

Antimicrobial uses in cattle and goat at Fatikchari Upazila of Chattogram



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Table of content

CHAPTER	CONTENTS	PAGE No
1	Abstract	01
2	Introduction	02 - 04
3	Materials and Methods	05
5	Results	06 - 07
6	Discussion	08 - 10
7	Conclusion	11
8	Limitation	11
9	References	12 - 14
10	Acknowledgements	15
11	Biography	16

Abstract

Inappropriate antibiotic usage in food animals is a serious food safety concern that contributes to the development of antimicrobial-resistant bacteria. A cross-sectional study was conducted to assess the usage of antimicrobials as well as the perspective of cattle and goat farmers regarding the use of antimicrobials in the Fatikchari Upazila of Chattogram, Bangladesh. The data was collected from the 110 cattle and goat farmers in Fatikchari, Chattogram by a well-structured and pre-prepared questionnaire. The most commonly used antibiotics in the field of study were streptomycin-penicillin, ceftriaxone, amoxicillin, and penicillin, according to the findings. The participants said that their prescribers did not aware of the drug withdrawal time and that 97% of them did not follow it and they were also unaware of the effect of antimicrobial resistance on animal health. Only 26% of farmers always followed a veterinarian's advice. Three more key prescriber groups recommending antimicrobials were discovered during the study: drug sellers/dealers experienced local farmers, and the farmer himself. To combat this antibiotic resistance challenge, the study demonstrated the importance of farmer awareness initiatives as well as antimicrobial stewardship programs aimed at veterinarians and other stakeholders.

Chapter 1: Introduction

Antibiotics are used in farm animals for three important purposes: treating sick animals, preventing infections in healthy animals (prophylactic usage), and promoting growth by increasing feed efficiency (Sawant *et al.*, 2005; Ventola, 2015). Antibiotics used inappropriately, unnecessarily, and excessively in food animals have resulted in drug residues accumulating in animal-derived foods and the development of antimicrobial-resistant bacteria (Salehzadeh *et al.*, 2006; Stolker and Brinkman, 2005). As a result, unrestricted antibiotic usage has a considerable impact on the formation and spread of antibiotic-resistant microorganisms in humans and animals. Livestock farmers in most developing countries engage in such reckless behavior. Furthermore, farmers are not accustomed to ensuring withdrawal periods after administering antibiotics to their livestock. A withdrawal period is a period of time following the administration of a drug during which drug residue must reach an acceptable and non-toxic level. Antimicrobial usage in dairy cattle has raised concerns regarding the safety of milk for human use. A few industrialized countries have devised methods to encourage producers, farmworkers, and veterinarians to use antimicrobials responsibly, with a focus on proper antimicrobial resistance (AMR) monitoring in farm animals (Landers *et al.*, 2012; Levy, 2014). However, developing countries with minimal veterinary services, such as Bangladesh, have little or no effective monitoring of antibiotic usage in farm animals.



A variety of antibiotic classes have been approved for use in animals, including cephalosporins of the third and fourth generations, fluoroquinolones, and macrolides (Sarmah *et al.*, 2006). Many veterinarians prescribe these antimicrobials in basic conditions to seek a quick outcome without considering the risks of resistance development (Sarker *et al.*, 2016). As a result, stronger antimicrobials must be considered critically significant antimicrobials by veterinarians to deal with the future resistance threat. Personal experience and perception (68 %) is the most common basis for picking an antibiotic in developing countries like Bangladesh, rather than a cultural sensitivity test (Akter *et al.*, 2012). It's most likely due to a lack of local veterinarian diagnostic facilities, as well as some hesitation. Another crucial aspect in the fight against antibiotic resistance is farmers' awareness (Friedman *et al.*, 2007).

Many goat farmers in Chittagong have only primary education. Furthermore, goat farmers are unaware of or unconcerned about the threat of antibiotic resistance. Another major driver of a farmer's favored product is their assessment of antimicrobial efficacy based on clinical outcomes (Vaarst et al., 2002). The World Health Organization's (WHO) 'Antimicrobial Resistance Global Report on Surveillance' revealed high resistance rates in bacterial pathogens regularly implicated in common hospital, community, and food chain diseases where there is a poor level of education (WHO, 2014). Although veterinarians are normally in charge of selecting appropriate antimicrobials for treatments, farmers' preferences and demands may be impacted by factors such as cost and profit margin, simplicity of medicine administration, and withdrawal duration. (Van der Fels-Klerx et al., 2011).

Globally, most commonly used Antimicrobials (AM) belonging to B-lactams, tetracyclines, aminoglycosides, quinolones, macrolides, and sulfonamides are used to prevent infection and promote rapid growth of farm stock (Brogden et al., 2003) [Figure 3.1]. The concerns arise mainly from the possibility of AMR bacteria may be transferred from animals to humans, through contact, water, manure or contaminated milk products (CAC, 1998). Unauthorized AM use may result in residues of these substances in milk and tissues (Ivona and Mate, 2002). However, these efforts are not practiced at all in Bangladesh. Veterinarians or livestock professionals in this country usually do not suggest farmers properly to follow the withdrawal period of drug for food-producing animals, therefore farmers lack knowledge about the persistence of drug residues in milk and milk products which can easily affect humans and become drug-resistant against human pathogens (Apata, 2009).

Farmers' antibiotic overuse could be attributed to a lack of information about judicious antibiotic usage and the health concerns associated with inappropriate use, according to the idea. In this setting, the goal of this study was to find out how farmers felt about antibiotic use, management strategies, and the AMR problem. Large commercial farms typically adhere to strong biosecurity protocols and do not allow anyone accesses to their property. They frequently hire their own veterinarians or consult with specialist veterinarians to manage farm activities. As a result, there are reduced chances of antibiotic overuse and malpractice. The current study focused on small and medium farmers. This research will be used as a foundation for further exploration and the development of methods to enhance farmers' perspectives

1.1. Objectives of the study

- ① To know the pattern of AM uses in farm level for cattle and goats animals.
- ② To get an idea about the awareness level of farmers regarding AM residue and resistance.
- ③ To get an idea about the farmers' perception toward antimicrobial usage and antibiotic resistance in Bangladesh.

Chapter 2: Materials and Methods

2.1 Description of the study area:

The study was carried out in the Fatikchari Upazila of Chattogram division of Bangladesh. Fatikchari is one of the largest Upazila of Chattogram having a total area of 773.1 square kilometers. Due to the great demand for milk and dairy products, commercial dairy farming is developed and the market is also quite large here. This region produces approximately 60 thousand liters of milk per day (Barua *et al.*, 2018).

2.2 Study design

This cross-sectional study was conducted from February to May 2022. A well-structured and pre-prepared questionnaire was developed for data collection. The final version of the questionnaire was then translated into Bengali, the mother tongue of the people. Small and medium farmers were prioritized in this study. A total of 110 goat and cattle farmers were surveyed through this study.

2.3 Data collection

Face-to-face interviews with farmers who visited Upazila veterinary hospital with their sick animals as well as a few small and medium scale farmers were used to gather data. We enlisted the help of a group of veterinary students to collect data. Participants were chosen for the study depending on their willingness to participate. The participants were informed of the study's purpose before the interview, and a verbal agreement was obtained. This study had no ties to either government or business interests, and participation was voluntary. The farmer's education level, the most commonly used antimicrobials, knowledge about antibiotics and antibiotic resistance, antibiotic residue, practices regarding antimicrobial usage following the withdrawal period, record-keeping system, means of access to antimicrobials, and drug storage system were all covered by the questionnaire [**Figure 3.3**].

2.4 Statistical Analysis

All the data was obtained and analyzed through the study by Microsoft Office Excel- 2010, USA.

Chapter 3: Results

Antimicrobial using pattern

At the Upazila, mostly used antibiotic in goats and cattle was ceftriaxone. 37 patients (33.10%) were treated with streptomycin-Penicillin. The second most prescribed antimicrobial was ceftriaxone, used in a total of 20 patients (17.95%). Amoxicillin was administered in 14 patients (12.9%) [Table 1 and Figure 3.1].

Table 1: Frequency of using antibiotics from February 2021 to April 2021

Antibiotics used	Therapeutic dose (mg/kg)	No. of animals (n)	Percentage (%)
Amoxicillin	10-15	14	12.9
Ampicillin	10-15	3	3.07
Ciprofloxacin	10	3	2.63
Streptomycin-Penicillin	1 ml/10 kg	37	33.10
Ceftiofur	1.1-2.2	10	9
Oxytetracyclin	11	7	6.48
Penicillin	10,000-60,000 IU/kg	8	7.33
Ceftriaxone	25-50	20	17.95
Sulfa	100-200	6	5.62
Metronidazole	40	2	1.92

Farmers' perspective about antibiotics

According to data, 97% of goat owners were unaware of antibiotic resistance and drug withdrawal periods, 81% of goat owners complained that treatment was ineffective, and 75% of goat owners followed prescriptions to treat their animals [Figure 3.2 and 3.3].

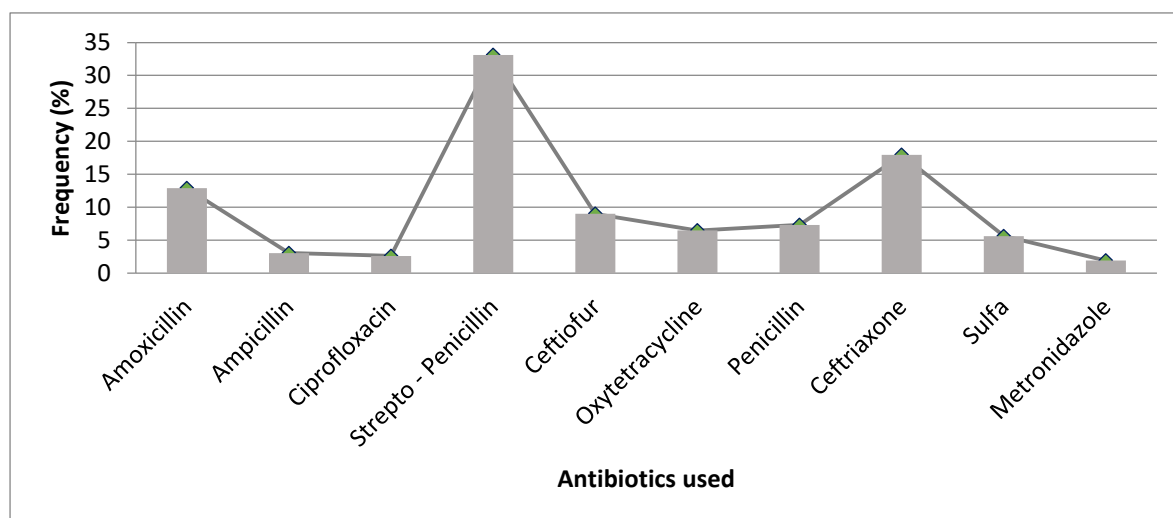


Figure 3.1: Frequency of antibiotics used in goat and cattle from February – April 2021

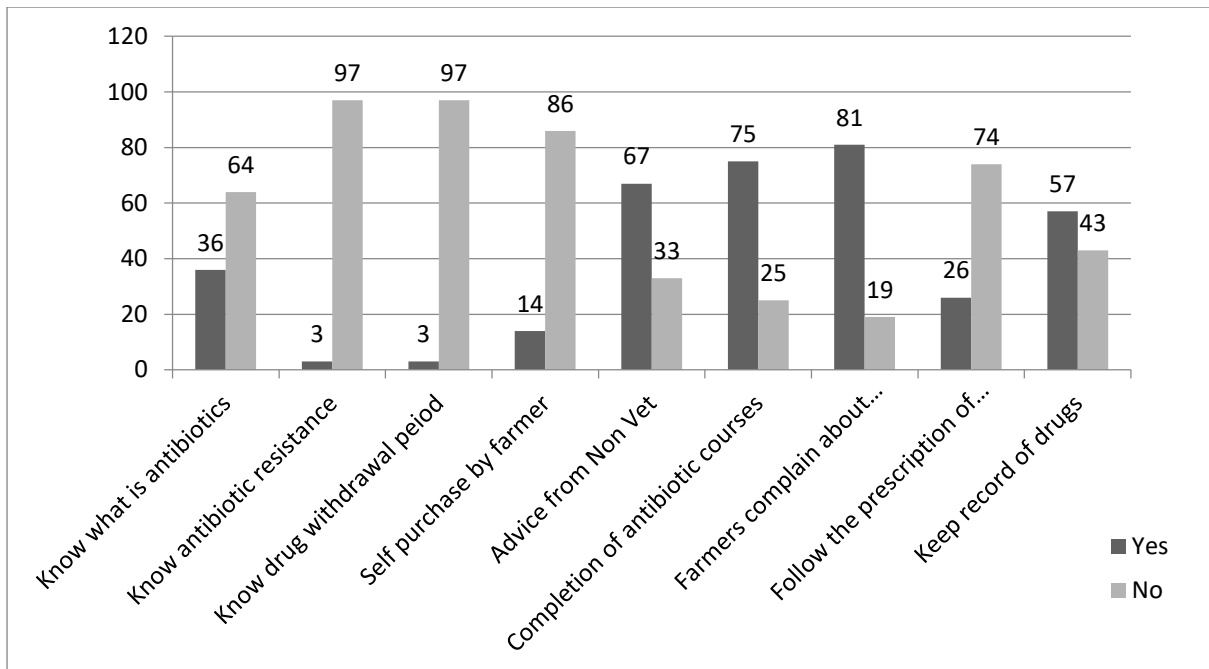


Figure 3.2: Farmer's perception about antibiotics



Figure 3.3: Collecting data during farm visit

Chapter 4: Discussion

In this study, the awareness levels and common practices of cattle and goat farmers were assessed as well as their perception of risk towards the antimicrobial resistance and residual effect [Figure 3.2]. Antimicrobial resistance is now a global challenge. Because of the longer therapy period and greater treatment expenses, it is a drain on the global economy. The global action plan's purpose is to ensure successful treatment using particular and sensitive antimicrobials that are both effective and safe. In developed countries, the global average annual consumption of antimicrobials per kilogram of animal production was estimated to be 45 mg/kg, 148 mg/kg, and 172 mg/kg, respectively, for cattle, fowl, and pigs (Van Boeckel *et al.*, 2015). The situation is seven times worse in developing countries like India, yet it is not assessed in Bangladesh.

Use of antibiotics around the globe

The majority of antibiotics used in animal agriculture are comparable to those used in human medicine. Only nine antimicrobial classes are utilized exclusively in animals, out of twenty-seven that are used in both humans and animals (Page and Gautier, 2012). Midenge (2010) surveyed 187 small-scale dairy cattle farmers in Kinondoni Municipality about the antibiotics they used and discovered that tetracycline (used by 79.5% of farmers), penicillin-streptomycin (used by 55%), sulfadimidine (used by 18%), gentamycin (used by 10%), and kanamycin (used by 8%) were the most commonly used antibiotics. Sulfa drugs (34%), aminoglycosides (29%), oxytetracycline (13%), a combination of aminoglycoside and β lactamase (12.44%), and β lactamase (12.44%) were the most commonly used antibiotics in goats, according to a cross-sectional survey conducted in Bangladesh's Naogaon district (10 percent) (Sarker *et al.*, 2016). However, the findings of this study differ from those of ours since Sarker *et al.* (2016) conducted their research in an area where PPR was more widespread, whereas myiasis is common in Chittagong. According to a teaching veterinary hospital study conducted at Usmanu Danfodiyo University (UDUVTH) in Sokoto, oxytetracycline was the most regularly used antibiotic (37.6%), followed by penicillins (24%), and aminoglycosides (17.6%). (Agaie *et al.*, 2016); the difference in geographical location, as well as the broad-spectrum nature of oxytetracycline, availability, and its wide variety of uses, could be the reason for this discrepancy. Streptomycin-penicillin was the most commonly recommended antibiotic in our study, owing to its capacity to treat both

gram-positive and gram-negative bacteria, as well as its widespread availability in local markets and lower cost than other antibiotics.

Possible causes of indiscriminate use of antibiotic

For successful health care, good grade antibiotics must be available and affordable, as well as their reasonable use. Irrational drug use, on the other hand, is common, especially in developing countries (Lalan et al., 2012). Veterinary advice (87%) was the most prevalent primary reason for adopting an antibiotic among 22 dairy farmers in New Zealand, followed by personal experience (68%). Farmers who had little understanding or concern about the threat of antibiotic resistance in their herds and persons, respectively, increased the likelihood of resistance in their herds and humans (McDougall et al., 2017). A Dutch study found that while prescribing antimicrobials, veterinarians must balance several competing objectives, including the need to alleviate animal suffering, financial reliance on customers, risk avoidance, public health concerns, and personal opinions (Speksnijder et al., 2015). The majority of prescriptions comprised either a single antibiotic or a combination of two antimicrobials that worked well together (Regula et al., 2009).

Farmer's perception toward the use of antibiotics

In this study, only 36% of farmers knew what the term "antibiotic" meant, but only 53% of French farmers knew that antimicrobials were only used to treat bacterial illnesses (**Figure 3.2**). Furthermore, this study revealed that 97% of farmers were unaware of antimicrobial resistance and antibiotic withdrawal periods (**Figure 3.2**), although a study in New Zealand found that the majority of farmers (79%) were aware of the possibility of acquiring antimicrobial resistance (McDougall et al., 2017) There is a significant difference between their findings with ours because just 47% of farmers had an elementary education and 40% of farmers were illiterate. Over 40% of farmers in South Carolina were very familiar with antibiotic resistance and were confident in their use of antibiotics, according to a survey, and its participants had either high school (42.9%, n = 18) or undergraduate college (45.2%, n = 19) education (Friedman et al., 2007).

One of the keys to antimicrobial use is a veterinarian's personal experience (McDougall et al., 2017), and a farmer's experience of goat rearing can also help them learn about antibiotics used for goat treatment and their withdrawal period. Farmers with more goat-rearing expertise knew more about antibiotics than the rest of the farmers. Because, for a long time,

when a goat became ill, they went to the hospital or consulted a private doctor, and as a result, they learned about the phrase antibiotic. It happened more frequently in the case of proprietors who had at least a primary educational background. In human medicine, it is thought that raising parents' and physicians' knowledge and awareness are crucial components of cautious use (Bauchner et al., 1999). As a result, adjustments in prescribing patterns and interactions with farmers will aid in the improvement of the situation.

Conclusion

The study shows the pattern of antibiotic usage in general. Streptomycin-penicillin was the most often used antibiotic in goats. Most farmers do not follow the prescription provided by veterinarians properly. We discovered that goat farmers are unaware of antibiotic resistance and withdrawal periods. Many livestock caretakers were unaware of the antimicrobial effect on animal bodies and were unaware that antibiotic use could harm their animals' and their own health. The study provides a perspective about farmers' attitudes toward the use of antimicrobials and antimicrobial resistance. As a result, farmers' training and veterinarians' friendly demeanor during prescription could be advantageous. Furthermore, reasonable antibiotic prescribing based on guidelines and the adoption of a specific treatment plan will alter the current scenario.

Limitations

A small amount of collected data and a short period were the most significant limitations in the study. Information bias could have been introduced as data recording relied on farmers' responses.

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Biography

I am Dibakar Chowdhury, son of Mr. Goatham Chowdhury and Mrs. Simla Chowdhury. I passed Secondary School Certificate examination in 2012 (GPA-5.00) from Chattogram Government High School, Chattogram followed by the Higher Secondary Certificate examination in 2012 (GPA-5.00) from Chattogram Government City College, Chattogram. Now I am an intern veterinarian under the Faculty of Veterinary Medicine at Chattogram Veterinary and Animal Sciences University. In the future I would like to work as a veterinary practitioner and do research on zoonotic diseases and public health significance in Bangladesh.