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Identification of antibiotic use patterns in poultry farms in the southwest region of Bangladesh

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A B S T R A C T

The study was conducted in southwestern Bangladesh, 90 chicken farmers were surveyed across three upazilas under three districts of southwestern Bangladesh to understand the practices and farmers' perceptions of antibiotic use in poultry farming. Data were collected through direct interviews of poultry farmers using a pre-tested interview schedule. The results showed that the highest percentage of farmers kept broilers in their farms (30.0%), followed by layer (28.9%), Sonali (26.7%) and cockerel (14.4%). Farmers marketed broilers at an average of 35 days with a live weight of 2187.04 kg bird^{-1} and egg production of layer chickens was 88.88%. The majority of chicken farmers (84.44%) used antibiotics while 47.8% and 92.2% of farmers used probiotics and vitamin-mineral supplements for chicken. The use of antibiotics was suggested by various people such as veterinary doctors (35.56%), animal health workers (23.33%), drug company representatives (20.00%) and self (5.56%). More than half of the chicken farmers (56.67%) applied antibiotics regularly and the highest percentage was supplied through water (82.2%). Half of chicken farmers used antibiotics for disease prevention (50.00%), followed by treatment of sick chickens (31.11%), growth promotion (2.22%) and both disease prevention & growth promotion (1.11%). The majority of the farmers did not know about the negative impacts of antibiotic use in poultry farming (87.8%), among the remaining 7.8% of farmers said it was carcinogenic, 3.3% stated it was toxicity in humans and only 1.1% said it had no effect of antibiotics in human health. It can be concluded that most of the chicken farmers are using antibiotics indiscriminately which suggests proper education and awareness creation of poultry farmers to reduce the risks associated with antibiotic use.

Keywords: Antibiotic residue, Disease prevention, Farmers' perception, Impact of antibiotics, Public health

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Introduction

The poultry farming industry in Bangladesh has several challenges, including low financing, adverse weather conditions, high mortality rates, and expensive treatment and vaccination costs. Despite these problems, there is a large market for chicken farming. Khan *et al.* (2018) stated that there is considerable antibiotic use in poultry farming in Bangladesh; Nevertheless, there is concern that antimicrobial residues in food animal tissues may have negative consequences for consumers. Their analysis confirmed that samples of chicken flesh contained antibiotic residues that might be dangerous to the general public's health. Although farm management measures serve to decrease the use of antibiotics, the higher density of cattle or poultry in intensive rearing operations necessitates an active approach to disease control, which can result in excessive prophylactic and therapeutic antibiotic use. (Tollefson and Miller, 2000). The use of antibiotics in conjunction with stringent biosecurity and hygiene protocols has contributed to the expansion of the chicken industry over the past half-century by mitigating the detrimental effects of numerous avian diseases (Bermudez, 2003). The primary goals of antibiotic use in food-producing animals are infection prevention, infection treatment, growth promotion, and enhanced farm animal productivity (Mathew *et al.*, 2009).

Although they can cause single- or multi-drug resistance, antibiotics are medications used to prevent and cure bacterial illnesses. These resistant bacteria have the ability to either directly infect animals with disease-causing pathogens or transfer their resistance traits to other bacteria. These resistant bacteria can be transmitted to humans via contaminated food or water or by direct contact with affected animals. Resistance bacterium infections have the potential to be more severe and persistent, and trade and travel can quickly disseminate these bacteria around the world. Siddiqui *et al.* (2023) identified the most widely used antibiotics as levofloxacin, azithromycin, enrofloxacin, ciprofloxacin, erythromycin, neomycin, amoxicillin, and colistin. They also observed that the farmers' decisions about antibiotic selection are primarily influenced by a variety of factors, including low levels of education and understanding, faith in one's intelligence, and a tendency to follow recommendations from agro-vet companies and there was no initiative pertaining to raising public awareness of antibiotic resistance. The purpose of this study was to evaluate the situation of chicken farming in Bangladesh today, with a focus on the southwest area, and to pinpoint challenges and concerns. It also looks at how antibiotics were used while raising chickens. The study was conducted with the following objectives:

i. Identifying antibiotic use patterns in poultry farming in southwestern Bangladesh.
ii. Assessing farmers' perceptions of antibiotic use in poultry farming on human health.

Materials and Methods

A field survey was conducted in Bangladesh as part of the study to look at the usage of antibiotics in chicken production. Data was collected from chicken producers using a pretested interview schedule.

Design of the study

To look at the persistent use of antibiotics in chicken farming, the study conducted personal interviews with poultry producers in southwest Bangladesh. A successful survey was made possible by selecting sites with a high concentration of chicken farms for the study. Ninety farmers were involved in the data collection process, with thirty (30) farmers taken at random from each upazila. A survey was conducted among small to medium-sized commercial chicken producers in three upazilas of southwestern Bangladesh: Dumuria in Khulna, Fakirhat in Bagerhat, and Tala in Satkhira district. A questionnaire was developed in Bengali to obtain relevant and subject-related information from the respondents. The questionnaire consisted of simple, easy-to-understand questions that were both open-ended and closed-ended. To assess the instrument's ability to collect data, a pretest of the interview schedule was conducted with chicken producers. For data collection purposes, the final interview schedule was then multiplied.

Collection and analysis of data

In-person interviews were used to get information from the respondents for the research. Upon being briefed about the purpose of the research, participants were asked to furnish precise data. Respondents provided their memoirs, and data were collected objectively. Data from the studies were collected, processed and tabulated in preparation for analysis. The computer program SPSS-v-20 was used to analyze the data, and descriptive statistics such as numbers, percentages, means, and standard errors were used to characterize the independent and dependent variables.

Results and Discussion

Types of chicken farms

The percentage of different types of poultry farms in the study area is presented in Table 1. The results showed that broiler farms had the highest percentage (30.0%) followed by layer (29.9%), Sonali (26.7%) and cockerel farms (14.4%).

Table 1. Types of chicken farms in the studied area.

Type of chicken farms	Frequency	Percent
Broilers	27	30.0
Layers	26	28.9
Sonali	24	26.7
Cockerel	13	14.4
Total	90	100.0

Production performances of different types of chickens

The production performance of different types of chickens is presented in Table 2. The data in the Table shows that the average number of birds per farm was highest for the Sonali farm (1650.00±307.77) followed by the layer farm (1404.42±282.28), cockerel farm (1056.92±107.34) and broiler farm (870.00±115.08) where the mean difference was not significant ($p>0.05$). The mean age at the marketing of broiler, layer, Sonali and cockerel chickens was 35.00±0.74, 579.19±21.59,

63.08±1.81 and 84.08±25.52 days, respectively and the mean difference was highly significant ($p<0.001$). Highly significant variations ($p<0.001$) were observed among the average marketing weights for different types of chicken being the highest for broiler chicken (2187.04±55.83) followed by layers (1560.00±58.22), Sonali (1064.58±44.89) and cockerel (984.62^{c}±90.47). The mean egg production percentage for layer hens was 88.88±5.27. The mortality percentage of different types of chickens did not vary significantly ($p>0.05$). Mortality ranged from 3.85±0.44 to 6.08±1.14 highest in Sonali and lowest in layer hens.

Table 2. Production performances (mean ± SE) of different types of chickens.

Parameters	Chicken types				Overall	F-value	Level of significance
	Broilers	Layer	Sonali (Fayoumi×RIR)	Cockerel			
Total number of chickens farm^{-1}	870.00±115.08 (27)	1404.42±282.28 (26)	1650.00±307.77 (24)	1056.92±107.34 (13)	1259.39±124.43 (90)	2.199	NS
Age at marketing (d)	35.00^{c}±0.74 (27)	579.19^{a}±21.59 (21)	63.08^{bc}±1.81 (24)	84.08^{b}±25.52 (13)	184.88±25.55 (85)	393.01	***
Marketing weight (g bird^{-1})	2187.04^{c}±55.83 (27)	1560.00^{b}±58.22 (20)	1064.58^{c}±44.89 (24)	984.62^{c}±90.47 (13)	1530.95±61.77 (84)	94.29	***
Egg production (%)	-	88.88±5.27 (26)	-	-	-	-	-
Mortality (%)	4.74±0.73 (27)	3.85±0.44 (26)	6.08±1.14 (24)	5.69±1.05 (13)	4.98±0.43 (90)	1.469	NS

Sultana *et al.* (2013) reported that about 78% of the respondents considered the market weight as 1.5 kg per broiler bird. Most of the farmers (64%) sold broilers at the age of 30-33 days. The marketing age of broilers reported by Sultana *et al.* (2013) agreed with the present findings but their observations on marketing live weight of broilers were much lower than the findings of the present study. This variation can be attributed to various factors such as broiler strain type, feed type and quality, and management.

Vaccination and treatments of sick birds

As per the study's findings, 98.9% of participants vaccinated their birds against different diseases, whereas 1.1% of respondents stated they vaccinated their birds occasionally. Sultana *et al.* (2013) reported that 90% of farmers routinely vaccinated their broilers.

Table 3. Vaccination pattern of chickens.

Pattern	Frequency	Percent
Regular vaccination	89	98.9
Occasional vaccination	1	1.1
Total	90	100.0

Data in Table 4 displays that 74.4% of the chicken farmers called a local doctor to treat their sick birds, followed by 21.1% by a veterinarian, 2.2% by themselves and 2.2% of the respondents did not take any treatment for their sick birds. Rimi *et al.* (2018) showed that most raisers (86%) sought care for their chickens locally, 14% used only home remedies, and none sought care from veterinary professionals.

Table 4. By which sick chickens are treated.

Means of treatment	Frequency	Percent
Local doctor	67	74.4
Veterinarian	19	21.1
Self	2	2.2
No treatment	2	2.2
Total	90	100.0

Instead of seeking the advice of experts, all farmers relied on their common sense and practicality when administering antibiotics. In fact, 22% of farmers prepared their treatment, while 10% and 68% of farmers followed recommendations from registered veterinarians and agro-vet companies/poultry feed and chick suppliers, respectively (Siddiqui *et al.*, 2023).

Supplementation of antibiotics, probiotics and vitamin-minerals

Supplementation of various feed additives by poultry farmers is presented in Table 5. The results showed that the majority of the farmers (84.44%) provided antibiotics and only 15.56% did not use antibiotics in poultry farming. Probiotics were not supplemented by more than half of the

chicken farmers in the studied area (52.2%) and the rest of the farmers used it in chicken rearing (Table 5). On the other hand, 92.2% of the respondents supplemented their birds with vitamin-mineral premix while only 7.8% of the respondents did not supplement the birds with vitamin-minerals.

Table 5. Distribution of the respondents according to the supplementation of antibiotics, probiotics and vitamins-minerals.

Supplementation patterns	Antibiotics		Probiotics		Vitamins-minerals	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Supplemented	76	84.44	43	47.8	83	92.2
Not supplemented	14	15.56	47	52.2	7	7.8
Total	90	100.0	90	100.0	90	100.0

Nearly all (94%) of the farmers in a different study conducted in Bangladesh on small-scale farms in the Mymensingh region used antibiotics without adhering to the required minimum withdrawal period prior to commercialization (Ferdous *et al.*, 2019). According to Patterson and Burkholder (2003), probiotics and prebiotics can, in some circumstances, change the immune system and gut microbiota to lessen the number of infections that colonize the body. Probiotics, according to Hassanein and Soliman (2010), improve the quality of chicken meat.

Sources and means of applying antibiotics

Different advisers on the use of antibiotics for chicken farming is presented in Table 6. The results of the study showed that the highest percentage of cases suggested the use of antibiotics by veterinarians (35.56%), followed by animal health workers (23.33%), pharmaceutical company representatives (20.0%) and self-medication (5.56%) while 15.56% farmers were not used antibiotics.

Table 6. Adviser on the use of antibiotics for chicken farming.

Categories	Frequency	Percent
Veterinary doctor	32	35.56
Self-medication	5	5.56
Animal health workers	21	23.33
Representative of medicine company	18	20.00
Don't use antibiotics	14	15.56
Total	90	100.00

Another study conducted by Siddiqui *et al.* (2023) in broilers and observed that most farmers (68%) administered antibiotics following the advice of agro-vet companies, 22% used it as their own decision and only 10% of broiler farmers followed the advice of a registered veterinarian. These results are nearly identical to those of Boamah *et al.* (2016). According to other studies, the majority of farmers (>60%) used antibiotics without a veterinarian's prescription (Islam *et al.*, 2016). In the private sector, between 50% and 90% of medicine purchases are done without a prescription due to the widespread and indiscriminate use of antibiotics (Shamsuzzaman *et al.*, 2007).

Table 7. Source of antibiotics for chickens.

Source of antibiotics	Frequency	Percent
Local veterinary pharmacy	40	44.44
Animal health workers	15	16.67
Agents of pharmaceutical companies	9	10.00
Feed and chick suppliers	12	13.33
Don't use antibiotic	14	15.56
Total	90	100.00

Data in Table 7 shows that the highest percentage of antibiotics used in chicken farming is from local veterinary pharmacies (44.44%) followed by animal health workers (16.67%), feed and chick suppliers (13.33%) and pharmaceutical company agents (10%). Antibiotics are easily obtained in Bangladesh without a prescription from a physician or veterinarian.

Table 8. Means of applying antibiotics to the chickens.

Feeding methods	Frequency	Percent
Through feed	1	1.1
Through water	74	82.2
Directly	1	1.1
Don't use antibiotic	14	15.6
Total	90	100.0

Antibiotics are fed to birds by 82.2% of respondents through water, 1.1% directly, and 1.1% through feed, according to data in Table 8. In order to avoid unintended death, 77.5% and 17.5% of farmers, respectively, added vitamins and antibiotics to the water (Khan *et al.*, 2018).

Frequencies and purposes of applying antibiotics

Table 9 shows how frequently antibiotics are applied to chickens. According to the study's findings, 56.67% of respondents gave antibiotics on a regular basis, 27.78% gave them on occasion, and 15.56% never gave them. According to Hasan *et al.* (2011), the majority of farmers (82.69%) selected antibiotics without a prescription and used them frequently to promote growth and avoid illness.

Table 9. Frequency of applying antibiotics to the chickens.

Frequency	Frequency	Percent
Occasionally	25	27.78
Regularly	51	56.67
Don't use antibiotics	14	15.56
Total	90	100.00

According to Siddiqui *et al.* (2023), farmers who sought veterinary assistance from a variety of agro-vet sectors were more likely to use antibiotics more frequently for the treatment and prevention of disease. When such people administer antibiotics, birds may receive an under- or overdose of the drugs (Chowdhury *et al.*, 2009; Maron *et al.*, 2013).

Table 10. Purposes of antibiotics usage in chicken rearing by the farmers.

Purposes of antibiotics usage	Frequency	Percent
Treatment of sick chickens	28	31.11
Disease prevention	45	50.00
Growth promotion	2	2.22
Both disease prevention & growth promotion	1	1.11
Don't use antibiotic	14	15.56
Total	90	100.00

The findings showed that half of the chicken farmers (50%) used antibiotics for disease prevention, 31.11% for treating sick birds, 2.22% for growth promotion and only 1.11% for disease prevention and growth promotion (Table 10). Selaledi *et al.* (2020) reviewed that the growth and health of food-producing animals have been improved through the use of antibiotics over the years.

According to McEwen and Fedorka-Cray (2002), antibiotics are used in food animals to treat clinical diseases, prevent and control common disease occurrences, and stimulate animal growth. Antibiotics are widely used by farmers as a prophylactic and growth-promoting risk-management tool (Begum *et al.*, 2013). According to Hasan *et al.* (2011), the majority of farmers (82.69%) select antibiotics without a prescription and use them frequently to promote growth and avoid illness. Antibiotic-using poultry farmers are aware that faster growth rates will offset the cost of antibiotics (Sirdar *et al.*, 2012). According to Siddiqui *et al.* (2023), 74% of poultry producers felt that taking antibiotics as a preventive measure would help ensure that their birds do not become ill, even if they had been using antibiotics prior to the disease's clinical breakout or confirmed diagnosis. Additionally, they mentioned that 82% of farmers treat their flocks of chickens with antibiotics to lessen stress, particularly following vaccination.

Farmers' perceptions on the impact of antibiotics use

Table 11. Farmers' perceptions on the negative impact of antibiotics use in chicken rearing on human health.

Types of impact	Frequency	Percent
No negative impact	1	1.1
Carcinogenic	7	7.8
Toxicity in human	3	3.3
Don't know	79	87.8
Total	90	100.0

The data in Table 11 shows that about 87.8% of the respondents did not know the negative effects of antibiotics used in poultry farming on human health, 7.8% of the respondents said that antibiotic residues are carcinogenic, 3.3% said that residues can cause toxicity in humans and only 1.1% said there were no negative effects. According to Siddiqui *et al.* (2023), there is a complete lack of knowledge among farmers regarding antibiotic resistance and its effects on public health. According to Hasan *et al.* (2011), there may be detrimental effects on the environment, human health, and animal health from the extensive use of antibiotics as feed additives for illness prevention and growth promotion. Therefore, regulatory bodies must act immediately to stop antibiotic violence, restrict the use of antibiotics in the broiler business, guarantee marginal farmers receive the best veterinary care possible, and raise public awareness of antibiotic resistance and its effects on public health.

Rank order of different statements on antibiotic use

The order of different sets of statements on the use of antibiotics in poultry farming based on respondents' perceptions is presented in Table 12. According to respondents' opinion, the statement "antibiotics should only be prescribed by a veterinarian" ranked first among seven affirmative statements (Table 12). On the other hand, the statements "consuming eggs with antibiotic residues can cause antibiotic infection in humans" and "consuming chicken meat with antibiotic residues can cause antibiotic infection in humans" are ranked 2nd and 3rd respectively. Other statements are raked by different numbers. Among the seven negative statements about various aspects of antibiotic use in poultry farming, "when antibiotics are about to expire, it is better to give medicine to birds to prevent wastage" ranked first according to respondents' perceptions (Table 12). Among other negative statements, "raising chickens without antibiotics would be too expensive" and "once a bird shows any symptoms, the bird should be given antibiotics to prevent the entire flock from becoming infected" ranked 2nd and 3rd, respectively.

Table 12. The rank order of different statements on antibiotics uses in chicken rearing on the basis of respondents' perception.

a) Positive statements				
Sl. No	Statements	Score	Percentage (%)	Ranking
1	Some antibiotics used in chicken are used in humans.	272	60.44	7th
2	Handling contaminated raw meat can transfer antibiotic-resistant bacteria to humans.	274	60.89	5th
3	Antibiotic-resistant bacteria can be transferred to humans when exposed to antibiotic-fed chickens.	273	60.67	6th
4	Only authorized people should have access to antibiotics during administration, and they must be stored in a restricted area.	281	62.44	4th
5	Only veterinarians should prescribe antibiotics.	295	65.56	1st
6	Humans can contract antibiotics by consuming chicken meat that has antibiotic residues	283	62.89	3trd
7	Eating eggs with antibiotic residues can expose individuals to antibiotics.	287	63.78	2nd
b) Negative statement				
1	Less profit can be made from poultry without the use of antibiotics.	143	31.78	7th
2	If antibiotics aren't utilized for regular disease prevention or growth improvement, chickens will die at a stunning rate.	144	32.00	6th
3	The cost of raising hens without antibiotics would be high.	349	77.56	2nd
4	The primary purpose of using antibiotics in poultry farming is to enhance the growth of the birds.	167	37.11	4th
5	Antibiotics should be added to chickens to help them stay healthy.	151	33.56	5th
6	Antibiotics should be administered to birds as soon as they exhibit any symptoms in order to keep the flock as a whole from contracting the disease.	170	37.78	3rd
7	To avoid waste, it is advisable to medication the birds when the antibiotic is close to expiration.	399	88.67	1st

Additionally, it seems that veterinarians have a say in how antibiotics are used on farms, and better veterinary care delivery can drastically cut down on the usage and possible abuse of antibiotics on these farms. According to Khan *et al.* (2018), just 7.5% of vendors are familiar with the term "antibiotic resistance," and 12% are unaware of the risks that indiscriminate antibiotic use poses to human health. The results of another study have also been related to the spread of antibiotic resistance in chicken farming due to the abuse of antibiotics (Carlet *et al.*, 2012). Microorganisms are exposed to sub-inhibitory antibiotic concentrations when an antibiotic treatment course is incomplete, which causes resistance to develop (Davies and Davies, 2010). Launching a well-planned awareness-building effort aimed at low-level, unknown providers can help address this crucial problem. Knowledge is crucial to solve the problem of indiscriminate use of antibiotics in poultry farming (Lee *et al.*, 2015).

Conclusion

The results of the study indicated that most of the farmers in the study area used antibiotics indiscriminately and less than half of the chicken farmers supplemented their chickens with probiotics. Most of the chicken farmers (87.8%) were not aware of the human health effects of antibiotic use in poultry farming which is alarming and calls for educating farmers about the negative effects of antibiotic use. The results of the study suggest the need to raise awareness among poultry farmers about the risks associated with antibiotic use and the importance of proper veterinary guidelines. In Bangladesh's southwest, poultry farming is regarded as a high-potential source of income, however, there are worries regarding the usage of antibiotics and their effects on human health. The study draws attention to the extensive use of antibiotics in southwestern Bangladeshi poultry farms, which puts consumers' health at risk.

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