KNOWLEDGE, ATTITUDE, AND PRACTICES ON ANTIMICROBIAL USE IN BROILER AND LAYER FARMS AT CUMILLA DISTRICT, BANGLADESH

A THESIS

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*This is to certify that the thesis entitled "**KNOWLEDGE, ATTITUDE, AND PRACTICES ON ANTIMICROBIAL USE IN BROILER & LAYER FARMS AT CUMILLA DISTRICT, BANGLADESH**" submitted to the faculty of animal science & veterinary medicine, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of Master of Science in Poultry Science, embodies the result of a piece of bona fide research work carried out by KAZI JOBAYEDUL HAQUE, Registration no. 14-06139 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

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TO

MY BELOVED PARENTS

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LIST OF ABBREVIATIONS AND SYMBOLS

ABBREVIATION	FULL WORD
AR.	Antimicrobial Resistance
Dept.	Department
DLS	Department of Livestock Services
e.g.	for example
et al.	and others
FAO	Food & Drug Administration
Fig.	Figure
AMR	Antimicrobial Resistance
AMU	Antimicrobial Use
i.e.	that is
KAP	Knowledge, Attitude & Practice

KNOWLEDGE, ATTITUDE, AND PRACTICES ON ANTIMICROBIAL USE IN BROILER & LAYER FARMS AT CUMILLA DISTRICT, BANGLADESH

ABSTRACT

Antimicrobial resistance (AMR) has emerged as a global public health concern and it is directly linked to the use of antibiotics by livestock farmers especially poultry and dairy farmers. This study was conducted to assess the current situation of Knowledge, Attitude and Practices (KAP) of farmers regarding antimicrobial use (AMU) in poultry farms in Cumilla district of Bangladesh. Information of farmers was collected in a pre-structured questionnaire and chi-square test was used to examine relationships between knowledge, attitude and practice. The findings indicated that farmers had a little knowledge about on AMR and ethical use of antibiotics. Majority of the farmers showed positive attitude towards use of antibiotics. However, practices regarding AMU were poor among the poultry farmers. The study also demonstrated that layer farmers had better idea about antibiotics and had a good practice compared to broiler farmers. The gap in the knowledge and attitude of the farmer's regarding AMU could be a potential factor of AMR. Further study can help build a more accurately address the situation and help build a correct pathway to combat AMR.

Keywords: AMR, AMU, Poultry farming, KAP, Antibiotics

CHAPTER 1

INTRODUCTION

The use of antibiotics in the production of animal foods and the possibility of the transfer of antimicrobial resistance via the food chain are subjects of growing concern. Small-scale farmers who rely on financing from poultry dealers to purchase day-old chicks and poultry feed make up the commercial poultry sector in many low- and middle-income nations, including Bangladesh. Antibiotics are distributed and promoted by the same dealers (Masud *et al.* 2020). Antibiotic resistance (AR) which is defined as the ability of an organism to resist the killing effects of an antibiotic to which it was normally susceptible and it has become an issue of global interest. Given that all microbes have the innate ability to resist various antibiotics, this microbial resistance is not a recent phenomenon. The main reason for concern, however, is the sudden increase in the development and dissemination of AR. A sufficient body of evidence has recently emerged showing a connection between overuse of antimicrobial agents and animal antimicrobial resistance as a factor in the overall incidence of AR. Due to the development of farming techniques in the majority of emerging countries, the extent of consumption is anticipated to significantly rise over the coming years (Agyare *et al*.2018) . Antibiotic resistance is mostly caused by the improper and excessive use of antibiotics. According to estimates from the World Health Organization, more people died in the last ten years from antibiotic-resistant bacteria than from influenza, the human immunodeficiency virus, and vehicle accidents put together. Stewardship of antibiotics is crucial for the prevention of antibiotic resistance. For the evaluations of the use of antibiotics on poultry farms, organized questionnaire surveys and in-depth interviews with key informants (farm veterinarians and animal production specialists) as well as poultry producers, managers, and key informants were conducted. All farms employed one or more antibiotics, which were mostly given through feed and water (Bussa *et al.2020*). 87 million tons of eggs and 123 million tons of poultry meat (or 37% of the world's total meat production), according to the Food and Agriculture Organization (FAO), were produced globally in 2017. It is crucial to assess global trends of AMR development linked to poultry production as food animal production and antimicrobial usage both grow quickly (Hedman *et al*. 2020). Antibiotic resistance has been cited by the World

Health Organization (WHO) as a significant global threat to human health. The widespread use of antibiotics in the production of food animals is a significant factor behind the rise in antibiotic resistance. Antibiotic usage in food animals is still unregulated in many low-income countries, which results in incorrect dosing and a significant rise in antibiotic resistance. There is proof that other variables that contribute to aggravating this issue include the widespread dependence on antibiotics, inadequate awareness efforts and the lack of education for farmers on the correct use of antibiotics. Antibiotics are used in veterinary medicine to treat infections, prevent illnesses, and promote growth. However, excessive use of antibiotics encourages the development of antibiotic-resistant genes in bacteria. There is currently a dearth of trustworthy information regarding the usage of antibiotics in food animal production. However, there are signs that non-therapeutic use of antibiotics in animals vastly outweighs non-therapeutic usage in people. According to one study, just 3 million pounds of antimicrobials are utilized for human treatment, compared to close to 25 million pounds used for nontherapeutic purposes in chickens, pigs, and cows (Martin Forde *et al.* 2020). Numerous studies show that resistant bacterial strains are being transferred from food animals to people in the United States, Europe, and Denmark.. E. coli, A. baumannii, Klebsiella, Salmonella, and *P. aeruginosa* are examples of well-known MDR pathogens. In Nigeria, *P. aeruginosa* transmission from the environment of poultry to humans has been documented. This strain is resistant to amoxicillin, augmentin, tetracycline, cotrimoxazole, and chloramphenicol. Another way that resistant pathogens are introduced to the soil from animal farms is through the manure-based disposal of animal waste. The tactics of concentrating animal feeding have made this issue worse. As a result, residues from antimicrobials and resistant bacteria build up in the soil and spread among microorganisms that live there (Kousar S *et al.*2021). Nowadays, poultry is a flourishing industry in Bangladesh. Thousands of chickens are maintained at a time in control and semi-control sheds for the purpose of raising them, and a lot of antibiotics are used to speed up their growth. Antibiotics that are often utilized by bacteria are losing their effectiveness due to selection pressure. To keep the control-sheds at a consistent temperature, exhaust blowers are used. The bacteria and antibiotic residues from the chicken farms are dispersed into the environment by these fans. Contamination of the soil with poultry litter may induce resistance in soil inhabiting bacteria ((Kousar S *et al*.2021). Controlling antibiotic use, keeping an eye on resistance, and coming up with fresh

ideas are now essential if we want to lower antimicrobial resistance in chicken farms. One important tactic is to raise the community's and farmers' knowledge and expertise on appropriate antibiotic use and to cultivate good attitudes toward AMU through awareness programs. It is crucial to evaluate the situation as it stands in Bangladesh in order to create and put into place AMR control measures that are both efficient and effective. The two most important users of antimicrobials for chicken farms are veterinarians and farmers. One crucial aspect in reducing the AMR issue in Bangladesh is the enforcement of the pertinent legislation for farmers. Educating farmers on antibiotics, residues, and resistance is one strategy to prevent excessive and needless use of antibiotics on livestock. Farmers' knowledge and actions can have a big impact on whether they choose to use AMU. However, the value in choosing antibiotics and the spread of AMR are restricted by the present antimicrobial stewardship training, curricula, and guidelines. Producers that explored material on AMU and AMR tended to have better knowledge, attitudes, and practices. Therefore, the main goal of this study was to evaluate Bangladeshi commercial poultry farmers' knowledge, attitudes, and behaviors (KAP) regarding AMU and AMR.

Considering the above information, the current study was designed with the following objective in mind:

- To investigate the knowledge of AMU and AMR of broiler & layer farmers,
- To know the attitudes & practices of AMU and AMR in broiler & layer farmers.

CHAPTER 2

REVIEW OF LITERATURE

This study was conducted to assess the current situation of antimicrobial use in poultry farms in Cumilla district of Bangladesh and farmers' perception about antimicrobial use and antimicrobial resistance in poultry farming. The experiment was aimed to learn about the knowledge, attitude and practice of poultry farmers regarding antibiotics. There were not many studies conducted previously on the matter.

Cumilla is one of the major district in Bangladesh. It is situated from $23^0$01' to $23^0$47'36" north latitude and from $90^0$39' to $91^0$22' east longitude. The population of Cumilla was 5.3 million with an area of 3087.33 square kilometers (BBS, 2011). There are over 3200 poultry farms in Cumilla district.

Figure 1. Cumilla district in Bangladesh

2.1 Knowledge

Hassan *et al.* (2021), In order to evaluate the knowledge, attitudes, and behaviors (KAP) of poultry farmers on AMU and AMR in Bangladesh, the current study conducted a cross-sectional survey. Using a tried-and-true paper-based questionnaire, the authors calculated the KAP of poultry farmers (broiler and layer farmers) in several chosen districts of the nation. The findings showed that the majority of respondents had insufficient KAP with reference to AMU and AMR. A major portion of the poultry farmers did not have the proper knowledge about antimicrobials, antibiotic residue, antimicrobial resistance, the alternates of antimicrobials, use of antimicrobials and about the effects of antibiotics. The study also showed that poultry farmers of Cox's Bazar region had more or less accurate knowledge regarding antibiotics, but most of the other regions did not. The vast majority had clear idea what an antibiotic was. However, layer farmers had more clear concept about antibiotics, its residue and resistance compared to broiler farmers. Most of the farmers knew the fact that antibiotics can pass to human by consuming poultry meat and egg. Layer farmers responded more positively than broiler farmers when asked about the side effects of antibiotics.

Schwendner *et al.* (2020), With regard to lactational intramammary antibiotic usage (AMU) and antimicrobial resistance (AMR), this cross-sectional study sought to ascertain farmers' knowledge, attitudes, and behaviors in Swiss dairy herds. The study revealed that although farmers were aware that bacteria had diverse antibiotic susceptibilities, 59.8% of them had never heard of an antimicrobial susceptibility test. The majority of responders were also unaware that mastitis is treated with HPCI antimicrobials. Most farmers were aware of the possibility that antimicrobial resistance could result from improper antimicrobial use and the possible risk that veterinary medication poses to human health. The study also showed that the majority of farmers were aware that antibiotics are used to treat bacteria. Some people, however, believed that viruses, fungi, and parasites could also be treated with antimicrobials.

Chah *et al.* (2022), This study investigated the habits and understanding of small-scale chicken farmers in Nigeria's Enugu State about the usage of antibiotics. Eighty-eight poultry farmers were chosen using a multistage sampling procedure. The data

gathering process used the interview schedule. The study revealed that A little over 48% of respondents were knowledgeable about using antibiotics. All farmers precisely agreed that antibiotics can treat bacterial infections and that treated birds can quickly recover if treatment is started as soon as the bacterial infection is detected, and nearly 91% satisfactorily accepted that it is appropriate to follow directions when giving antibiotics. Regrettably, about 80, 81, 82, and 86% of respondents wrongfully agreed that it is legitimate to obtain an antibiotic prescription from another farmer, that it is good to dispense antibiotics before the appearance of disease symptoms, that it is appropriate to implement antibiotics without a veterinary prescription, and that it is proper to stop using antibiotics as soon as the wellness of the birds improves. Approximately 59% of respondents wrongly disagreed that performing culture and sensitivity tests prior to antibiotic treatment is appropriate.

Kemp *et al*. (2021), This study looked on the prevalent practices of veterinary antimicrobial users and prescribers linked with AMU and AMR, as well as how antimicrobial users in the veterinary industry received veterinary antimicrobials. In Busia county, western Kenya, 70 farmers, employees at 49 agricultural-veterinary antimicrobial shops, and 28 veterinary animal healthcare workers or veterinary surgeons (veterinary professionals) were all interviewed in 2016. Structured interviews were conducted using a standard questionnaire. The study revealed that a large portion of the farmers did not have any knowledge about AMR. Majority of the farmers had superficial knowledge about withdrawal period of antibiotics. In case of a treatment failure, most of the farmers were unware.

Siddiky *et al*. (2022), In this study using a pretested structured field study, a cross sectional research of 74 commercial poultry farms was carried out to evaluate the knowledge, attitudes, and behaviors of the poultry farmers regarding the use of antibiotics, antibiotic resistance, and maintenance of farm hygiene. According to the study, almost 85% of the 74 chicken producers were unaware of antimicrobials, compared to 86.49% of those who were aware of antibiotics. Almost all respondents were unaware of the distinctions between antibiotics and antimicrobials. Around 83% of respondents claimed they used antibiotics for treatment of diseases, and 89.19% agreed that antibiotics should be taken in accordance with a prescriber's instructions. Approximately 37.84% of respondents thought that antibiotics could be used to cure both bacterial and viral illnesses. Nearly 51.35% of those surveyed had heard of

antibiotic resistance, and 58.11% thought it was to blame for treatment failure. About 90% of people were unaware of the "Animal and Fish Feed Act, 2010," and 44.59% thought that all feeds sold in stores contained antibiotics. The training on the use of antibiotics in the chicken production cycle was attended by 13.51% of farmers, but no one was trained on antibiotic resistance. Almost 60.81 percent of respondents said all antibiotics may be used on both people and animals. About 71.62% of people thought that using more antibiotics would improve treatment outcomes. A whopping 86.49% of respondents believed that incorrect antibiotic use had an economic impact on farm management. Almost 71.62% of respondents believed that antibiotics might be used to stimulate growth, and 54.05 percent believed they could be used to prevent sickness. The withdrawal time should be maintained before selling or butchering chicken, according to about 66.22% of respondents. A whopping 62.16% of respondents said there was no connection between antibiotic use and tolerance.

Kalam *et al*. (2021), The current study was aimed to evaluate the knowledge, attitudes, and practices (KAPs) of community poultry drug and feed merchants regarding antibiotic use (AMU) and antibiotic resistance (AMR) in some chosen areas of Bangladesh. The majority of respondents—90% of drug merchants and 76% of feed dealers—said that antibiotics are transferred from poultry to humans. The drug sellers' response was more substantially reported ($p<0.05$). It was statistically significant that feed vendors (93% of all feed sellers) were more likely to concur that the entire flock needs antibiotic treatment when one bird becomes ill than medicine sellers (70% of all drug sellers). Antimicrobials have certain side effects, according to 100% of medicine merchants, and 89% of feed sellers also expressed this opinion. Antibiotics have similar curative effects on poultry, but a larger percentage of respondents (89% drug sellers and 82% feed sellers, respectively) were unaware of this, demonstrating correct knowledge. A sizable majority of respondents (53% of feed vendors and 30% of medicine merchants) provided inaccurate information when they stated that antibiotics can treat viral and bacterial diseases. Precisely 25% of the respondents of both drug and feed vendors, respectively, said that antibiotics could be used to treat all illnesses. Compared to medicine merchants (47% versus 20%), feed vendors were more likely to admit that they were unaware of AMR. Similar to the previous statement, they both significantly stated that they were unaware of antibiotic residue (47% and 30%, respectively). However, the majority of respondents (80% of

feed vendors and 90% of medicine sellers) are aware of the time period during which antibiotics must be discontinued.

2.2 Attitude

Hassan *et al.* (2021). The study revealed that most of the poultry farmers showed inappropriate attitude about antimicrobial use and antibiotic resistance. A significant portion of farmers showed improper attitude towards the actual purpose of using antibiotics is poultry farm, correct dosing of antibiotics, expiration of antibiotics and its disposal, potential substitutes to antimicrobials and future aspects of irrational use of antibiotics and antibiotic resistance. The study showed that poultry farmers from Chattogram region showed somewhat appropriate attitude towards AMU and AMR. Layer farmers showed somewhat appropriate attitude about antibiotics addition to feeds, random antimicrobial use, correct dosing and its consequence to AMR than broiler farmers. A majority of the respondents showed positive attitude towards rational use of antibiotics.

Schwendner *et al.* (2020), The study demonstrated that the majority of farmers believed that antibiotics should only be administered in urgent situations and in consultation with a veterinarian. The majority of farmers advised using antimicrobials as seldom as feasible, in part to reduce expenses. Most farmers believe that the veterinarian must inform the herdsmen of any potential udder health issues in the herd. The majority of farmers believed that AMR is a problem; however, they only somewhat agreed that the use of antimicrobials in Swiss dairy farms is excessive.

Chah *et al*. (2022), The study demonstrated that the vast bulk of responses (95,5%) erroneously concurred that antibiotic resistance happens when the bird develops an antibiotic resistance. About 96 percent of the respondents answered right, and 88.6 percent of them thought that resistance to antibiotics could resulted in a poor therapeutic outcome to antibiotic therapy. The respondents also correctly identified antibiotic resistance as a significant and serious medical condition (83%), and that resistance could result in higher mortality and healthcare costs (84.1%). Nonetheless, 51.1% of the farmers wrongly disagreed that antibiotic resistance is an issue globally, and 94.3% of the farmers disagreed with the necessity of performing culture and sensitivity testing whenever an infection is not responding to therapy.

Kemp *et al*. (2021), The study showed that the majority of farmers (78.6%) stated that they initially sought a veterinarian's opinion before buying antibiotics. Well over half of farmers (54.3%) never asked for particular antimicrobials without first talking to an agrovet employee or veterinary specialist. 12.9% of farmers bought antibiotic without consulting an agrovet or getting a prescription from a veterinary expert. A tiny percentage of farmers indicated said they have used previously prescription or bought antimicrobials. The primary concern of the farmers before buying an antibiotic was its cost.

Siddiky *et al*. (2022), This study stated that of all the poultry producers surveyed, 62.16% said it would be more serious if antibiotics failed to treat a human infection, while 48.65% said it would be extremely serious if they failed to treat an infection in livestock or poultry. About 66.22% of respondents said they strongly agreed that antibiotics may prevent illness in both humans and animals. Only 37.84% of respondents strongly agreed that using antibiotics as prescribed can reduce the likelihood of developing antibiotic resistance. About 50% of respondents strongly disputed that antibiotics are not required to promote growth, compared to 43.24% who strongly disagreed that antibiotics are not required to prevent sickness. A veterinarian or other animal health professional should be consulted before using antibiotics, according to about 56.76% of respondents. Only 44.59% of respondents strongly agreed that chicken should be sold without antibiotics before it is sold for human consumption. AMR negatively affected poultry productivity, according to 40.54% of respondents, while 36.49% agree with the statement that it negatively affected human health. A sizable portion of respondents (33.78%) and (52.70%) firmly agreed that antibiotics had a detrimental influence on the environment and the economy. The respondents claimed that vaccination (60.81%) and appropriate biosecurity (54.05%) could lower the need for antibiotics. A total of 72.97% of farmers expressed a strong interest in knowing more about antibiotics, and 87.84% agreed that doctors should be contacted before taking antibiotics.

Kalam *et al*. (2021), This study showed that the majority of respondents (85% of medication sellers and 73% of feed dealers) chose "no" in response to the statement "It is better to sell with a lower price when antibiotics are close to expire in order to prevent the wastage of antimicrobials." Drug merchants were more frequently named in this response than other respondents were (80% and 60%, respectively), despite the

fact that most respondents believed that antibiotics should be kept in a limited area. 45% of respondents believed that antimicrobials may be used in feed to prevent disease. When asked whether skipping a dose can result in AMR, medicine dealers dramatically outperformed feed sellers (90% vs. 56%, respectively). Similar to feed merchants, they were substantially more likely to believe that indiscriminate use of antimicrobials can result in AMR (80% versus 56%, respectively).

2.3 Practice

Hassan *et al.* (2021). This study demonstrated that almost one third of the poultry farmers did not practice accordingly regarding using antimicrobials in their farms. They did not seek prescription from the registered veterinarians and in case of diseases in the farms the used self-prescribed antibiotics for treatment. The study showed that most farmers did not check for expiry date of antimicrobials prior to use, used antibiotics as growth promoter and did not maintain withdrawal period in case of antibiotic use. The study also revealed that experienced farmers with higher educational background showed correct KAP regarding AMU and AMR. However, layer farmers had better practice regarding the use of antibiotic in the farm than broiler farmers had.

Schwendner *et al.* (2020), The study demonstrated that 18.3% of farmers requested an antibiotic susceptibility test in every incidence of mastitis, compared to 42.6% who allowed their veterinarian make the call, 22.9% who never did so, and 16.2% who occasionally did so. Study also showed that the majority of dairy producers said they did not keep any antimicrobials on their property.

Chah *et al.* (2022), This study showed that barely 17% of respondents used antibiotics properly on their farms, it was discovered. Almost 91% of those surveyed said they use antibiotics to increase the amount and grade of poultry products, and 86.4% said they stop using antibiotics as soon as disease symptoms abate. Other improper antibiotic use procedures listed by the farmers include giving antibiotics for every disease case (84.1%), keeping leftover drugs in case of future diseases (80.7%), and giving antibiotics in excess (75%). The majority of farmers, however, disapproved of improper practices such not paying attention to drug expiration dates (88.5%), purchasing antibiotics without a prescription (75%), and using antibiotics without contacting a veterinarian (67%). About 85% of the farmers acknowledged

that it is proper to administer antibiotics in accordance with the label's instructions, and 75% agreed that they should only buy these medications with a veterinarian's prescription.

Kemp *et al*. (2021), The study demonstrated that farmers who bought antibiotic from agrovet stores without a proper prescription revealed no limitations (in quantity or category). Farmers bought a total of 26 antibiotics from drugstores and the most common of them were Oxytetracycline and Penicillin-streptomycin. About 37 percent of farmers used antibiotics for prophylactic purpose and subsequently a similar percentage of farmers used antibiotics as growth promoter.

Siddiky *et al*. (2022), This study showed that farmers used non-government private veterinary experts in a total of 60.81% of cases, whereas just 13.51% of farmers used a government veterinary doctor. Approximately 87.84% of farmers used antibiotics for medical purposes, while 5.41% used them to avoid illness. Prior to dispensing antibiotics, antimicrobial susceptibility testing was not routinely performed. Approximately 87.84% of farmers followed the manufacturer's recommendations when using antibiotics. Only 4.05% of farmers purchased their antibiotics directly from a pharmaceutical company, whereas nearly 94.59% purchased them from drugstores or pharmacies. Before taking antibiotics, about 59.46% of farmers followed prescriptions, and 35.14 % got verbal counseling. A respectable percentage of farmers (13.51%) utilized prior prescriptions for antibiotics' therapeutic purposes in farm settings. Before purchasing antibiotics, almost 91.89% of farmers looked at the expiration date, and 13.51% had specific brand preferences. A little over 85.14% of farmers employed the prescribed doses of antibiotics, and 87.84% of them adhered to the suggested dosing schedule. The majority of farmers (90.54%) dumped leftover and expired antibiotics in public areas. The study also showed that 39.19% of the farm litter or manure was preserved in open pits, 33.78% was utilized in fish farms, and 13.51% was used for agricultural land, while 5.41% is a biogas plant. The dead birds were found to have been disposed of in a variety of ways, including burial (58.10%), field toss (9.5%), bush throw (6.75%), waste throw (9.45%), and water throw (13.51%). 91.89% of respondents said they regularly sprayed disinfectant on the farm's grounds to keep it clean. 94.95% of farmers had footbaths, while 63.51% had no current immunization program.

Kalam *et al*. (2021), This study revealed that a bit less than half of all respondents (45% of feed sellers and 50% of medicine sellers) told the poultry producers about the antimicrobial drug course. The majority of those surveyed (80% of feed vendors and 100% of medicine vendors) stated that they advise farmers to avoid eating chicken when they are receiving their final round of antibiotics, which was a prudent practice. Sixty eight percent of the respondents of the drug sellers and sixty percent of the feed sellers reported that they do not merely propose antibiotics to farmers at random. When compared to medication vendors, feed vendors were more likely to report that they continue to use antibiotics (71% vs. 58%, respectively). When the health of the poultry birds did not improve, they considerably reported increasing the antimicrobials' dose and frequency (58% and 25%, respectively), which was considered a "poor" practice. However, compared to feed dealers (79% vs. 48%, respectively), medicine vendors were significantly encouraged to continue antibiotic withdrawal periods. Most of the respondents (80% of medicine vendors and 71% of feed merchants) did not use antimicrobials as a growth booster, which was considered a "positive" practice. Nevertheless, 40% of medicine merchants and 82% of feed sellers offered antibiotics without a prescription from a licensed veterinarian. When compared to drug vendors, feed vendors substantially more frequently practiced this.

CHAPTER 3

MATERIALS AND METHOD

3.1 Study period and areas

This study was carried out in a total of 3 upazilas of Cumilla districts in Bangladesh, for six months between January 2021 and June 2021. The lowest administrative boundary of a district in Bangladesh is called an upazila, which is regarded as a subdistrict. The locations for the study were picked because there are more chicken farms there.

3.2 Study design and sampling

In order to identify the farmers in Bangladesh who are engaged in the production of chicken meat and eggs, a pre-structured questionnaire on KAP was used to obtain cross-sectoral insights. To learn more about farmers' knowledge, attitudes, and self-reported practices regarding AMU and AMR, interviews were conducted with them. According to the manufacturer's guidelines, sample size calculations employed a single proportion estimation with a 95% confidence interval, 5% margin of error, and an assumption that 50% ($p = 0.5$) of chicken farmers used antimicrobials in poultry production. 100 farmers in total, including 50 layer farmers and 50 broiler farmers from 1 (one) districts, were questioned for the current survey (Cumilla). Based on the random sample methodology, the study locations (districts and upazilas) and farmers (layer and broiler) were chosen. A list of farmers was obtained from the Upazila Livestock Office and used to make selection of farmers. The farmers were then randomly chosen and contacted to see if they were accessible and interested in taking part in the study. Face-to-face interviews were used by the enumerators to gather information from participants once they willingly agreed to take part in the study. People who were unwilling to provide written consent or who did not have enough time to participate in the study were not included in it.

3.3 Data instrument and collection

There were various sections in the questionnaire. Information from the demographic sections, including the farmers' ages (in years), years of farming experience, economic status, education level, primary occupation, kind of farm (broiler or layer

poultry production), farm size, and location, were taken into account. During the data collection, the size of the poultry farms was categorized as small (1000 birds), medium (1000 to 5000 birds), and large (>5000 birds). Questions pertaining to knowledge (eleven questions), attitudes (eight questions), and practices (eleven questions) were included in some parts. Each theme had elements that were both negative and positive. The questionnaire was initially created in English before being translated into Bengali. To verify the translation's accuracy, the Bengali version was translated back into English and put side by side with the original. A small group of poultry producers pretested the questionnaire before data collection to determine whether the language was appropriate. Based on the outcomes of the pretesting, certain adjustments were made to make sure the language was appropriate. Interviews that have been pretested were not included in the analysis.

3.4 Data management and analyses

A paper-based questionnaire was filled up using interview data, which was then cross-referenced. After that, the data was retrieved and sent to an MS Excel spreadsheet for additional processing, processing, and analysis. AMU and AMR-related knowledge, attitudes, and practices were the subjects of two kinds of closed-ended "yes" and "no" questions from which we gathered data. For knowledge, attitude, and practice items, responses were graded on a two-point scale (composite score range: 0 to 1), with "yes" receiving a score of 1, and "no" receiving a score of 0. The aggregate of each participant's responses for that specific portion was calculated in order to examine how each participant did generally in the knowledge, attitude, and practice areas. Frequencies and percentages were employed as descriptive statistics. The chi-square test was used to examine relationships between independent samples to see if there were any variations in the characteristics of respondents with regard to the themes. We found significant variables in the demographic characteristics and themes using the principal factor technique proposed. Results were categorized as "incorrect" vs. "correct," "unfavorable" vs. "favorable," and "bad" vs. "good" for knowledge, attitudes, and habits, respectively. Additionally, a p-value of 0.05 was used as the cutoff point for statistical significance.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

4.1.1 Demographic and socioeconomic characteristics of the respondents

A total of 100 interviews were done. Fifty of the total 100 responders were farmers who raised broilers or layers, respectively. One district (Cumilla) provided 100 farmers for recruitment. All of the respondents (n = 100) were male and majority of them were under the age of 30 years. The majority of respondents (n = 36) had between 11 and 15 years of farming experience, and 48 had only completed their secondary education. Most respondents (n = 94) reported that poultry farming was their main source of income. Majority of the respondents (n = 65) identified themselves as small-scale poultry farmers.

4.1.1.1 Farmers category according to type of farm

Table 1 show that Two types of farm owners were selected for this study on the basis of types of the farm namely broiler and layer farmers.

Table 1. Distribution of farmers according to farm type

Farm Type	**Poultry farmers**	
	Numbers	**%**
Broiler	50	50
Layer	50	50
Total	100	100

4.1.1.2 Farmers category according to size of farm

Table 2 shows that three types of farm owners were selected for this study on the basis of size of farms,

Table 2. Distribution of farmers according to farm size

Farm Size	Poultry farmers	
	Numbers	**%**
Small (<1000 birds)	65	65
Medium (1000 to 5000 birds)	25	25
Large (>5000 birds)	10	10
Total	100	100

4.1.1.3 Farmers category according to age of farmers

Table 3 shows that 4 types of farmers were selected for this study according to their age ranging from 20 to 60.

Table 3. Distribution of farmers according to farmers' age

Age of Farmers	Poultry farmers	
	Numbers	**%**
Below 30	37	37
31-40	33	33
41-50	18	18
Above 50	12	12
Total	100	100

4.1.1.4 Farmers category according to education level of farmers

Table 4 shows that 5 types of farmers were selected for this study according to their education level.

Table 4. Distribution of farmers according to farmers' education level

Education Level	Poultry farmers	
	Numbers	**%**
None	10	10

Table cont'd

Primary	22	22
Secondary	48	48
Higher Secondary	14	14
Honors and above	6	6
Total	100	100

4.1.1.5 Farmers category according to experience of farmers

Table 5 shows that 4 types of farmers were selected for this study according to their experience of farming ranging from 0 to 15 or above years.

Table 5. Distribution of farmers according to farmers' experience

Experience (years)	**Poultry farmers**	
	Numbers	**%**
0-5	19	19
6-10	31	31
11-15	36	36
Above 15	14	14
Total	100	100

4.1.1.6 Farmers category according to main occupation of farmers

Table 6 shows that 2 types of farmers were selected for this study according to their main occupation.

Table 6. Distribution of farmers according to main occupation of farmers

Main Occupation	**Poultry farmers**	
	Numbers	**%**
Poultry farming	94	94
Other than poultry farming	6	6
Total	100	100

4.1.2 Seeking advice by farmers

The poultry farmers searched for antimicrobials from several sources for illnesses and disease conditions farms (Figure 1 & 2). Most farmers (broiler and layer combined) (46%) relied on licensed veterinarians, which is a healthy practice. Compared to broiler farmers, layer farmers were more likely to request antimicrobials from a licensed veterinarian (50% vs. 42%, respectively). However, a sizable portion (54%) of all farmers looked for antimicrobials from places other than licensed veterinarians. According to a disaggregated analysis by type of farmer, broiler farmers were more inclined to buy antimicrobials from a feed vendor than layer farmers, who preferred to buy antimicrobials from medicine stores. In contrast to layer farmers, broiler farmers tended to look for antimicrobials on their own. A post-mortem inspection by a veterinarian was not performed, according to 39% of the broiler and layer farmers, in order to detect the infections, before selecting an appropriate antibiotic.

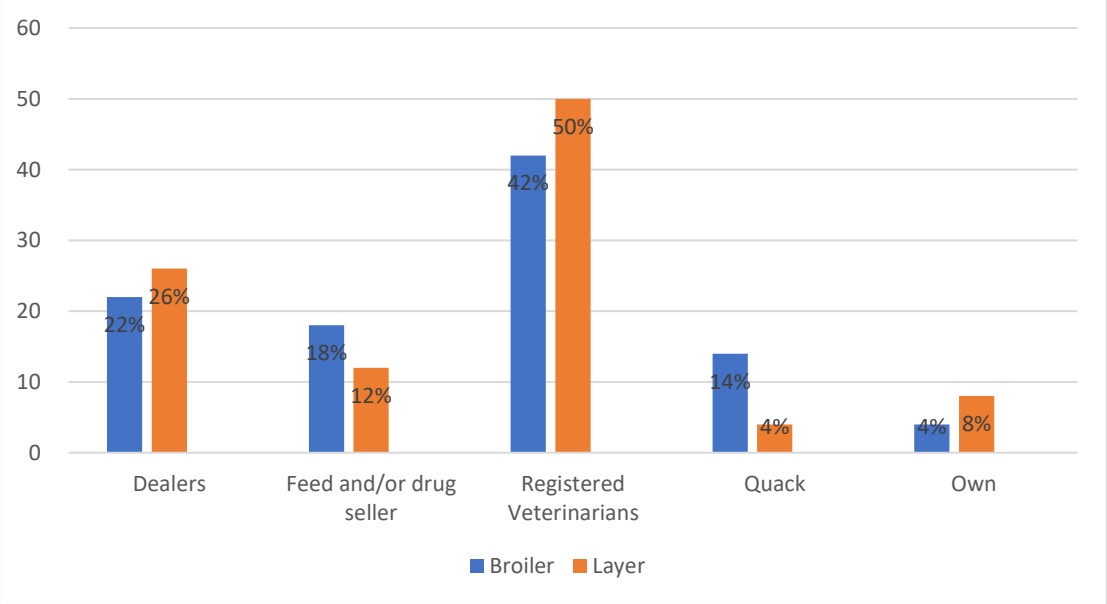

Figure 1. Seeking out antimicrobials by broiler and layer farmers.

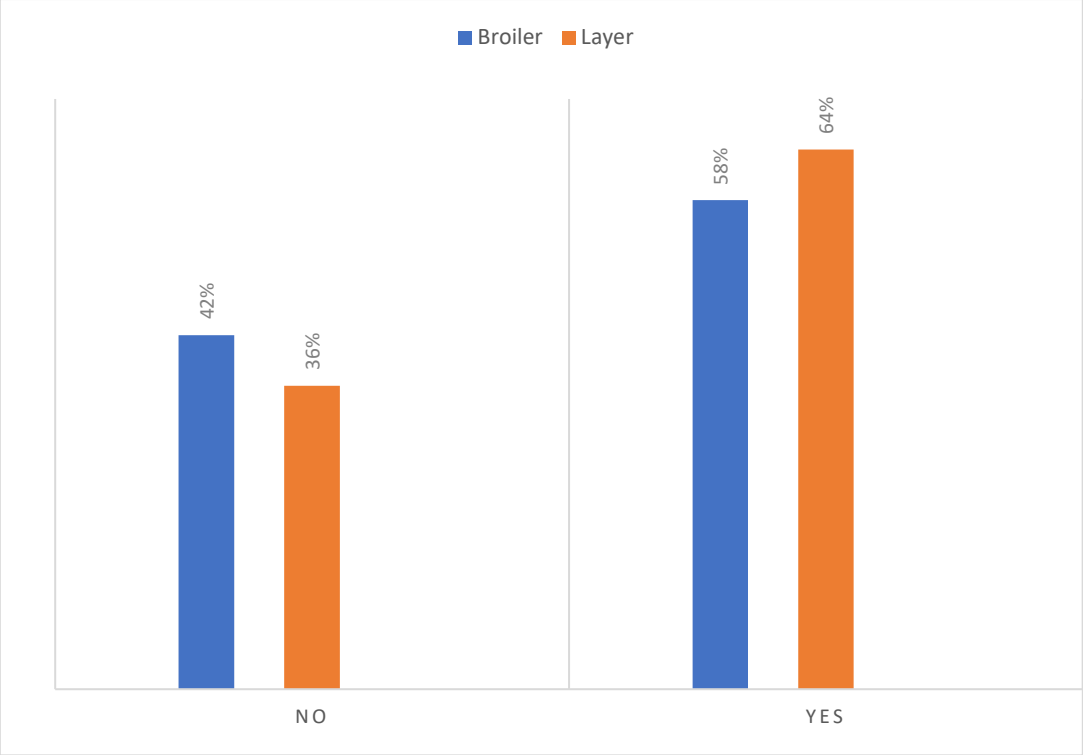

Figure 2. Performing post-mortem examination by veterinarians before antimicrobial use

4.1.3 Knowledge on AMU and AMR of broiler and layer farmers

A survey was conducted on the farmers' awareness of AMU and AMR with eleven questions, eight of which were positive and three of which were negative. Table 7 presents the outcomes. The majority of the farmers, according to their self-reported responses (n = 84), were aware of the right to prescribe antibiotics. However, when looking at the item-based questions, layer farmers outperformed broiler farmers in terms of the percentage of desirable responses and significance level (as determined by the chi-square test).

Table 7. Knowledge of AMU and AMR of broiler and layer farmers

Items with expected response	Total (N=100)	Broiler farmers N=50 (%)	Layer farmers N=50 (%)	p-Value
Knowledge about prescription using person (Positive)	84 (84%)	43 (86%)	41 (82%)	0.585
Idea about antimicrobials (Positive)	92 (92%)	44 (88%)	48 (96%)	0.269
Idea about antimicrobial residues? (Yes)	63 (63%)	27 (54%)	36 (72%)	0.062
Knowledge about antimicrobial resistance (Positive)	56 (56%)	23 (46%)	33 (66%)	0.044*
Concern about herbal drugs (Positive)	64 (64%)	26 (52%)	38 (76%)	0.012*
Specific Antimicrobials act against specific disease (Positive)	84 (84%)	39 (78%)	45 (90%)	0.101
Idea about antimicrobials passing to humans (Positive)	80 (80%)	38 (76%)	42 (84%)	0.317
Use of antimicrobials against Disease (Negative)	71 (71%)	31 (62%)	40 (80%)	0.047*
Efficiency of antimicrobials against infection (Negative)	57 (57%)	23 (46%)	34 (68%)	0.026*
Knowledge about side effects of antimicrobials (Positive)	95 (95%)	46 (92%)	49 (98%)	0.362
Curative effect of all antimicrobials in poultry diseases (Negative)	78 (78%)	42 (84%)	36 (72%)	0.147

[*significant at 5% i.e. $p \leq 0.05$]

Farmers' familiarity with words like "antimicrobials", "antimicrobial resistance", and "antimicrobial residue" were also inquired about. Antimicrobials were understood by the vast majority of respondents (92%) according to the analysis, which also revealed that layer farmers were more knowledgeable about antimicrobials than broiler farmers were (96% versus 88%, respectively; $p = 0.269$). The percentage of accurate answers was 56% for antimicrobial resistance and 63% for antimicrobial residues, respectively. In both situations, layer farmers' responses were found to be significantly more favorable than broiler farmers'.

When asked, "specific antimicrobials act against a specific disease", 84% of the total respondents responded "Yes", demonstrating a fair level of knowledge. However, this statement made a prominent reference of the broiler growers. A good understanding of how AMR is transmitted from animals to humans was demonstrated by the majority of farmers (80% of all farmers) who stated that "antimicrobials can be conveyed to humans through eating of poultry meat and egg."

Idea about antimicrobials have any negative effects was a question that was correctly answered by the vast majority of farmers (95%) and received considerably more "Yes" responses from layer farmers than from broiler farmers (98% and 92%, respectively; $p = 0.362$). When asked, "Idea about herbal medicines" the majority of farmers (64%) said "Yes," and roughly uneven numbers of broiler and layer farmers (52 and 76, respectively), expressed this response.

Overall, the respondents' desirable reactions to the unfavorable things were quite good. In particular, 71% and 57% of farmers overall respectively responded "No" to the questions "use of antimicrobials against disease" and "efficiency of antimicrobials against infection". Nearly 78% of farmers also responded "No." when asked " Curative effect of all antimicrobials in poultry disease".

4.1.4 Attitudes on AMU and AMR of broiler and layer farmers

On broiler and layer farms, farmers' attitudes about AMU and AMR were surveyed with eight questions in total of which five were positive and three were negative. Overall, the ideal response patterns to the attitude questions indicated a similar trend to the knowledge response patterns (as stated in the section above), namely that layer farmers provided more accurate answers than broiler farmers (Table 8).

Table 8. Attitudes towards AMU and AMR in broiler and layer farmers.

Items with expected response	Total (N=100)	Broiler farmers N=50 (%)	Layer farmers N=50 (%)	p-Value
Random use of antimicrobials (Positive)	62 (62%)	30 (60%)	32 (64%)	0.680
Belief about missing a dose to antibiotic resistance (Positive)	61 (61%)	32 (64%)	29 (58%)	0.538
Administration of antimicrobials causing more damage than benefits (Positive)	56 (56%)	26 (52%)	30 (60%)	0.420
Adding antimicrobials to poultry feed to prevent birds sickness (Negative)	62 (62%)	28 (56%)	34 (68%)	0.216
Importance of accurate dose of antimicrobials (Positive)	88 (88%)	41 (82%)	47 (94%)	0.121
Whether antimicrobials should be placed in restricted area and accessed only by specific staff (Negative)	24 (24%)	10 (20%)	14 (28%)	0.349
Benefit of medication to prolong the storage of feed (Negative)	90 (90%)	46 (92%)	44 (88%)	0.741
Attitude on minimizing use of antimicrobial in future recovery of bird (Positive)	80 (80%)	37 (74%)	43 (86%)	0.134

When asked "adding antimicrobials to poultry feed to prevent bird sickness" the majority of farmers (62% of all respondents) gave the appropriate answer, "No." Farmers who raise layers substantially more often responded in this way. The

majority of farmers (n = 100) (62% & 61%) thought that "Random use of antimicrobials" and "Missing a dose of antimicrobials" may both contribute to the emergence of AMR. The minority of farmers, or 24% of all respondents, expressed the preferred response "No," indicating that they thought antimicrobials should be kept in a secure location and only be accessed by farmers or a specific person. A little over half of the respondents (56%) indicated "Yes" when asked restriction of antimicrobials causing more damage than benefits, which is a reasonable response. 88 percent of respondents agreed that limiting improper antimicrobial use in the chicken industry required precise antimicrobial dosages. When compared to broiler farmers, layer farmers had a considerably stronger reaction. When asked "Benefits of medication to the birds to prevent wastage" the clear majority of respondents responded "No," demonstrating a favorable attitude. Farmers raising broilers were much more likely to respond in this way than farmers raising layers. The overwhelming majority of farmers (80%) believed that correct knowledge about arbitrary applications might result in a future reduction in the usage of antibiotics. When compared to broiler farmers, layer farmers also responded more favorably.

4.1.5 Practices towards AMU and AMR in broiler and layer farmers

In order to evaluate farmers' AMU and AMR practices, 11 questions were asked, three good and eight negative (Table 9). Both groups shared some procedures that were deemed to be at risk for AMR. Both layer and broiler farmers reported similar rates of self-medication. A notable percentage (31%) of the farmers who responded said they had used antimicrobials alone, and it was discovered that this response was higher in layer farmers than broiler farmers were (20% vs. 42%, $p = 0.017$). Only 18% of all farmers indicated that they did not use antimicrobials while their animals were brooding, indicating that the vast majority of farmers engaged in this practice improperly. Only 20% of the farmers responded "No" when asked if they approached non-vets for advice on how to use antibiotics, indicating that this was the bulk of their practice. When compared to broiler farmers, layer farmers were much more likely to engage in this activity. On the other hand, the majority of farmers (94%) made sure to check the expiration date before buying antimicrobials, which is a good habit. Farmers who raise layers were found to engage in this approach more frequently than farmers who raise broilers (98% vs. 90%, respectively; $p = 0.204$). When asked "Do you utilize antimicrobials as a growth promoter?" more than half of the farmers (57%)

said "No," indicating that a sizable fraction of the farmers engaged in the misuse of antimicrobials.

Table 9. Practice in AMU and AMR in broiler and layer farmers.

Items	Total (N=100)	Broiler farmers N=50 (%)	Layer farmers N=50 (%)	p-Value
Practice about antimicrobials at own choice (Negative)	31 (31%)	10 (20%)	21 (42%)	0.017*
Exercise of using antimicrobials during brooding period (Negative)	18 (18%)	7 (14%)	11 (22%)	0.298
Checking expired date before purchasing drugs (Positive)	94 (94%)	45 (90%)	49 (98%)	0.204
Antimicrobial as a growth promoter (Negative)	57 (57%)	21 (42%)	36 (72%)	0.002*
Taking non-vet suggestions of antimicrobials using (Negative)	20 (20%)	12 (24%)	8 (16%)	0.317
Seeking advice from a vet about withdrawal period (Positive)	48 (48%)	16 (32%)	32 (64%)	0.001
Maintaining antimicrobial withdrawal period (Positive)	55 (55%)	26 (52%)	29 (58%)	0.546
Practice of increasing the dose and frequency of antimicrobials upon no signs of recovery (Negative)	55 (55%)	23 (46%)	32 (64%)	0.070
Concern of halting dose application when the birds feel better (Negative)	66 (66%)	28 (56%)	38 (76%)	0.035*
Practice of eating poultry meat after antimicrobial treatment (Negative)	81 (81%)	41 (82%)	40 (80%)	0.799

Table cont'd

Using different antimicrobials during the course of a disease (Negative)	70 (70%)	32 (64%)	38 (76%)	0.190

[*significant at 5% i.e. p≤0.05]

Less than 50% of all respondents said they had asked veterinarians for guidance about the withdrawal time, and layer farmers were significantly more likely to have said this. When asked "Practice of increasing antimicrobials dose & frequency upon no signs of recovery," broiler and layer farmers overwhelmingly responded "No." (46% and 64%, respectively), which is a respectable standard. Similar to this, a larger percentage of farmers (70 percent of all farmers) chose "No" in response to the question "utilizing various antimicrobials during the course of a disease" This choice reflected a suitable practice. This response was found to be more common among layer farmers than broiler farmers (76 % and 64 %, respectively; p = 0.190). Same as the two negative statements above, the majority of the farmers said "No" when asked, "Practice of eating the meat of birds that are given antimicrobials at the end state", which depicted an excellent practice. This response was found almost equally among the broiler and layer farmers.

4.2 Discussion

Antimicrobial usage (AMU) and antimicrobial resistance (AMR) have grown in importance over the past 20 years, endangering both human and animal health. AMR is linked to a variety of issues, including improper and illogical antibiotic use, unfinished medication regimens, and ignorance about proper antimicrobial usage. Farmers, who are regarded as end users, must take action in order to reduce AMR in the public health and animal health sectors. The knowledge, attitude, and practices (KAP) of layer and broiler poultry farmers about AMU and AMR were evaluated in the current study. This study showed that the KAP toward AMU and AMR was influenced by the respondents' age, years of farming experience, degree of education, socioeconomic status, and farm type and size. The findings of the current analysis

offer baseline data on the KAP of the low-income poultry farmers and provide guidance for creating interventions and county policies.

Antimicrobials are most frequently provided to farmers through feed, medicine, and antibiotic suppliers. They frequently collaborate closely with medication company representatives to meet their sales goals, which may have an additional impact on farmer behavior. Additionally, poultry dealers' credit is the main source of funding for small-scale poultry farmers. As a result, farmers are forced to use antibiotics, whether they want to or not, as advised by the suppliers. Farmers are the final users of antimicrobials, thus if feed merchants and medication sellers have knowledge gaps in AMU and AMR, such gaps will eventually show in their behaviors. The present research has also supported this. This study discovered that farmers' lower levels of education, knowledge of antimicrobial facts, and exposure to relevant medication training and awareness programs than other stakeholders (such as feed and drug vendors) may help to explain the issue. In this inquiry, it was also discovered that a significant number of poultry farmers did not ask licensed veterinarians for antimicrobials, not even for post-mortem examinations of their animals (Siddiky *et al.* 2022)

They either relied on ideas from outside sources (such feed and drug dealers) or came up with their own methods, which included adjusting dosages and duration, switching to antibiotics frequently if the symptoms persisted, and performing post-mortem inspections. Not knowing much about the services or avoiding the costs associated with veterinary care may be two reasons why people do not seek out qualified veterinarians. Farmers may face a variety of difficulties as a result of not requesting prescriptions from licensed veterinarians. These include farms' rural locations, the difficulty of accessing veterinary care, including laboratory tests to confirm infections, the provision of unskilled services by feed and medication vendors, or the sharing of knowledge and experiences by nearby farmers. Another factor would be that farmers in many nations, including Bangladesh, can easily get antibiotics without a prescription. Farmers most frequently purchased antimicrobials via feed and chick sellers, veterinary medical supply companies, and even some farmers who sold their own antibiotics, according to research. One of the primary causes of the frequent overuse of antimicrobials on poultry farms is thought to be a lack of awareness about on-farm management, particularly biosecurity measures. Additionally, farmers use

antibiotics to make up for poor farm conditions, to avoid frequently recurring chicken diseases, and as a growth promoter to boost production, which leads to the development of AMR. It has been extensively explored the knowledge gap in AMR development coming from the poultry sectors in resource-constrained environments. A recent study showed that the KAP considerably changed depending on various demographic parameters, including age, years of farming experience, degree of education, disease dynamics of the farm, and information source. The present study's results agreed with those from past studies (Hassan *et al.* 2021). The key factors that affect farmers' KAP in the choice and use of antibiotics in the poultry sector are their age, years of farming experience, economic status, degree of education, farm type, and size, in particular. This study also showed that layer farmers with medium-sized farms had better awareness of and attitudes concerning AMU and AMR than their colleagues with smaller farms. Farmers must invest more money to reap greater rewards because layer farming takes longer to attain its production level. Contrarily, raising broilers requires less time and money, and farmers see a quick return on their investment in terms of profits. Therefore, compared to broiler farming, layer farming is preferred by experienced farmers with a high degree of knowledge.

It was also noticed that high-income and larger farm-sized groups are further linked to strong AMU and AMR practices. As observed in other parts of the current study, this is also connected to layer farming, which calls for a higher degree of investment, expertise, and knowledge, i.e. education. This finding was supported by previous findings of (Hassan *et al.* 2021).

The current study found a link between respondents' lack of awareness, unsuitable attitudes, and poor behavior with reference to the AMU and AMR concerns. Similar to prior research of the KAP of AMR, we found that farmers' attitudes and practices toward AMU and AMR were influenced by their level of knowledge. Age, education, prior agricultural experience, and economic standing of the farmers may all be indicators of a lesser level of expertise. In general, a lack of training in poultry farming and insufficient communication with animal care staff were to blame for farmers' lower level of knowledge (Moffo *et al.* 2020). In the current study, it was found that one-third of the farmers relied on other stakeholders or themselves when using antimicrobials rather than obtaining a prescription from licensed veterinarians. A portion of the farmers chose not to have the birds' post-mortem investigations to

confirm the infections. The abuse of antibiotics and the emergence of AMR on farms may result from a lack of understanding and communication between farmers and veterinarians. Additionally, the effective implementation of laws and their rigorous limitations on drug use, sale, and prescription writing may further minimize antibiotic resistance and antimicrobial abuse (Clifford *et al.* 2018; Ouedraogo *et al.* 2017). As veterinarians are better equipped to influence farmers' behavioral changes, increased support from veterinarians and veterinary services may further enhance the use of antibiotics and prevent AMR. To prevent the spread of infections within farms or their infiltration, they are enhancing biosecurity measures.

This study had a number of drawbacks. First, consider the sample population's geographic representation. Out of the 64 districts in Bangladesh, samples from one district were used in the study. The results of the present study might not be representative of everything. Second, recollection bias and participant self-reporting procedures may have impacted the validity of some of the interview-based findings. Finally, while the study evaluated participants' knowledge, attitudes, and practices related to AMU and AMR, more thorough qualitative research is required to comprehend cultural, social, and historical elements and identify the variables influencing KAP disparities. Therefore, using the results of this study as a base, a qualitative investigation might be carried out (Harbarth *et al.,* 2015)

Antimicrobial resistance (AMR) in humans is inter-linked with AMR in other populations, especially farm animals, and in the wider environment. The relatively few bacterial species that cause disease in humans, and are the targets of antibiotic treatment, constitute a tiny subset of the overall diversity of bacteria that includes the gut microbiota and vast numbers in the soil. However, resistance can pass between these different populations; and homologous resistance genes have been found in pathogens, normal flora and soil bacteria. Farm animals are an important component of this complex system: they are exposed to enormous quantities of antibiotics (despite attempts at reduction) and act as another reservoir of resistance genes. Whole genome sequencing is revealing and beginning to quantify the two-way traffic of AMR bacteria between the farm and the clinic. Surveillance of bacterial disease, drug usage and resistance in livestock is still relatively poor, though improving, but achieving better antimicrobial stewardship on the farm is challenging: antibiotics are an integral part of industrial agriculture and there are very few alternatives. Human

production and use of antibiotics either on the farm or in the clinic is but a recent addition to the natural and ancient process of antibiotic production and resistance evolution that occurs on a global scale in the soil. Viewed in this way, AMR is somewhat analogous to climate change, and that suggests that an intergovernmental panel, akin to the Intergovernmental Panel on Climate Change, could be an appropriate vehicle to actively address the problem (Mark Woolhouse *et al.* 2015)

Antimicrobial resistance (AMR) is one of the most important global health crises in recent times and is driven primarily by antimicrobial consumption. In East Africa, there is a paucity of data regarding the knowledge, attitudes, and practices (KAP) related to antimicrobial use (AMU). The study was performed among 70 farmers, staff at 49 agricultural-veterinary antimicrobial shops (agrovet staff) and 28 veterinary animal healthcare workers or veterinary surgeons (veterinary professionals) were interviewed in Busia county, western Kenya in 2016 using a standard questionnaire as a framework for structured interviews. The finding of the study was the majority of antimicrobials were accessed through informal means, purchased from agroveterinary shops; more than half of staff did not hold nationally mandated qualifications to advise on or sell veterinary antimicrobials. Approximately 40% of veterinary antimicrobials were sold without a prescription and it was noted that both price and customer preference were important factors when selling antimicrobials in almost all agrovet shops. Knowledge of the dangers associated with AMR and AMU were mostly superficial. Treatment failure occurred often, and there was a lack of differentiation between AMR and simply treatment failure. (Steven A. Kemp *et al.* 2021). The Antimicrobial resistance is increasing day by day due to farmer's unconsciousness the majority of the farmers used these agents based on self-prescription. Thus, the use of antibiotics in poultry farming is a common practice and almost (70%) of the farms sampled often or always used antibiotics belonging to the tetracyclines (particularly oxytetracycline and chlortetracycline), macrolides (tylosin and erythromycin), aminoglycosides (gentamicin and neomycin) and penicillins (ampicillin) (J.M. Chah *et al.* 2022). The poultry farming is considered one of the hotspots for the use of antimicrobials. The knowledge, attitude and practices of poultry farmers are closely associated with the prudent use of antimicrobials in poultry farm practices (Shariful *et al.* 2022).

CHAPTER 5

SUMMARY AND CONCLUSION

Antimicrobial use and its resistance is currently a provocative question all around the globe. WHO has declared AMR as the next pandemic due to which about 50 million people will die by 2050 if no immediate measures are taken by authorities.

The present research on the knowledge, attitudes, and practices of poultry farmers about AMU and AMR provides crucial data for enhancing the use of antibiotics in poultry farms .Findings showed that socioeconomic demographics of the respondents, like education, Age and main occupation have a significant impact on AMU's knowledge, attitudes, and practices. AMR, too.

The findings indicated that one of the major causes of increasing AMR is overuse. Of antibiotics connected to the antimicrobial knowledge gap. Producers with greater attitudes are more favorable at higher educational levels. Additionally, a bigger percentage of poultry farmers did not ask registered veterinarians for a recommended antibiotic, not even for post-mortem exams of their animals, which is poor hygiene. Most of the poultry farmers showed proper attitude towards antibiotic use. However, knowledge and practices regarding AMU was poor in poultry farmers of the study area. The result showed that layer farmers had somewhat better understanding about antimicrobials and showed knowledge that is more acceptable and practice that is more appreciable regarding the use of antibiotics than the broiler farmers, still the standards were not up to the mark.

The results provided baseline evidence about the KAP of poultry farms for the current inquiry. Provided ideas towards creating interventions and strategies using low-income resources. For Bangladesh's use of antibiotics. Particularly, the study fervently advises including farmers as antimicrobial end users in AMR prevention initiatives. Hence, the inclusion of initiatives to promote knowledge and awareness, positive AMU should adopt more positive behaviors and attitudes.

Further study regarding the knowledge, attitude and practices of farmers and other stakeholders associated with poultry business around the country will help to get a clearer picture of current national status of KAP regarding antibiotics. Similar studies

should be conducted in dairy sector as well. With the help of these findings, Department of Livestock Services (DLS) should be able to take necessary steps to increase the awareness in the farmer level to rational use of antibiotics with the aid of other concerned institutions such as FAO, OIE, and WHO etc. Information from dairy farmers will along with the poultry farmers will help in contributing in formation of a blueprint to curve the pathway of combating AMR in the future.

CHAPTER 6

REFERENCES

Afakye, K., Kiambi, S., Koka, E., Kabali, E., Dorado-Garcia A., Amoah, A., Kimani, T., Adjei, B. and Caudell, M. A. (2020). The impacts of animal health service providers on antimicrobial use attitudes and practices: An examination of poultry layer farmers in Ghana and Kenya. *Antibiotics*. **9**:554.

Ahaduzzaman, M., Hassan, M. M., Alam, M., Islam, S. and Uddin, I. (2014). Antimicrobial resistance pattern against Staphylococcus aureus in environmental effluents. *Res. J. Vet. Pract*. **2**: 13–16.

Alhaji, N., Haruna, A., Muhammad, B., Lawan, M. and Isola, T. (2018). Antimicrobials usage assessments in commercial poultry and local birds in North-central Nigeria: Associated pathways and factors for resistance emergence and spread. *Prev. Vet. Med.* 154:139–14.

Begum, I., Buysse, J., Alam, M. J. and Van Huylenbroeck, G. (2010). Technical, allocative and economic efficiency of commercial poultry farms in Bangladesh. *World's Poult. Sci. J*. **66:** 465–476.

Boamah, V., Agyare, C., Odoi, H., Dalsgaard, A. (2016). Practices and factors influencing the use of antibiotics in selected poultry farms in Ghana. *J. Antimicrob. Agents*. **2**: 120.

Chah, J. M., Nwankwo, S. C., Uddin, I. O. and Chah, K. F. (2022). Knowledge and practices regarding antibiotic use among small-scale poultry farmers in Enugu State, Nigeria. *Heliyon.* **8**: e09342.

Chauhan, A. S., George, M. S., Chatterjee, P., Lindahl, J., Grace, D., Kakkar, M. (2018). The social biography of antibiotic use in smallholder dairy farms in India. *Antimicrob. Resist. Infect. Control.* **7:** 1–13.

Chowdhury, S., Hassan, M. M., Alam, M., Sattar, S., Bari, M. S., Saifuddin, A., Hoque, M. A. (2015). Antibiotic residues in milk and eggs of commercial and local farms at Chittagong, Bangladesh. *Vet. World*. **8:** 467.

Clifford, K., Desai, D., da Costa, C. P., Meyer, H., Klohe, K., Winkler, A. S., Rahman, T., Islam, T., Zaman, M. H. (2018). Antimicrobial resistance in livestock and poor quality veterinary medicines. Bull. *World Health Organ*. **96:** 662.

Gajdács, M., Paulik, E., Szabó, A. (2020). Knowledge, attitude and practice of community pharmacists regarding antibiotic use and infectious diseases: A cross-sectional survey in Hungary (KAPPhA-HU). *Antibiotics*. **9:** 41.

Hamid, M., Rahman, M., Ahmed, S., Hossain, K. (2017). Status of poultry industry in Bangladesh and the role of private sector for its development. *Asian J. Poult. Sci*. **11**: 1–13.

Harbarth, S., Balkhy, H. H., Goossens, H., Jarlier, V., Kluytmans, J., Laxminarayan, R., Saam, M., Van Belkum, A., Pittet, D. and for the World Healthcare-Associated Infections Resistance Forum participants. (2015). Antimicrobial resistance: one world, one fight!. *Antimicrobial Resistance and Infection Control.* **4**: 49.

Hassan, M. M., Kalam, M. A., Alim, M. A., Shano, S., Nayem, M. R. K., Badsha, M. R., Mamun, M. A. A., Hoque, A., Tanzin, A. Z., Nath, C., Khanom, H., Khan, S. A., Islam, M. M., Uddin, M. B. and Islam, A. (2021). Knowledge, attitude, and practices on antimicrobial use and antimicrobial resistance among commercial poultry farmers in Bangladesh. *Antibiotics*. **10**: 784.

Hedman, H. D., Vasco, K. A., Zhang, L. (2020). A review of antimicrobial resistance in poultry farming within low-resource settings. Animal. **10:** 1264.

Islam, A., Saifuddin, A., Al Faruq, A., Islam, S., Shano, S., Alam, M., Hassan, M. M. (2016). Antimicrobial residues in tissues and eggs of laying hens at Chittagong, Bangladesh. *Int. J. One Health*. **2:** 75–80.

Landfried, K. L., Barnidge, K. E., Pithua, P., Lewis, D. R., Jacoby, A. J., King, C.& Baskin, R. C. (2018). Antibiotic Use on Goat Farms: An investigation of knowledge, attitudes, and behaviors of missouri goat farmers. *Animals*. **8:** 198.

Kalam, M., Alim, M., Shano, S., Nayem, M., Khan, R., Badsha, M., Mamun, M., Al, A., Hoque, A. & Tanzin, A. Z. (2021). Knowledge, attitude, and practices on

antimicrobial use and antimicrobial resistance among poultry drug and feed sellers in bangladesh. *Vet. Sci.* **8:** 111.

Kalam, M. A., Alim, M. A., Shano, S., Nayem, M. R. K., Badsha, M. R., Mamun, M. A. A., Hoque, A., Tanzin, A. Z., Khan, S. A., Islam, A., Islam, M. M. and Hassan, M. M. (2021). Knowledge, Attitude, and Practices on Antimicrobial Use and Antimicrobial Resistance among Poultry Drug and Feed Sellers in Bangladesh. *Vet. Sci.* **8**: 111.

Kemp, S. A., Pinchbeck, G. L., Fevre, E. M. and Williams, N. J. (2021). A Cross-Sectional Survey of the Knowledge, Attitudes, and Practices of Antimicrobial Users and Providers in an Area of High-Density Livestock-Human Population in Western Kenya. *Front. Vet. Sci.* **8**: 727365.

Khan, M., Ferdous, J., Ferdous, M., Islam, M., Rafiq, K., Rima, U. (2018). Study on indiscriminate use of antibiotics in poultry feed and residues in broilers of Mymensingh city in Bangladesh. *Prog. Agric.* **29:** 345–352.

Khan, S. A., Imtiaz, M. A., Sayeed, M. A., Shaikat, A. H., Hassan, M. M.(2020). Antimicrobial resistance pattern in domestic animal-wildlife environmental niche via the food chain to humans with a Bangladesh perspective; a systematic review. *BMC Vet. Res.* **16:** 1–13.

Kramer, T., Jansen, L. E., Lipman, L. J., Smit, L. A., Heederik, D. J., Dorado-García, A. (2017). Farmers' knowledge and expectations of antimicrobial use and resistance are strongly related to usage in Dutch livestock sectors. *Prev. Vet. Med.* **147**: 142–148.

Mahmud, T., Hassan, M. M., Alam, M., Khan, M. M., Bari, M. S., Islam, A. (2016). Prevalence and multidrug-resistant pattern of Salmonella from the eggs and egg-storing trays of retail markets of Bangladesh. *Int. J. One Health.* **2:** 7–11.

McNulty, C. A., Cookson, B. D., Lewis, M. A. (2012). Education of healthcare professionals and the public. *J. Antimicrob. Chemother*. **67:** i11–i18.

Ministry of Health and Family Welfare. National Action Plan. (2017). Antimicrobial Resistance Containment in Bangladesh 2017–2022; Directorate General of Health Services: Dhaka, Bangladesh, **pp:** 1–12.

Moffo, F., Mouiche, M. M. M., Kochivi, F. L., Dongmo, J. B., Djomgang, H. K., Tombe, P., Mbah, C. K., Mapiefou, N. P., Mingoas, J. P. K. and Awah-Ndukum, J. (2020). Knowledge, attitudes, practices and risk perception of rural poultry farmers in Cameroon to antimicrobial use and resistance. *Prev. Vet. Med.* 182: 105087.

Nepal, A., Hendrie, D., Robinson, S., Selvey, L. A. (2019). Knowledge, attitudes and practices relating to antibiotic use among community members of the Rupandehi District in Nepal. *BMC Public Health*. **19:** 1–12.

Okeke, I. N., Laxminarayan, R., Bhutta, Z. A., Duse, A. G., Jenkins, P., O'Brien, T. F., Pablos-Mendez, A., Klugman, K. P. (2005). Antimicrobial resistance in developing countries. Part I: Recent trends and current status. *Lancet Infect. Dis.* **5:** 481–493.

Ouedraogo A., Pierre H.J., Bañuls A., Ouédraogo R. and Godreuil S. (2017). Emergence and spread of antibiotic resistance in West Africa: Contributing factors and threat assessment. *Med. Sante Trop.* **27**: 147–154.

Ouedraogo, A., Pierre, H. J., Bañuls, A., Ouédraogo, R., Godreuil, S. (2017). Emergence and spread of antibiotic resistance in West Africa: Contributing factors and threat assessment. *Med. Sante Trop*. **27:**147–154.

Ozturk, Y., Celik, S., Sahin, E., Acik, M. N., Cetinkaya, B. (2019). Assessment of farmers' knowledge, attitudes and practices on antibiotics and antimicrobial resistance. *Animals.* **9:** 653.

Reyher, K. K., Barrett, D. C., Tisdall, D. A. (2017). Achieving responsible antimicrobial use: Communicating with farmers. *Practice*.**39:** 63–71.

Sarwar, M. R., Saqib, A., Iftikhar, S., Sadiq, T. (2018). Knowledge of community pharmacists about antibiotics, and their perceptions and practices regarding antimicrobial stewardship: A cross-sectional study in Punjab, Pakistan. *Infect. Drug Resist*. 11: 133.

Schwendner, A. A., Lam, T. J. G. M., Bodmer, M., Cousin, M. E., Regula, G. S. and Borne, B. H. P. V. D. (2020). Knowledge, attitude and practices of Swiss dairy farmers towards intramammary antimicrobial use and antimicrobial resistance: A latent class analysis. *Preventive Veterinary Medicine.* **179**: 105023.

Shahana, A., Tridip, D., Zohorul, I. M., Herrero-Fresno, A., Biswas, P. K., Olsen, J. E. (2020). High prevalence of mcr-1-encoded colistin resistance in commensal Escherichia coli from broiler chicken in Bangladesh. *Sci. Rep*. **10:** 1–13.

Siddiky, N. A., Islam, S., Sarker, M. S., Begum, R. and Samad, M. A. (2022). Knowledge, Attitude and Practices of Poultry Farmers on Antimicrobial Use, Resistance and Farm Hygiene Management in Bangladesh. *Antibiotics*. **10**(7): 784.

Uddin, M., Ahmed, S., Hassan, M., Khan, S. (2010) Mamun, M. Prevalence of poultry diseases at Narsingdi, *Bangladesh. Int. J. Biol. Res*. **1**: 9–13.

Wang, Y., Guo, F., Wei, J., Zhang, Y., Liu, Z., Huang, Y. (2020). Knowledge, attitudes and practices in relation to antimicrobial resistance amongst Chinese public health undergraduates. *J. Glob. Antimicrob. Resist*. **23:** 9–15.

Waseem, H., Ali, J., Sarwar, F., Khan, A., Rehman, H. S. U., Choudri, M., Arif, N., Subhan, M., Saleem, A. R. (2019). Jamal, A. Assessment of knowledge and attitude trends towards antimicrobial resistance (AMR) among the community members, pharmacists/pharmacy owners and physicians in district Sialkot, Pakistan. Antimicrob. *Resist. Infect. Control*. **8:** 1–7.

You, J., Yau, B., Choi, K., Chau, C., Huang, Q., Lee, S. (2008). Public knowledge, attitudes and behavior on antibiotic use: A telephone survey in Hong Kong. Infection **36:** 153–157.

APPENDIX I

Department of Poultry Science
Faculty of Animal Science and Veterinary Medicine
Sher-e-Bangla Agricultural University, Dhaka-1207.

For research purpose

The collected information is for research purpose under the Department of Poultry Science, Sher-e-Bangla Agricultural University, which reserves all the rights for the information in this questionnaire.

Questionnaire No-

1) **Data related to information**

a) Village/Union : **b) Upazila :**

c) Farmers name:

d) Sex: ☐ **Male** ☐ **Female**

e) Type of farm : ☐ **Broiler** ☐ **Layer**

f) Farm size

- ☐ **Small (<1000 birds/farm)**
- ☐ **Medium (1000-5000 birds/farm)**
- ☐ **Large (> 5000 birds/farm)**

g) Age of farmers

- ☐ **20-30 years**
- ☐ **30-40 years**
- ☐ **40-50 years**
- ☐ **50-above years**

h) Education level of farmers

- ☐ **None**
- ☐ **Primary**
- ☐ **Secondary**
- ☐ **Higher secondary**
- ☐ **Honors or above**

i) Experience in farming

- ☐ **0-5 years**
- ☐ **6-10 years**
- ☐ **11-15 years**
- ☐ **16-above years**

j) Main occupation:

- ☐ **Poultry farming**
- ☐ **Other than farming**

Questions Related to Knowledge, Attitude and Practice

1) Do you know who has authority to write a prescription?

☐ **YES** ☐ **NO**

2) Do you have any idea about antimicrobials?

☐ **YES** ☐ **NO**

3) Do you know about antimicrobial resistance?

☐ **YES** ☐ **NO**

4) Do you know about antimicrobial resistance?

☐ **YES** ☐ **NO**

5) Do you know about herbal drugs that can be used as alternatives to antimicrobials?

☐ **YES** ☐ **NO**

6) Do you know any specific antimicrobials that act against a specific disease?

☐ **YES** ☐ **NO**

7) Do you think antimicrobials can be passed to humans through consumption of poultry meat and egg?

☐ **YES** ☐ **NO**

8) Did you know antimicrobials can be used for any type of disease?

☐ **YES** ☐ **NO**

9) Do you think antimicrobials are efficient for the treatment of both bacterial and viral infections?

☐ **YES** ☐ **NO**

10) Do you think antimicrobials have some side effects?

☐ **YES** ☐ **NO**

11) Do you think all antimicrobials can show the same Curative effect in poultry diseases?

☐ **YES** ☐ **NO**

12) Do you believe that the antimicrobials you use randomly might contribute to antimicrobial resistance?

☐ **YES** ☐ **NO**

13) Do you believe that missing a dose may contribute to antibiotic resistance?

☐ **YES** ☐ **NO**

14. Do you think the restriction of antimicrobials can cause more damage than benefits?

☐ **YES** ☐ **NO**

15) Do you think antimicrobials should be added to poultry feed at any time to prevent birds from becoming sick?

☐ **YES** ☐ **NO**

16) Do you feel the importance of accurate dose of antimicrobials?

☐ **YES** ☐ **NO**

17) Do you think antimicrobials should be placed in restricted areas and accessed only by specific staff when needed?

☐ **YES** ☐ **NO**

18) When antimicrobials are about to expire, is it better to give medication to the birds to prevent wastage?

☐ **YES** ☐ **NO**

20) Would you use less antimicrobial, if you knew that the random use of antimicrobials could hamper recovery in the future?

☐ **YES** ☐ **NO**

21) Did you try to use any antimicrobials yourself?

☐ **YES** ☐ **NO**

22) Do you use any antimicrobials during the brooding period?

☐ **YES** ☐ **NO**

23) Do you check the expired date before purchasing the drugs?

☐ **YES** ☐ **NO**

24) Do you use antimicrobial as a growth promoter?

☐ **YES** ☐ **NO**

25) Did you get any suggestions of using antimicrobials from a non-vet?

☐ **YES** ☐ **NO**

26) Did you get (seek) advice from a vet about the withdrawal period?

☐ **YES** ☐ **NO**

27) Do you maintain an antimicrobial withdrawal period?

☐ **YES** ☐ **NO**

28) Do you increase the dose and frequency of antimicrobials when there are no signs of recovery?

☐ **YES** ☐ **NO**

29) Do you stop the application of the dose when the birds feel better?

☐ **YES** ☐ **NO**

30) Do you eat the meat of birds that are given antimicrobials at the end stage?

☐ **YES** ☐ **NO**

Thank you for your patience. Hope you have a wonderful day!

_____

Signature of respondent

_____

Signature of the Enumerator

APPENDIX II

Demographic and Socio-economic information of the respondents

Variables		N (%)
Type of farm	Broiler	50 (50%)
	Layer	50 (50%)
Farm size	Small (<1000 birds)	65 (65%)
	Medium (1000 to 5000 birds)	25 (25%)
	Large (>5000 birds)	10 (10%)
Age of the farmers (years)	Below 30	37 (37%)
	30-40	33 (33%)
	41-50	18 (18%)
	Above 50	12 (12%)
Education level of farmers	None	10 (10%)
	Primary	22 (22%)
	Secondary	48 (48%)
	Higher secondary	14 (14%)
	Honors or above	6 (6%)
Experience in farming (years)	0-5	19 (19%)
	6-10	31 (31%)
	11-15	36 (36%)
	Above 15	14 (14%)
Main occupation	Poultry farming	94 (94%)
	Other than poultry farming	6 (6%)

APPENDIX III

Knowledge of AMU and AMR of broiler and layer farmers

Items	Total (N=100)	Broiler farmers N=50 (%)	Layer farmers N=50 (%)
Do you know who has authority to write a prescription? (Yes)	84 (84%)	43 (86%)	41 (82%)
Do you have any idea about antimicrobials? (Yes)	92 (92%)	44 (88%)	48 (96%)
Do you know about antimicrobial residues? (Yes)	63 (63%)	27 (54%)	36 (72%)
Do you know about antimicrobial resistance? (Yes)	56 (56%)	23 (46%)	33 (66%)
Do you know about herbal drugs that can be used as alternatives to antimicrobials? (Yes)	64 (64%)	26 (52%)	38 (76%)
Do you know any specific antimicrobials that act against a specific disease? (Yes)	84 (84%)	39 (78%)	45 (90%)
Do you think antimicrobials can be passed to humans through consumption of poultry meat and egg? (Yes)	80 (80%)	38 (76%)	42 (84%)
Did you know antimicrobials can be used for any type of disease? (No)	71 (71%)	31 (62%)	40 (80%)
Do you think antimicrobials are efficient for the treatment of both bacterial and viral infections? (No)	57 (57%)	23 (46%)	34 (68%)
Do you think antimicrobials have some side effects? (Yes)	95 (95%)	46 (92%)	49 (98%)
Do you think all antimicrobials can show the same curative effect in poultry diseases? (No)	78 (78%)	42 (84%)	36 (72%)

APPENDIX IV

Attitudes towards AMU and AMR in broiler and layer farmers

Items	Total (N=100)	Broiler farmers N=50 (%)	Layer farmers N=50 (%)
Do you believe that the antimicrobials you use randomly might contribute to antimicrobial resistance? (Yes)	62 (62%)	30 (60%)	32 (64%)
Do you believe that missing a dose may contribute to antibiotic resistance? (Yes)	61 (61%)	32 (64%)	29 (58%)
Do you think the restriction of antimicrobials can cause more damage than benefits? (Yes)	56 (56%)	26 (52%)	30 (60%)
Do you think antimicrobials should be added to poultry feed at any time to prevent birds from becoming sick? (No)	62 (62%)	28 (56%)	34 (68%)
Do you feel the importance of accurate dose of antimicrobials? (Yes)	88 (88%)	41 (82%)	47 (94%)
Do you think antimicrobials should be placed in restricted areas and accessed only by specific staff when needed? (No)	24 (24%)	10 (20%)	14 (28%)
When antimicrobials are about to expire, is it better to give medication to the birds to prevent wastage? (No)	90 (90%)	46 (92%)	44 (88%)
Would you use less antimicrobial, if you knew that the random use of antimicrobials could hamper recovery in the future? (Yes)	80 (80%)	37 (74%)	43 (86%)

APPENDIX V

Practice in AMU and AMR in broiler and layer farmers

Items	Total (N=100)	Broiler farmers N=50 (%)	Layer farmers N=50 (%)
Did you try to use any antimicrobials yourself? (No)	31 (31%)	10 (20%)	21 (42%)
Do you use any antimicrobials during the brooding period? (No)	18 (18%)	7 (14%)	11 (22%)
Do you check the expired date before purchasing the drugs? (Yes)	94 (94%)	45 (90%)	49 (98%)
Do you use antimicrobial as a growth promoter? (No)	57 (57%)	21 (42%)	36 (72%)
Did you get any suggestions of using antimicrobials from a non-vet? (No)	20 (20%)	12 (24%)	8 (16%)
Did you get (seek) advice from a vet about the withdrawal period? (Yes)	48 (48%)	16 (32%)	32 (64%)
Do you maintain an antimicrobial withdrawal period? (Yes)	55 (55%)	26 (52%)	29 (58%)
Do you increase the dose and frequency of antimicrobials when there are no signs of recovery? (No)	55 (55%)	23 (46%)	32 (64%)
Do you stop the application of the dose when the birds feel better? (No)	66 (66%)	28 (56%)	38 (76%)
Do you eat the meat of birds that are given antimicrobials at the end stage? (No)	81 (81%)	41 (82%)	40 (80%)
Do you shift to using different antimicrobials during the course of a disease? (No)	70 (70%)	32 (64%)	38 (76%)