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Research article

Antibiotic Use Pattern in Dairy Cattle and Farmers' Perception of its Impact on Public Health in a Selected Area of Khulna District

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ABSTRACT

This study examined the pattern of antibiotic use in dairy cattle and farmers' perception of its effects on public health in a selected area of Khulna District, Bangladesh. Data were collected from sixty (60) farmers associated with dairy farms through survey using interview schedule. About one-third of farmers used antibiotics, typically on advice from informal practitioners rather than veterinarians. About half of dairy farmers used antibiotics to treat sick animals while the remaining portion applied it for various purposes like growth promotion and boosting of milk yield. More than two-third of the dairy farmers in the studied area were not aware of the adverse effects of antibiotics residue on human health. Similarly, a large portion of them (85.71%) were ignorant of the removal period. The results highlight the necessity for awareness training, strict implementation of antibiotic rules, and enhanced veterinary regulation to mitigate public health hazards rising from antibiotic residues in milk.

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Introduction

Antimicrobial resistance (AMR) has appeared as a key global health challenge, driven mostly by misapplication of antibiotics in both humans and animals (Mim et al., 2024). The livestock segment, mainly milk production, contributes significantly to the spread of antibiotic residues and resilient bacteria through milk and other livestock products (Al Amin et al., 2020). In developing countries like Bangladesh, non-judicial use of antibiotic is intensified by poor veterinary services, lack of alertness, and insufficient rule (Chowdhury et al., 2021).

Public health officials have stepped up their efforts to avoid antibiotic overuse through communication, both globally and in industrialized nations in particular, since antibiotic resistance is currently a global concern. Lactic acid generation and the growth of starting bacteria are inhibited by antibiotic residue in milk. As milk is ingested by babies, children, and adults worldwide, antibiotic residues in milk pose a serious threat to public health. Human health may be at danger from antibacterial residues in terms of pharmacological, toxicological, microbiological, and immunopathological effects (Ram et al., 2000). Furthermore, farmers are not accustomed to keeping their animals off antibiotics for extended periods of time. There is research from industrialized countries that monitor the use of antibiotics in farms, but there aren't many studies from developing countries like India that evaluate antimicrobial use. Three major uses of antibiotics in farm animals are: treating sick animals, prophylactically preventing infections in healthy animals, and stimulating development by raising feed efficiency (Sawant et al., 2005; Ventola, 2015).

Inadequate control methods and incorrect use of antibiotics remain as residues in edible tissues (Chakma et al. 2023). Misuse, as well as indiscriminate, or fraudulent use of medically important antibiotics as veterinary drugs is one of the significant causes of the growing trend of bacterial resistance to antimicrobial agents in Bangladesh (Sachi et al. 2019). Antimicrobial drug treatment of animal diseases has proven immensely beneficial; yet, the growth of antibiotic resistance as a result has caused concern worldwide (Landers et al. 2012). The detrimental effects of overusing, overusing, and using antibiotics as a preventative measure in animals and aquaculture are not as well known to many farmers in Bangladesh. Inadequate veterinary healthcare facilities, a lack of oversight and regulatory services regarding the use of antibiotics, a high incidence of diseases, and malpractices by unqualified veterinary healthcare providers (quacks, drug sellers, and animal feed dealers) are all major contributing factors to the overuse and misuse of antibiotics in the animal health

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sectors (Al Amin et al. 2020). For the sectors involved in animal production, there isn't a comparable drug policy or guideline. The Bangladeshi government passed the "Bangladesh Fish Feed and Animal Feed Act 2010" in order to outlaw the use of antibiotics in animal feed throughout the manufacturing process (Bangladesh Gazette, 2010).

Though some investigations have stated antibiotic residues in milk across diverse regions of Bangladesh, incomplete evidence exists for the south-west zone, particularly Khulna District, where small scale dairy farms dominate. This study fills that gap by verifying the use pattern of antibiotics in dairy cattle and evaluating farmers' awareness concerning its effect on public health in Khulna District.

Objectives of the study

1. To observe the pattern of antibiotic apply in dairy cows in a particular area of Khulna District.
2. To evaluate farmers' awareness and perception of the effect of antibiotic use on human health.

Materials and Methods

Design of the study

The study was carried out in Dumuria Upazila of Khulna District, selected for its concentration of smallholder dairy farms. From the Dumuria upazila in the district of Khulna, sixty (60) farmers who were involved in dairy farming and willing or able to offer information were chosen at random. Sixty (60) farmers were selected through simple random sampling, which confirmed proportional inclusion of both intensive and backyard dairy farms. The sample size was considered suitable for descriptive analysis given the similarity of the population.

Interview schedule develop and collection of data

An interview schedule was created in order to get pertinent and topic-related information from farmers that raise dairy cattle. The questions were so simple that the dairy cattle farmers could easily understand and could provide accurate information. After preparation, interview schedule was pretested with few dairy farmers. In accordance with the interview schedule, the dairy cattle farmers were personally interviewed in order to get the data. Data were collected via face-to-face interviews using a pre-tested semi-structured interview schedule concentrating on feeding, health care, and antibiotic application practices. Verbal consensus was taken from all respondents, and secrecy of data was firmly upheld. Since replies were memory-based, data collectors followed cross-checking and constancy confirmation to minimize memory bias. Before asking any question to the dairy cattle farmers, the purposes of the study were explained to them and requested to cooperate that they could provide the true and accurate information. The questions were explained and clarified whenever any dairy cattle farmers they could not understand or felt any hesitation about the question. All the information was collected without any bias. The dairy cattle farmers were responding from memory since they lacked written documentation. Following each interview, the data sheets were examined and confirmed to ensure that the dairy cattle farmers' comments had been accurately recorded. Following the conclusion of the interview, the farmers of dairy cattle received appropriate gratitude.

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Data analysis

All of the data were collated, coded, and then tabulated for processing when the collection procedure was finished. To ensure ease and accuracy in achieving the goals, a basic statistical method was employed for data analysis. To describe the variables, several statistical techniques like number, mean, SD, and percentage were applied. Utilizing IBM SPSS statistics, the data was analyzed.

Results

Feed types for dairy cattle

According to the study's findings, the majority of dairy cattle farmers—58.3%—fed their cattle rice straw in addition to green grasses and concentrate feeds, followed by 15% who fed green grasses and concentrate feeds, 11.67% who fed rice straw and green grasses, 6.67% who fed green grasses, and 3.33% who fed rice straw alone (Table 1).

Health care of dairy cattle

Figure 1 displays the vaccination pattern for dairy cattle in the research area. The study's findings indicate that the majority of dairy cattle farmers (38%) vaccinated their cattle on a regular basis to protect them against diseases, followed by no vaccination (37%) and sporadic vaccination (25%).

Table 1: Types of feed used for dairy cattle in the studied areas

Categories	Frequency	Percent
Rice straw	2	3.33
Green grasses	4	6.67
Rice straw & green grasses	7	11.67
Green grasses & concentrates feed	9	15.00
Rice straw & concentrates feed	3	5.00
Rice straw, green grasses & concentrates feed	35	58.33
Total	60	100.00

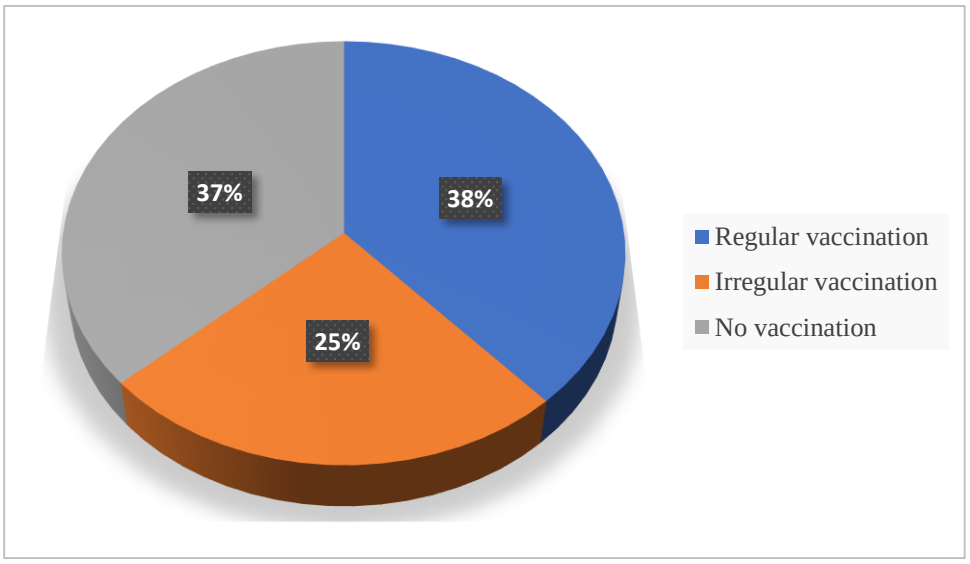

Figure1: Vaccination patterns of dairy cattle in the studied areas

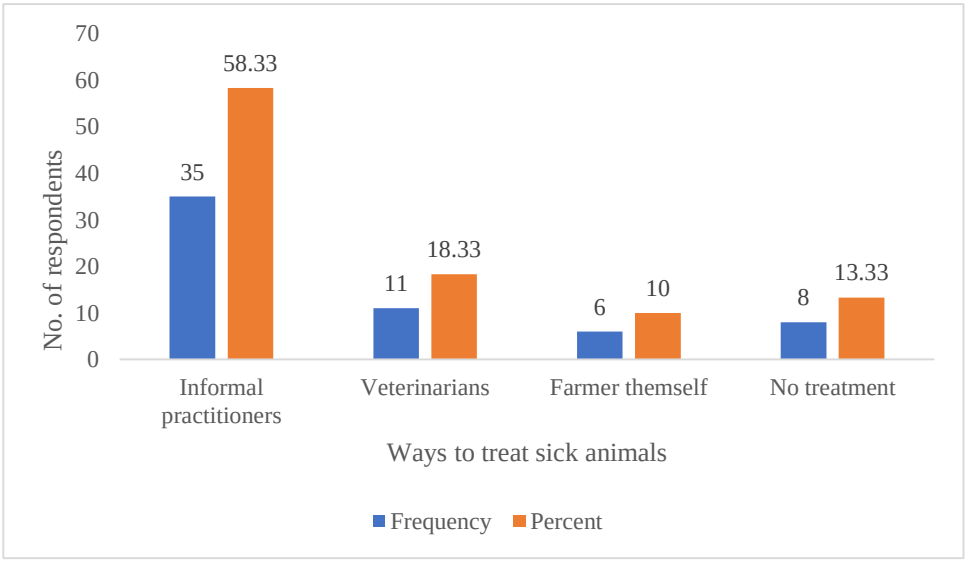

Figure 2: Ways to treat sick animals

Ways of treatments of sick animals are presented in Figure 2. It has been shown that highest 58.33% of the dairy cattle farmers treated sick animals by informal practitioners, 18.33% by the veterinarians, 13.33% did not provide any treatment and 10% treated by themselves.

Isolation practice of sick animals from healthy animals is presented in Table 2. The data in the Table show that most dairy farmers did not separate sick animals from healthy animals (85%) and only 15% did.

Table 2: Isolation practices of sick animals from healthy animals

Categories	Frequency	Percent
Isolated	9	15.0
Not isolated	51	85.0
Total	60	100.0

Use pattern of antibiotics, hormones and vitamin-minerals

According to the survey's findings, 35% of dairy cow producers used antibiotics and the majority (65%) of farmers who raised cattle did not utilize antibiotics for livestock production (Table 3).

According to the findings, 60% of dairy cattle farmers did not utilize hormones for their animals, whereas the remaining 40% did (for their animals) (Table 3).

The study's findings demonstrated that while 35% of dairy cattle farmers did not use vitamins and minerals in their cattle farming, the majority of dairy cattle farmers (65%) supplemented their cattle with these additives (Table 3).

Table 3: Distribution of the dairy cattle farmers according to the supplementation of antibiotics, hormones and vitamins-minerals

Supplementation patterns	Antibiotics		Hormones		Vitamins-minerals	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Supplemented	21	35.0	24	40.0	39	65.0
Not supplemented	39	65.0	36	60.0	21	35.0
Total	60	100.0	60	100.0	60	100.0

Advisers on the use of antibiotics

Data of the Table 4 indicate that highest 38.1% of the dairy cattle farmers stated that the antibiotics were recommended by informal practitioners for applied in cattle farming, 33.33% veterinary doctors, 19.05% by animal health workers and 9.52% by themselves.

Highest percentages of dairy cattle farmers reported that using of hormones were advised by animal health workers (41.67%), followed by informal practitioners (33.33%), by themselves (20.83%) and veterinary doctors (4.17%).

Table 4: Advisers on the use of antibiotics for dairy cattle

Categories	Antibiotics		Hormones	
	Frequency	Percent	Frequency	Percent
Informal practitioners	8	38.10	8	33.33
Veterinary doctors	7	33.33	1	4.17
Animal health workers	4	19.05	10	41.67
Self-medication	2	9.52	5	20.83
Total	21	100.00	24	100.00

Table 5: Sources of antibiotics using for dairy cattle

Sources	Frequency	Percent
Veterinary medicine company	8	40.00
Medicine stores	10	46.67
Local vendors	3	13.33
Total	21	100.00

Sources of antibiotics

The dairy cattle farmers who were applied antibiotics in cattle were collected it from different sources. Data of the Table 5 display that highest 46.67% of the farmers collected antibiotics from medicine stores followed by veterinary medicine company (40%) and local vendors (13.33%).

Purposes of antibiotics use

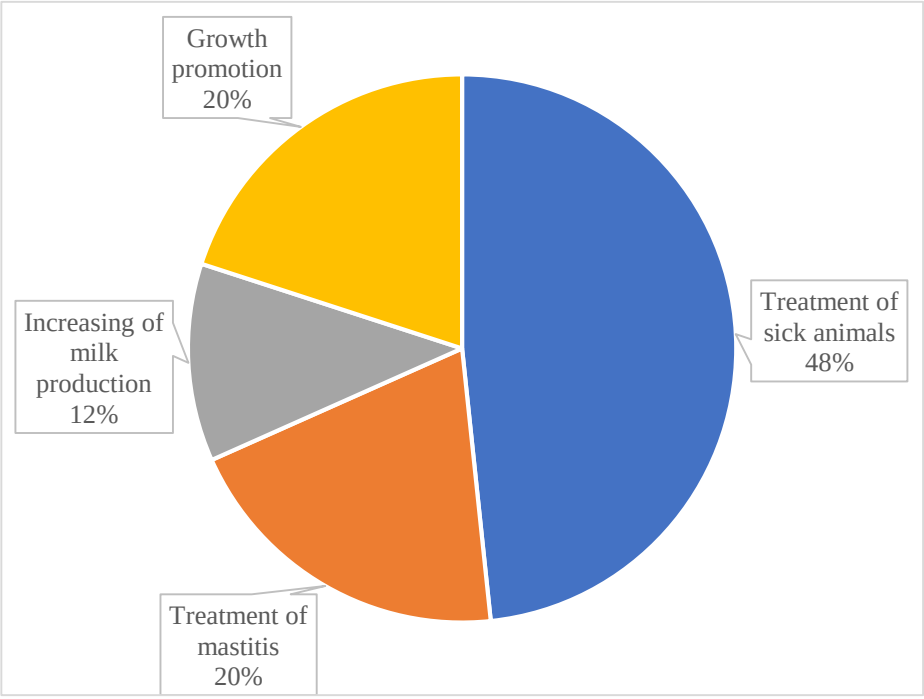

Figure 3: Purposes of antibiotics use in dairy cattle

Data of the Figure 3 indicate that the dairy cattle farmers used antibiotics for several purposes. The results revealed that the majority (48%) of the dairy cattle farmers used antibiotics for treatment of sick animals, 20% of the dairy cattle farmers used for mastitis treatment, 20% for growth promotion and 12% of the dairy cattle farmers used it for increasing milk production.

Perceptions of dairy farmers on the negative impact of antibiotic use

The results of the study showed that the majority (70%) of the dairy cattle farmers did not know the impact of antibiotics used in dairy cattle on human health, 11.67% stated no impact, 10% of stated it as toxicity and rest 8.33% stated it as failure in therapy in human (Figure 4).

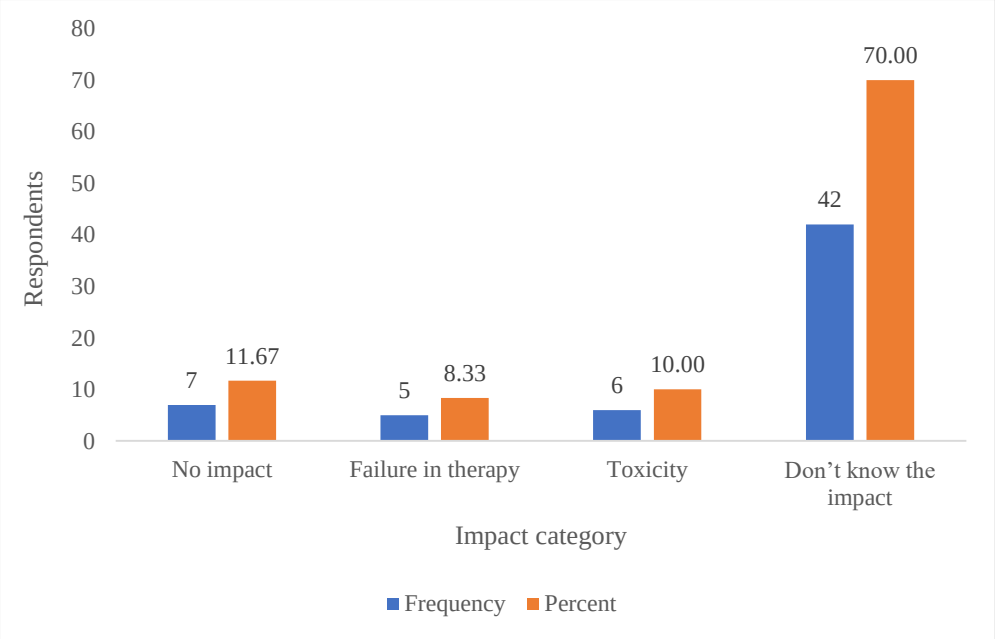

Figure 4: Perceptions of dairy farmers on the negative impact of antibiotic use on public health

Antibiotic withdrawal periods

Consideration of antibiotic withdrawal periods in lactating cows during milk selling is mentioned in Table 6. Results revealed that majority of the dairy cattle farmers (85.71%) did not consider the withdrawal period of antibiotics for milk sale while only 14.29% considered it.

Table 6: Consideration of antibiotic withdrawal periods in lactating cows for milk sale

	Frequency	Percent
Considered withdrawal period	3	14.29
Not considered withdrawal period	18	85.71
Total	21	100.00

Awareness of antibiotic usage guidelines

The results of the study show that majority (88.33%) of the dairy cattle farmers didn't know the Government rules of using antibiotics and only (11.67%) of the dairy cattle farmers know the rules of using antibiotics for cattle farming (Table 7).

Table 7: Awareness of dairy farmers regarding government regulations for use of antibiotics in dairy cattle

Awareness	Frequency	Percent
Aware of regulations	7	11.67
Not aware of regulations	53	88.33
Total	60	100.0

Frequency of antibiotic use

The frequency of using antibiotics by the farmers to their dairy cattle is presented in Figure 5. Data in the Table shows that highest percentages of the dairy cattle farmers applied antibiotics to the dairy cattle daily (33.33%) followed by once a week (23.81%), once a month (19.05%), 2 to 3 times in a week (9.52%), once a year (9.52%) and once in six months (4.76%).

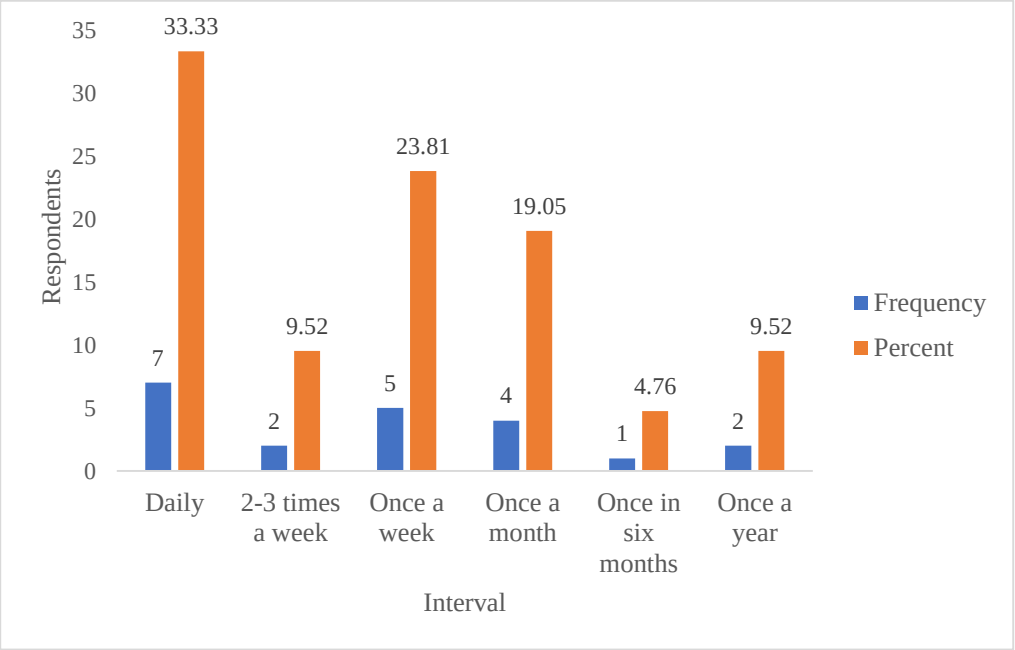

Figure 5: Frequency of antibiotic use in dairy cattle

Problems stated by the dairy cattle farmers

The findings showed that 85% of the dairy cattle farmers faced moderate problems followed by 13.3% high problem and only 1.7% less severe problems (Table 8).

Table 8: Problem stated by the dairy cattle farmers with cattle farming

Categories	Frequency	Percent
Less severe (<=15)	1	1.7
Moderately severe (16-30)	51	85.0
Highly severe (>30)	8	13.3
Total	60	100.0

Rank orders of the statements on problems

Rank order of different problems faced by the dairy cattle farmers is shown in Table 9. Among different problems faced by the farmers, "high cost of cattle feeds" was ranked first according to the statement of the dairy cattle farmers. "high cost of quality breeds of dairy cattle" was ranked second followed by "lack of quality dairy cattle breed in time", "scarcity of quality feeds", etc.

Table 9: Rank orders of the statements on problems faced by the dairy farmers while rearing cattle

SI. No.	Statement	Score	Percentage (%)	Ranking
A.	**Problems related to cattle breeds**			
1	High cost of quality breeds of dairy cattle	168	93.33	2nd
2	Lack of quality dairy cattle breed in time	132	73.33	3rd
B.	**Feeds & fodder related problems**			
3	High cost of cattle feeds	173	96.11	1st
4	Scarcity of quality feeds	130	72.22	4th
5	Lack of knowledge about feed production	119	66.11	5th
C.	**Health related problems**			
6	High mortality rate	77	42.77	9th
7	Unavailability of vaccines and medicines	77	42.77	9th
8	High prices of vaccine and medicines	89	49.44	6th
9	Lack of veterinary surgeons	79	43.88	8th
10	High disease susceptibility	80	44.44	7th
D.	**Other problems**			
11	Low economic return	50	27.78	11th
12	Insufficient capital and loan	52	28.89	10th
13	Poor marketing facilities	48	26.67	12th
14	Lack of Govt. support	48	26.67	12th
15	Lack of training facilities	50	27.78	11th

Feed types for dairy cattle

The study results showed that more than half of the dairy farmers fed their cattle a combination of rice straw, green grasses and concentrate mixture which is differed from that of Al Mamun et al. (2018) in beef cattle. They reported that majority (58.3%) of the farmers provided cultivated fodder and compound feed, while 5% fed roadside grasses and cultivated fodder, 10% cultivated fodder and mixed feed, 23.3% fed roadside grasses, cultivated fodders and compound feed and rest 1.7% of the farmers fed roadside grasses to the beef cattle. This difference is may be due to different in cattle type and feeds and fodder availability in two different areas.

Health care of dairy cattle

Around two-third of the dairy cattle farmers in the study area was vaccinated their cattle although a portion of this farmers provided vaccines occasionally. More percentages of farmers' vaccination practices were reported by Ahmed et al. (2010) as 72.6% than the findings of present study. However, Al Mamun et al. (2018) reported that only 26.7% of the cattle farmers practiced vaccination and 73.3% cattle farmers didn't vaccinate their cattle. Higher percentage of dairy cattle farmers in the current study (58.33%) treated their sick animals by the informal practitioners and only 18.33% by the veterinarians which suggest that farmers' access to the veterinarians should increase by creating their awareness. Al Mamun et al. (2018) also observed higher percentage of farmers called informal practitioners for treatment of sick animals (90%). Majority of the dairy cattle farmers in the study did not separate sick animals from healthy animals (85%). The results justified that these practices can increase the risk of spreading diseases rapidly within their farms and it suggests to increase the awareness of the farmers on animals' healthcare by training and motivation.

Farmers participating in the current study stated that illegal individuals, including para-veterinarians, unlicensed practitioners, and farmers themselves, frequently gave out antibiotics. Similarly, according to earlier research, para veterinarians, unlicensed practitioners, and dairy farmers themselves were the main users of antibiotics in India's dairy industry (Sharma et al., 2020; Vijay et al., 2021). When it comes to the individuals providing routine care on farms, para-veterinarians treated 34.21% of the herds, while "unauthorized practitioners"—often referred to as "private doctors" in the villages—treated 26.32% of the herds. In 23.68% of the herds, the farm owners themselves provided treatment, while veterinarians handled 15.79% of the herds (Vijay et al., 2023). Nonetheless, dairy farmers sought advice from veterinarians for all complex cases (such as dystocia, recurrent mastitis, severe injuries, fractures, etc.) as well as treatment failures handled by para-veterinarians, unlicensed practitioners, or the farmers themselves (Vijay et al., 2023).

Use pattern of antibiotics, hormones and vitamin-minerals

Majority (65%) of dairy cattle farmers did not use antibiotics and 35% used antibiotics for livestock farming. However, Islam et al. (2012) reported higher application of antibiotics (95.3%) for fattening cattle than the present findings indicating a decreasing trend in antibiotic use over time. Majority (60%) of the dairy cattle farmers did not use any hormones for their cattle and rest 40% of the dairy cattle farmers used hormones for their cattle. Islam et al. (2012) found that 70.6% of the dairy cattle farmers used anabolic steroid as growth hormones and rest of them did not use any kind of growth hormones which is in agreement with the current findings. The comparatively lesser percentage of antibiotic usage compared to previous investigations (Rahman et al., 2021) recommends growing awareness but persistent misapplication at the field condition.

Advisers on the use of antibiotics

Rahman et al. (2021) reported that merely 26.7% of respondents consistently adhere to a veterinarian's recommendation for antibiotics use and three more significant actors they were identified as being involved in the farmers' recommendation of antimicrobials: drug dealers and sellers, elderly farmers with experience, and the farmers themselves. Little higher percentages of dairy farmers (33.33%) in the current study were suggested to use antibiotics by the veterinarians. A dealer, drug vendor, or the farmer themselves would often modify a prescription written by a veterinarian. Only 32 percent of dairy farmers consulted a veterinarian prior to administering antibiotics (Sawant et al., 2005). Many farmers made the decision to heed the advice of their other farmers when it came to caring for their animals (Ozturk et al., 2019). Due to a shortage of veterinarians, these farmers typically utilize antimicrobials that they administer themselves or depend on other knowledgeable local farmers. According to a prior study, farmers planned to alter the recommended dosage (Jones et al., 2015). Only 32 percent of dairy farmers consulted a veterinarian prior to administering antibiotics (Sawant et al., 2005). The domination of non-veterinary practitioners reflects insufficient entree to specialized animal health facilities, a problem also stated in India (Vijay et al., 2023) and Nigeria (Adesokan et al., 2016).

Purposes of antibiotics use

According to Rahman et al. (2021), a significant proportion of farmers (82.18%) used antibiotics for both disease treatment and prevention, which is consistent with the results of a prior study (Eltayb et al., 2012). Research has demonstrated that the two main causes of antibiotic resistance are prophylactic and therapeutic antibiotic use (Ozturk et al., 2019). In the present study, less percentages of dairy farmers (48.33%) were applied antibiotics for treatment purposes than that of Rahman et al. (2021). Antibiotics were mostly used to treat infections in cattle, and according to two studies, 56–66% of sick animals received prescriptions for antibiotics (Bhowmik et al., 2017; Samad et al., 2020). According to a study conducted at a hospital, the veterinarian administered antibiotics to almost 90% of the sick animals (Haider et al., 2017) which is higher than the findings of current study. Understanding the prudent use of antibiotics in food animals, safe food handling practices, and safe cooking techniques is crucial to reducing the risk of hazardous antibiotic-resistant bacteria arising from animal origin foods (Chowdhury et al., 2021). According to Hossain et al. (2022), animal

farmers in the study areas frequently employed antimicrobial medications in livestock production to reduce the source of infection on their farms as a result of poor management. These results line up with the findings of other researchers (Moffo et al., 2020; Geta and Kibret, 20121). Hossain et al. (2022) demonstrated the use of a number of antimicrobials, either singly or in conjunction with other antimicrobials, to treat a variety of diseases in large animals.

Perceptions of dairy farmers on the negative impact of antibiotic use

According to Sadiq et al. (2018), the majority of farmers showed little concern about the detrimental impacts of antibiotic resistance on animal and public health. Consuming antimicrobial-contaminated meat and milk by humans increases the risk of developing antimicrobial resistance (AMR) by causing allergies, teratogenic effects, decreased reproductive function, acute toxicity, carcinogenicity, and the emergence of AMR bacteria (Singh et al., 2014; Asredie and Engdaw, 2015). Since most of the dairy cattle farmers in the present study (70%) were not familiar with the negative impact of antibiotics use in dairy cattle on human health hazards, it suggests the necessity of awareness creating among them on the public health hazards by antibiotic residue in milk.

According to Adesokan et al. (2016), only 49.54% of dairy farmers in Nigeria demonstrated a thorough awareness of antimicrobial resistance (AMR), which was also substantially correlated with higher education ($p = 0.01$). About 81% of interviewees did not know that antibiotic resistance has an impact on animal health (Rahman et al., 2021). According to McDougall et al. (2017), farmers who showed minimal awareness or concern regarding the threat posed by antibiotic resistance in their herds and humans, respectively, raised the risk of resistance in both.

Antibiotic withdrawal periods

Since majority of the dairy cattle farmers (85.71%) did not consider the withdrawal period of antibiotics for milk sale it is a great public concern. According to a study by Rahman et al. (2021), only 1% of farmers adhered to the advised antibiotic withdrawal period, while the majority of farmers (99%) did not. Due to their prescribers' failure to specify the withdrawal period in their recommendations, the majority of respondents did not adhere to the guidelines (Rahman et al., 2021). This result is in line with studies from Nigeria, where 91.67% of livestock owners reported never receiving advise from their veterinarians to follow the antibiotic withdrawal periods, and 81.02% of respondents were unaware that drugs have a withdrawal period (Adesokan et al., 2016). Lack of farmers' knowledge of antibiotics withdrawal times and health inferences mirrors results from other low-income areas (Sadiq et al., 2018).

Awareness of antibiotic usage guidelines

The results of the study show that majority (88.33%) of the dairy cattle farmers didn't know the Government rules of using antibiotics. According to Chowdhury et al. (2021), rigorous training is beneficial in educating farmers, feed dealers, and drug marketers about basic biosecurity procedures, excellent farming practices, personal hygiene, and the wise use of antibiotics. Despite the fact that the majority of farmers in New Zealand (79%) were aware that they could develop antibiotic resistance (McDougall et al., 2017). According to Adesokan et al. (2016), 81.02% of Nigerians were not aware of the drug withdrawal phase.

Problems stated by the dairy cattle farmers

The findings showed that 85% of the dairy cattle farmers faced moderate problems followed by 13.3% high problem and only 1.7% less severe problems. Al Mamun et al. (2018) reported that majority 73.3% of the respondents had less problem confrontation while 26.6% of the respondents had medium problem confrontation and none of them had high problem confrontation.

Rahman et al. (2025) stated that 10.71% of farmers realized the significance of withdrawal periods, 11.07% acknowledged the risks to public health, and 5.71% comprehended the residual effects of antibiotics. Similarly, only 14.46%, 16.75%, and 7.71% of informal practitioners were aware about the withdrawal periods, public health risk, and the residual effects of antibiotics, respectively. These gaps underline the crucial necessity for organized farmers' training programs and the incorporation of antibiotic stewardship within livestock policies. Training initiatives, joined with firmer investigation of medicine supply and veterinary prescription implementation, could significantly control misapplication. Enhancing farmer–veterinary contact is vibrant for rational antibiotic uses and harmless milk production.

Conclusion

Antibiotic application by dairy farmers in Khulna remains a human health hazard, mostly due to non-professional prescription, lack of withdrawal consciousness, and lac of regulatory agreement. Arranging farmer training programs on judicious antibiotic applies, confirming veterinary mistake, and implementing withdrawal period adherence are critical steps to alleviate the hazards of antibiotic residues in milk and to protection of consumer health.

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