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Knowledge, Attitude, and Practice Related to Antibiotic Use and Resistance towards Dairy Camel Farmers in the Banadir Region, Somalia

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Abstract

Despite the widespread utilization of antibiotics among camel dairy farmers in the Banadir Region of Somalia, an alarming 70% of the surveyed farmers showed a lack of awareness about the critical issue of antibiotic resistance. This cross-sectional study, conducted among 100 respondents from 83 intensive and semi-intensive camel dairy farms across five districts, aimed to evaluate the knowledge, attitudes, and practices concerning antibiotics. The findings also revealed gender disparities, with limited female participation due to the predominantly male ownership and workforce in camel dairy farming. The antibiotics commonly utilized by the farmers include oxytetracycline, tetracycline, and streptomycin. It has been observed that 80% of farmers used antibiotics without a veterinary prescription. The study findings shed light on the prevalent use of these antibiotics against various pathogens, with 41% used for bacterial diseases, 34% for fungi, and 24% for parasites. It is concerning to note that antibiotics are being used for various purposes, including treatment (58%), prevention (23%), and growth promotion (19%). What's more alarming is that farmers are administering antibiotics without veterinary assistance (88%), and a significant number (79%) are consuming milk during antibiotic administration without observing withdrawal periods (81%). These findings underscore the urgent need for interventions to enhance antibiotic knowledge and attitudes and promote responsible antibiotic practices among cam dairy farmers. Effective strategies should include targeted educational campaigns, training programs, and policy initiatives to curb inappropriate antibiotic use and mitigate the risk of antibiotic resistance.

Keywords: *Antibiotic use, resistance, knowledge, camel farmers, Somalia.*

1. INTRODUCTION

The widespread problem of antibiotic resistance has raised alarm bells globally, as it is estimated to cause around 0.7 million fatalities annually. By 2050, the number of antibiotic-resistant bacterial strains is projected to rise to 10 million annually (Piotrowski et al., 2014). These strains pose a growing threat to both animal and human health. Antibiotic residues are deposited in milk due to the usage of these drugs in animals raised for food. (Ouwehand et al., 2016).

The extensive and untargeted use of antimicrobials in food animals is a significant factor contributing to the problem of antimicrobial resistance and residue, which has become a pressing issue for both human and animal health in developing countries like Somalia, as well as a matter of growing concern for the general public(Hossain et al., 2022). Antibiotic resistance is thought to be primarily caused by the use of antibiotics in livestock production worldwide. (Geta et al., 2022).

Antimicrobial usage in food animals, unrestricted and widespread, contributes to the emergence of antimicrobial resistance and residue, which pose pressing public and animal health issues in developing nations. (Hossain et al. 2022).

Due to the lack of a withdrawal time when milking treated camels is deemed unsuitable for consumption, the recent increase of camel farming in Somalia is noteworthy in terms of widespread antibiotic usage and resistance (Hassan et al., 2023). Other reasons include

needing more essential knowledge on antimicrobial resistance among livestock keepers, unregulated waste disposal, and self-medication using antimicrobials. AMR is being observed at a time when there has been a diminishing number of novel antimicrobials, risking the rise of untreatable infections and the inevitable loss of life, especially in resource-limited countries with limited treatment options (Sindato et al., 2020). The deficiency in public health capability is also a concern, particularly considering the evolving resistance mechanisms and the rise of multidrug-resistant bacteria, which necessitate identification through systematic screening in microbiology laboratories that adhere to quality standards (Liu et al., 2016)

Assessing camel dairy farmers' knowledge, attitudes, and practices (KAP) about antibiotic use and resistance is crucial for designing effective control and prevention strategies. These assessments aid in detecting malpractices and identifying gaps in the farmers' understanding (Mohamed et al., 2021). While antimicrobial resistance (AMR) is widely recognized as a global issue, its extent must be more adequately comprehended in numerous regions worldwide (Tadesse et al., 2017).

Data Sources and Measurements: The study used a **self-administered questionnaire (English version)** as the primary tool for collecting data. The researcher and trained researcher assistants collected the data. The study used this data collection method because questionnaires can collect information about people's knowledge, attitudes, and practices. This study is concerned with variables that cannot be found through the observation of the respondents. Moreover, the selection of this instrument is guided by the time available to conduct this research, the research questions, and the study's objectives. The questionnaire was pretested in the Dayniile District. These instruments included closed-ended and open-ended questions to capture a wide range of information. The questionnaires covered topics on knowledge about antibiotic use, resistance, withdrawal period, and purpose of usage, as well as attitudes and practices related to antibiotic use and resistance.

2. METHODOLOGY

This study focuses on camel dairy farms in Banadir, Somalia, specifically in five districts on the outskirts of Mogadishu: Hodan, Dayniile, Yaqshiid, Karan, and Dharkenley. These districts were chosen deliberately because of their significant camel population. Conducted from March to December 2023, this cross-sectional study aimed to assess the knowledge, attitudes, and practices regarding antibiotics and resistance among camel dairy farmers in the Banadir Region. The selection of these districts was driven by the need for more information on Mogadishu's camel dairy farms and the relevance of their animal populations to the study's objectives.

2.1. Sampling Procedure

The study utilized a purposive non-probability sampling technique to gather information on the number of camel farms, focusing on the five districts chosen for their significant camel population. Random samples were collected from individuals associated with these farms. The study involved 100 respondents from the target population. The study used the Slovene formula to determine the sample size of the actual respondents.

$$n = \frac{N}{[1 + N(\propto^2)]}$$

$$n = \frac{134}{[1 + 134(0.05^2)]}$$

$$n = \frac{134}{[1 + 134(0.0025)]}$$

$$n = \frac{134}{[1 + 0.275]}$$

$$n = 100$$

Where formula states: n = sample size, N=target population; and α=0.05 level of significance

3. RESULTS

Results from Table 2 show respondents' demographic data, while Table 3 can be observed in the analysis of knowledge data on the use of antibiotics on farms. All respondents (100%) indicated that they know antibiotics. Among the respondents, 30 (30.0%) reported having heard about antibiotic resistance, while 70 (70.0%) stated that they had not heard about it. The primary sources of information about antibiotics reported by respondents were veterinary doctors (63.0%), TV and radio (30.0%), and social media (7.0%), which said social media was their source of information about antibiotics. When asked about the microbes treated with antibiotics, respondents

mentioned parasites (24.0%), bacteria (41.0%), viruses (1.0%), and fungi (34.0%). Regarding regularly used antibiotics, respondents cited penicillin (15.0%), streptomycin (17.0%), tetracycline (22.0%), oxytetracycline (33.0%), and enrofloxacin (13.0%). The reasons for using antibiotics reported by respondents were prophylactics (23.0%), growth promotion (19.0%), and therapeutics (58.0%).

According to the result, Table 4 shows the attitude of the respondents towards the use of antibiotics. 18.0% of respondents acknowledged misuse of antibiotics, while 82.0% did not.

Regarding the effects of overdosing on antibiotics, 13.0% of respondents agreed that it affects them, while 87.0% did not.18.0% of respondents agreed on the importance of antibiotic withdrawal periods, while 82.0% did not.20.0% of respondents believed antibiotics reduce resistance, while 80.0% did not.79.0% of respondents agreed when asked about administering antibiotics, while 21.0% did not.

Overall, the results from Table 5 indicate that 79 out of 100 respondents (79.0%) reported drinking milk after administering antibiotics, while 21 respondents (21.0%) did not. Out of 100 respondents, only 19 (19.0%) reported waiting for withdrawal periods after administering antibiotics, while the majority, 81 respondents (81.0%), did not wait. The respondents' storage practices for antibiotics are as follows: 13 (13.0%) store them in the refrigerator, 55 (55.0%) in the storeroom, 14 (14.0%) in the barn shelter, and 18 (18.0%) under trees. Regarding the administration of antibiotics, 12 respondents (12.0%) reported that vet doctors administer them, while the majority, 88 respondents (88.0%), reported self-administration.

Table 1. *Showing categories of respondents and sample size*

District	Target population			Sample size		
	Camel workers	**Owners**	**Total**	**Camel keepers**	**Owners**	**Total**
Dharkenley	40	9	49	31	8	39
Hodan	19	5	24	13	4	17
Dayniile	16	4	20	10	4	14
Kaaraan	17	4	21	9	3	12
Yaqshiid	14	6	20	12	6	18
Total	106	28	134	75	25	100

Table 2. *Analysis of demographic data*

`	**Responses**	**Frequency**	**Per cent**	**Cumulative percent**
Gender	Male	94	94.0	94.0
	Female	6	6.0	6.0
	Total	100	100.0	
Age	15-20 years	2	2.0	2.0
	21-30 years	17	17.0	17.0
	31-40 years	57	57.0	57.0
	More than 45	24	24.0	24.0
	Total	100	100	
Educational Level	Primary	9	9.0	9.0
	Secondary	9	9.0	9.0
	University	12	12.0	12.0
	Literacy	70	70.1	70.1
	Total	100	100	
Camel farming experience	6 Months	22	22.0	22.0
	1Year	9	9.0	9.0
	2Year	22	22.0	22.0
	3Year	47	47.0	47.0
	Total	100	100.0	
District of origin of respondent	Dharkeenlay	39	39.0	39.0
	Hodan	17	17.0	17.0
	Deynile	14	14.0	14.0
	Karan	12	12.0	12.0
	Yaqshiid	18	18.0	18.0
	Total	100	100	

Table 3. *Analysis of knowledge data*

Questions	**Responses**	**Frequency**	**Percent**
Do you use antibiotics on your farm?	Yes	100	100.0
	No	0	0.0
Have you ever heard about antibiotic resistance?	Yes	30	30.0
	No	70	70.0
	Total	100	100.0
Source of information about antibiotics	Social media	2	7.0
	Veterinary doctor	19	63.0
	TV and Radio	9	30.0
	Total	30	100.0
Microbe treatment is used for antibiotics	Parasites	24	24.0
	Bacteria	41	41.0
	Virus	1	1.0
	Fungi	34	34.0
	Total	100	100.0
Regularly used for antibiotic	Penicillin	15	15.0
	Streptomycin	17	17.0
	Tetracycline	22	22.0
	Ox tetracycline	33	33.0
	Enrofloxacin	13	13.0
	Total	100	100.0
Reasons use antibiotics	Prophylactics	23	23.0
	Growth promotion	19	19.0
	Therapeutics	58	58.0
	Total	**100**	**100.0**

Table 4. *Analysis of attitude data*

Question	Responses	Frequency	Percent
Misuse for antibiotic	Yes	18	18.0
	No	82	82.0
	Total	100	100.0
Overdose affects antibiotic	Yes	13	13.0
	No	87	87.0
	Total	100	100.0
Withdrawal periods for antibiotics	Yes	18	18.0
	No	82	82.0
	Total	100	100.0
Antibiotics reduce resistance	Yes	20	20.0
	No	80	80.0
	Total	100	100.0
Administer antibiotics Uses	Yes	79	79.0
	No	21	21.0
	Total	100	100.0

Table 5. *Analysis of practice data*

QuestionResponses	Frequency	Percent	
drink milk after you administer antibiotics	Yes	79	79.0
	No	21	21.0
	Total	100	100.0
Administration of antibiotics on your farm	Vet doctors	12	12.0
Injection of antibiotics of animals without a prescription	Self-administration	88	88.0
	Total 100 No	20	20.0
	Total	100	100.0

Storage of antibiotics	**Refrigerator**	13	13.0
	Storeroom	55	55.0
	Barn shelter	14	14.0
	Under trees	18	18.0
	Total	100	100.0

4. DISCUSSION

One hundred respondents were interviewed using a semi-structured questionnaire in the current study. All camel dairy farmers from 83 intensive and semi-intensive camel dairy farms in five districts of the Benadir Region used antibiotics. Understanding holds a crucial significance in the context of antibiotic use and resistance. Our survey demonstrated that 70% of farmers lack literacy, contrasting with the findings in a study conducted in Turkey (Ozturk et al., 2019). Farmers who completed their primary schooling exhibited limited Knowledge, Attitude, and Practice (KAP) responses regarding the use of antibiotics and resistance(Sitotaw et al., 2023).

Numerous researchers propose fostering understanding and awareness regarding antibiotics and antibiotic resistance, which is crucial for judicious use (Trepka et al., 2001). In less-educated populations like Somali camel farmers, knowledge is anticipated to be primarily gained through hands-on experience in camel dairy farms, as indicated by a study conducted by (Odongo et al., 2017). This study indicates that a limited proportion of the participants, amounting to 30%, have been informed about antibiotic resistance through various channels. Our research showed that the results are consistent with the results of Eltayb et al.'s research conducted in 2012 in Sudan, Khartoum state, and the result shows equality. Camel dairy farmers commonly use antibiotics such as ox tetracycline, tetracycline, and streptomycin. This pattern closely resembles the discoveries of Ogunleye et al. (2008) in Southwestern Nigeria, where gentamicin and tetracycline were prevalent in antibiotic usage. This study revealed that camel dairy farmers commonly employ ox tetracycline, tetracycline, and streptomycin as frequently utilized antibiotics. Consequently, the residues of these antibiotics in dairy products are transmitted to consumers through ingestion. Like the study of Brown et al. (2012), consuming milk contaminated with antimicrobials poses potential risks, including teratogenic effects, diminished reproductive performance, allergies, acute toxicity, carcinogenicity, and the emergence of antimicrobial-resistant (AMR) bacteria, thereby increasing the risk of AMR development (Kyuchukova *et al*., 2020)

Antibiotics may be utilized in animal farming for therapeutic and non-therapeutic objectives (Annan *et al*., 2012; Darwish *et al.,* 2013). In this survey, farmers employed various antibiotics for disease treatment (58%), prevention (23%), and growth promotion (19%). These findings match a prior study investigating the use of antimicrobial drugs for treatment and prevention in farms within Ghanaian communities; taking advantage of the situation, manufacturers have produced and marketed poultry feed supplements containing banned antibiotics. (Annan *et al*., 2012).

Furthermore, the research indicated that 82% of farmers lack awareness regarding antibiotic misuse and resistance, echoing similar findings reported in previous studies. (Forgetta *et al*., 2012).

Our study also demonstrates that (80%) of participants administer antibiotics without a prescription, which surpasses the findings of a previous study where slightly more than half of the farmers (54.2%) believed that antibiotics should only be prescribed by veterinarians (Gebeyehu *et al*., 2021). This result contradicts the outcomes of the current study.

Additionally, the study indicates that respondents stored antibiotics in different locations: 13 (13.0%) in the refrigerator, 55 (55.0%) in the storeroom, 14 (14.0%) in the barn shelter, and 18 (18.0%) under trees, a figure lower than reported in some studies on poultry farmers in Bangladesh but higher than in Nigeria (Ferdous *et al.,* 2019; Alhaji *et al*., 2019). Furthermore, investigation reveals that most farmers prefer self-administration over seeking veterinary assistance; notably, (88%) of camel dairy farmers make decisions independently when administering antibiotics. These findings are similar to the conclusions from other studies in Ghana(Boamah et al., 2016).

Appendix 1: Figure 1. *A map showing the districts of Study in Benadir Region, Mogadishu, Somalia*

5. Conclusion

The study found that only 30% of camel dairy farmers know antibiotic resistance. Commonly used antibiotics, including oxytetracycline, tetracycline, and streptomycin, pose a risk of residues in dairy products, with potential health consequences for consumers.

The predominantly male composition of camel dairy farm owners and workers is noted, reflecting a gender disparity in the profession. Alarmingly, 82% of farmers lack awareness of antibiotic misuse and resistance, while 79% consume milk on camels during antibiotic administration. These findings underscore the need for targeted education and interventions to address knowledge gaps and mitigate potential health risks associated with antibiotic use in camel dairy farming.

6. Recommendations

This study provides baseline data on the KAP of camel dairy farm owners/workers regarding antibiotic use and resistance, which may be helpful to authorities in developing strategies to combat antibiotic resistance. Recommendations include:

- Develop and implement educational programs to enhance farmers' knowledge about antibiotics, including their proper use, potential risks, and the development of antibiotic resistance.
- Offer training sessions or workshops targeting dairy camel farmers to promote

responsible antibiotic use and prudent management practices.

- Improve access to veterinary services in rural areas of Banadir Region to ensure farmers have access to professional guidance on animal health management, including appropriate antibiotics use.
- Establish mobile veterinary clinics or outreach programs to provide veterinary services directly to dairy camel farmers in remote areas.
- Strengthen monitoring systems to regulate the sale and use of antibiotics in livestock farming.
- Implement policies to restrict the over-the-counter sale of antibiotics and require prescriptions from qualified veterinarians for their use in livestock.
- Encourage the adoption of alternative strategies for disease prevention and control, such as vaccination, improved hygiene practices, and proper nutrition for dairy camels.
- Engage with local communities through awareness campaigns, workshops, and community meetings to raise awareness about the importance of antibiotic stewardship and the risks of antibiotic resistance.

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