers, percentages, and 95% confidence interval (CI). Figures for the results were generated using the online portal Meta-Chart (www.meta-chart.com).

Results

Post-mortem examination and coproscopy revealed that 34.48% (20/58) of the broilers examined had *Eimeria* spp. infection (Figure 2a and 2b).

According to the data retrieved from questionnaire, it was observed that among 119 farms, 88.23% of the farms had the capacity of 500 to 2000 chick rearing at a time (Table 1). A large proportion of these farms, 84.87% (101/119) farms had single farm shed for chicken. These sheds were usually made of local materials like mud or concrete floor. The ceilings were commonly made of tin which hovered over plastic covering to the wall built with tin or bamboo slat or chicken wire. This covering could be folded up or down for protection against heat, cold, rain or unwanted intruders. For

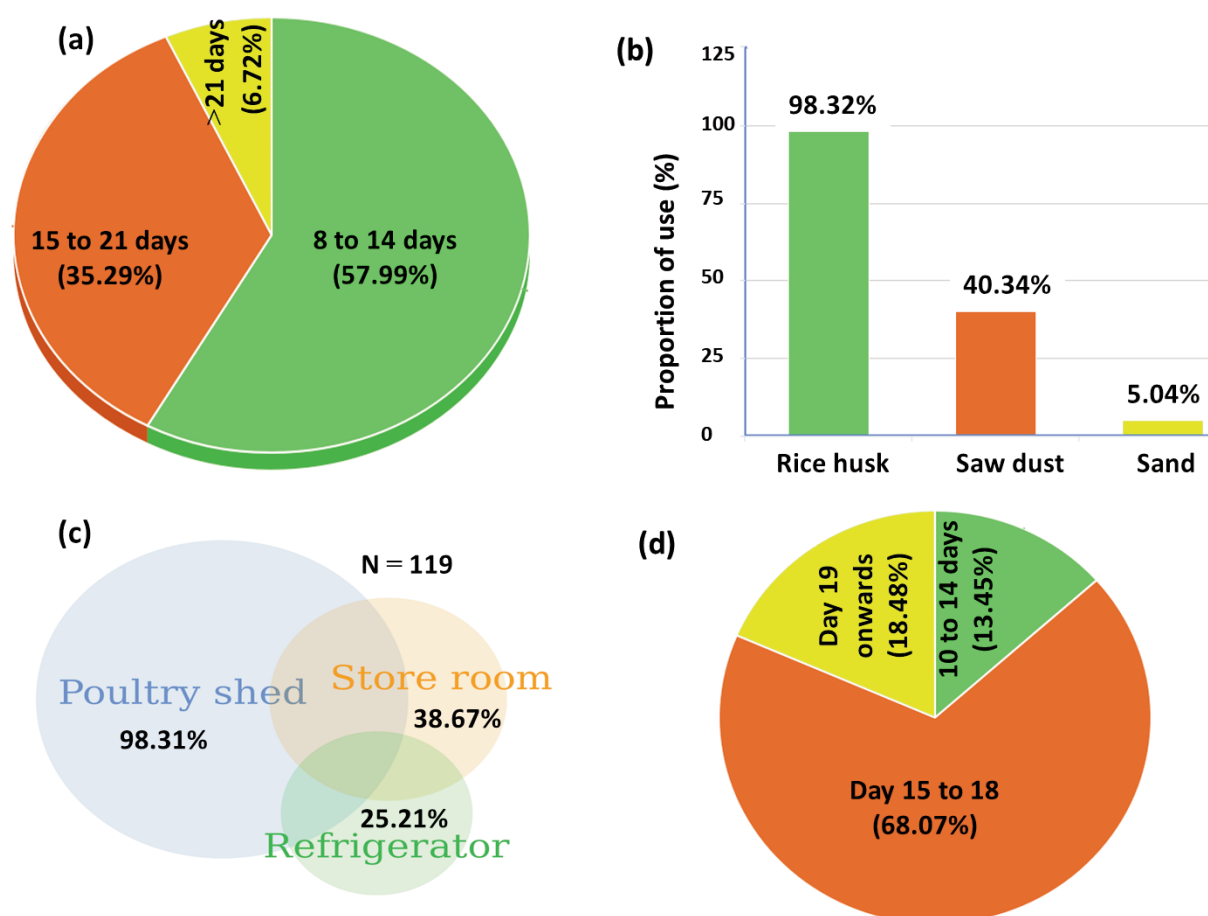


Figure 3. Proportion of response by the farmers on (a) interval between batches, (b) type of bedding material used, (c) storage sites for medicine and vaccines and (d) starting time of anticoccidial drug use

ventilation, most of these farms were equipped with electric fan and light besides the provision of natural air and light. Entrance of the farm in most cases, included a small footbath filled with disinfectant mixed water.

About 96.63% of the farms used floor type rearing system for birds (Table 1). Approximately 73.11% of respondents were using 'A' grade day old chicks (DOCs). Exclusively all-in all-out system was well-practiced in 68.91% (82/119) of inspected farms. Broilers were typically reared for 30–35 days. Daily basis cleaning of feed and watering utensils was performed by 91.6% of farmers. All the farmers practiced mixing sun-dried old litter with new litter as the bedding material for new flock. Interval between flocks for 57.99% of farms was 8 to 14 days, 35.29% for 15–21 days and only 6.72% prolonged it for more than 21 days (Figure 3a). Rice husk was used as bedding in the farm by 98.32% of respondents (Figure 3b). For storage of vaccines and medicines, farm shed was used by 56.30% (67/119) of respondents, shed and store

room by 18.49% and combination of refrigerator, shed and store room by 16.81% (Figure 3c). Approximately 68.07% (81/119) of the farmers routinely started the anticoccidial treatment at the age of 15–18 days of broiler (Figure 3d).

The present survey indicated that all the farms included in the study had previous history of coccidiosis, anticoccidial drug use, no vaccination for coccidiosis, but regular immunization for other common diseases (Table 2). Besides anticoccidials and herbal medicine, clinical outbreak was often managed by supplementation of antibiotics, metronidazole, zinc, vit. K, saline etc. based on the severity of the condition (Table 2). Approximately 82.35% (98/119) of farms were regularly vaccinated for common viral diseases like Ranikhet and Gumboro. Only 12.61% of the farms used probiotics in feed and/water.

Chemotherapeutics and/or herbal treatments were used for coccidiosis in the study area. Commonly used anticoccidials were amprolium (74.78%), toltrazuril (55.46%), sulphaquinoxaline

Table 2. Farmer's practice and perception on coccidiosis management in broiler farms

Variables and categories	No. of respondents	% (95% CI)	Variables and categories	No. of respondents	% (95% CI)
Previous history of coccidiosis in the farm			History of anticoccidial drug use		
Yes	119	100 [96.87 to100]	Yes	119	100 [96.87 to100]
No	0	00 [0 to 3.13]	No	0	00 [0 to 3.13]
History of anticoccidial vaccine use			History of herbal treatment for coccidiosis		
Yes	0	00 [0 to 3.13]	Yes	5	4.20 [1.81 to 9.46]
No	119	100 [96.87 to100]	No	114	95.80 [90.54 to 98.19]
Vaccination for other common diseases			Supplementary treatment (antibiotics, metronidazole, vit. K, Zinc, saline etc.)		
Yes	98	82.35 [74.52 to 88.16]	Yes	119	100 [96.87 to100]
No	21	17.65[11.84 to 25.48]	No	0	00 [0 to 3.13]
Probiotics use			Reuse of old litter		
Yes	15	12.61 [7.79 to 19.76]	Yes	119	100 [96.87 to100]
No	104	87.39[80.24to 92.21]	No	0	00 [0 to 3.13]

(23.52%), sulphaclozine (28.57%), sulphadimidine (24.36%) and sulphadimethoxine (24.36%) (Figure 4a). A few respondents 4.20% (5/119) were found to use herbal products, i.e. extracts of bulk of arjuna (*Terminalia arjuna*), and leaf of sal (*Shorea robusta*) and bollygum (*Litsea glutinosa*) in drinking water for the treatment of coccidiosis in addition to anticoccidial drugs (Figure 4b).

Regarding minimum drug withdrawal period, 75.63% of the farmers quoted 7 days and only 5.04% were aware of the range of 3 to 7 days (Figure 4c).

Discussion

Coccidiosis is considered as man-made disease. Intensive system of farming play crucial role in high prevalence, intense morbidity and mortality, leading to colossal economic losses [4, 6]. Here, we provided several management factors associated with the prevalence of coccidiosis in small-scale broiler farming. The bird level and farm level

prevalence of coccidiosis in Gazipur were 34.48% and 100%, respectively. Majority of the small scale farms were operated with good quality DOCs, all-in-all-out system, daily cleaning of feeder and drinker, good flow of drinking water, mixture of old and new litter and routine anticoccidial treatment. All these practices are supposed to reduce the rate as well as intensity of infection [6,10,17,18]. Therefore, failure to reduce farm level coccidiosis prevalence might have resulted from some breach in management due to lack of adequate knowledge, no immunization and less use of probiotics.

We revealed high bird-level prevalence of coccidiosis in Gazipur, which is higher than the previous studies conducted at Kishoreganj district, Bangladesh [9]. However, globally the prevalence of coccidiosis varied from 10–90% [7], which is mainly due to the differences of geography, climatic condition, on-farm hygiene, sanitation and biosecurity, production type, and host factors (species, strains, age, gender and immunity). Being located in the commercially popular poultry farming zone,

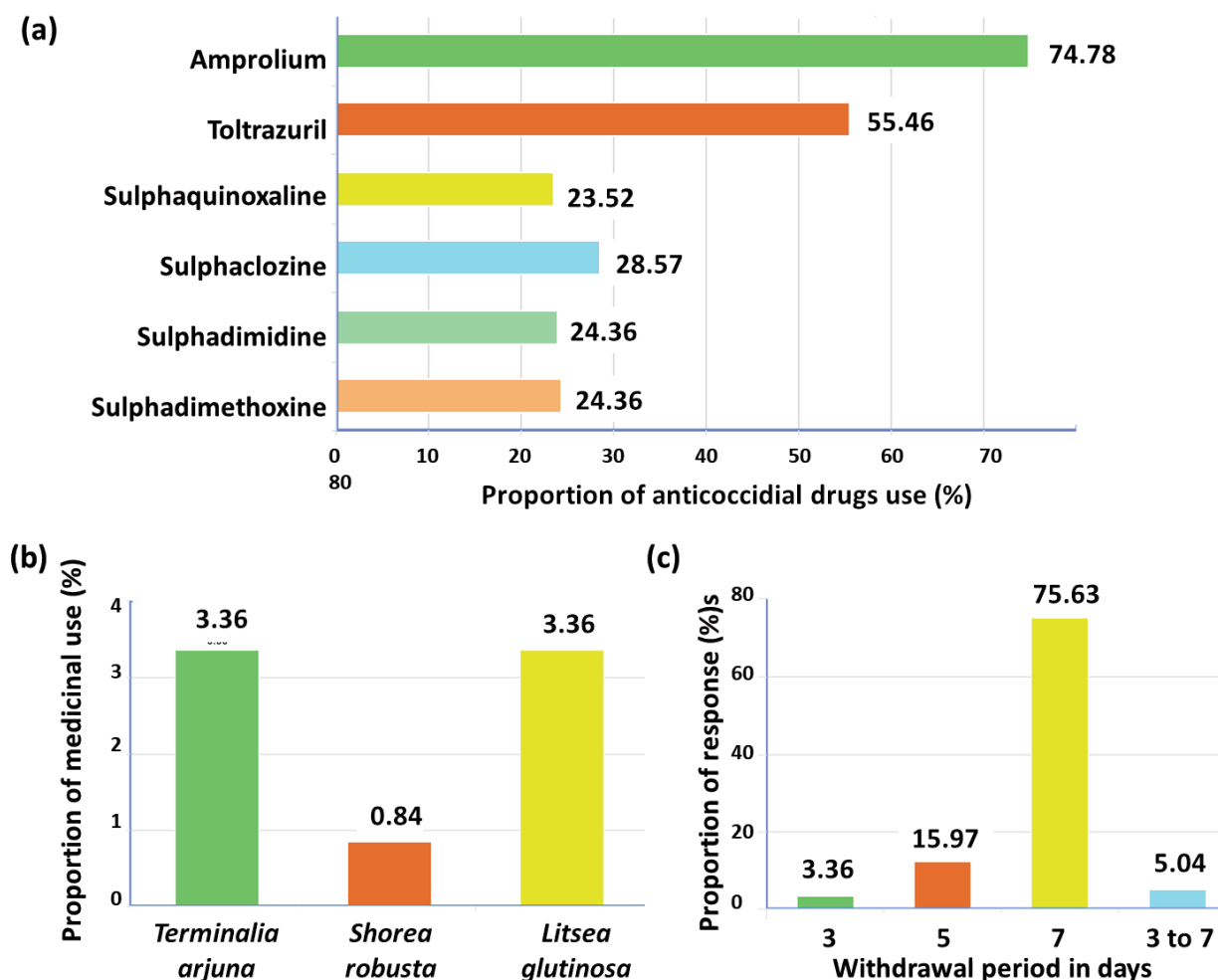


Figure 4. Proportion of farmers response on (a) use of anticoccidial drug, (b) use of plant medicine and (c) minimum withdrawal period

farmers of the study area are expected to have frequent contact with veterinary personnel, vetero-medical sales representatives and government officials. There is also a strong possibility of receiving training on commonly encountered broiler disease management. Yet, being all the farms experiencing clinical coccidiosis in previous flocks is alarming. The reasons behind the prevalent situation in the study area might be the ubiquitous and disinfectant resistant-oocysts, which have high reproductive potential and fast transmissibility [3,6].

In our study, broiler producers were experiencing coccidiosis despite routine anticoccidial uses, which is in agreement with Gharekhani et al. [10] clearly indicating inadequate dosing, improper choice of anticoccidials and probiotics or faulty delivery. However, development of resistance to the compounds cannot be ruled out. Besides, lack of

suitable storage facilities specific for medicine or vaccine in majority of the farms under this survey might also contribute to the loss of efficacy of coccidiostats.

Housing, bedding and litter management are also very important issues for broiler production as wet floors might pose significant risk for coccidiosis transmission [4]. The important factors that may influence moisture retention in the rearing environment include short interval between flocks, partial-house brooding, evaporative cooling systems, and poor drinking water management [19]. Floor system rearing and usage of the old and new litter mixture for new flock was quite common in Gazipur as revealed from this study, which can also contribute to the high prevalence of the disease. Recycling of old litter might allow continuous intake of low number of *Eimeria* oocysts resulting high prevalence. In European countries, thorough

cleaning of farm in between flocks and in USA, caked litter removal followed by aeration every 2 to 3 weeks and top dressing of fresh litter before operating new flock are practiced [20]. Similarly, lengthening the interval between flocks might not be apparently economic for farmers, but it could be useful to reduce the risk of disease transmission.

Around three-quarters of the participants maintained a good flow of water supply to the flocks at every 2–3 hours and farmers cleaned the feeding and drinking utensils on a daily basis. In farm, utensils for feeding and drinking can be a potential source of intra-flock oocyst transmission. Majority of the respondents from study (91.6%) cleaned the feed and drinking utensils expecting the less chance for feed and water-borne diseases. We found that farmers commonly used amprolium followed by toltrazuril, sulphaquinoxaline, sulphaclazine, sulphadimidine and sulphadimethoxine as chemoprophylaxis. Amprolium was used either singly or in combination with other sulpha-drugs for e.g., sulphaquinoxaline. Although amprolium was reported not to be equally effective against all chicken *Eimeria* spp., but it is considered as one of the safest antimicrobial drug for high safety dose [21] and no premarketing withdrawal is required. Toltrazuril is effective against intracellular stages of *Eimeria* spp. [22], but the residual effect is long. Sulphonamides are linked to potential residues, and in some cases, interference in vit. K synthesis and metabolism, and mostly discontinued in many parts of the world, like Europe and North America [21]. Therefore, use of these drugs should be judicious and should maintain minimum withdrawal period for safety to broiler meat consumers. This trend in drug use might have been influenced by the local availability of anticoccidials. In many cases, small-scale farmers come in contract with feed and chick suppliers to use the feed, drug and vaccine as per the commodities delivered by the same agent. Although the poultry drug market is very competitive in Gazipur, yet there was a high variation in the acceptability of different anticoccidial preparations.

A few number of respondents (4.20%) of our study used phytomedicines like bark and/or leaf extracts of *T. arjuna*, *S. robusta* and *L. glutinosa* in drinking water for the treatment of coccidiosis in addition to anticoccidial drugs. Anticoccidial effect was noticed in several plant extracts as reviewed by Fatoba et al. [6]. Bark of *T. arjuna* could exhibit antioxidant, anti-inflammatory and immunomodulatory action and is used to treat human blood

related diseases [23]. *Litsea* is known to exert antibacterial, anti-oxidant and antiparasitic properties and traditionally used for human gastrointestinal ailments [24]. The extracts of *Shorea robusta* act as astringent, analgesic, antimicrobial and antipyretic and traditionally used in diarrhea and dysentery [25]. Unfortunately, understanding of their specific mode of action related to coccidiosis and safety – toxicity have yet to be examined yet. If these products are proved as safe for human health, then they can be used as cost-effective anticoccidial agent singly or in conjunction with low dose of anticoccidial drugs.

Farmers under this survey did not use any vaccine against coccidiosis and a very few of them used probiotics. Probiotics alone can potentiate host defense, affect gut microbiota positively, maintain intestinal integrity and minimize clinical signs and together with *Eimeria* vaccine, can enhance protection [6,26]. Farmers need to be motivated for the use of vaccines and probiotics and beneficial aspects of those must be disseminated among the farmers.

Our results suggested that although the farmers knew about the concept of drug withdrawal period, but they were not well-aware of the duration of withdrawal period for specific drug. This ignorance in perception and in practice might bring financial loss if selling is delayed or might put threat to food safety if the birds are sold early. Moreover, significant levels of drug residues were found in chicken meat in Bangladesh [27], which is in accordance to the findings of our study. Unfortunately the field situation reflected serious ignorance of withdrawal period suggesting potential threat to food safety.

In conclusions, in the lights of current study, coccidiosis exists as one of the commonest farm diseases in small scale-broiler production. This project provided a better insight into the bird level and farm level prevalence of coccidiosis, current farm management practices, range of anticoccidial drugs in use and possible risks and trends in recurrent infection in broiler farms of Gazipur, Bangladesh. More intensive study is required to confirm the relative contribution of farmers' awareness and farm operations in the recurrent outbreak of coccidiosis despite routine chemoprophylaxis.

Acknowledgements

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