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Assessment of Livestock Owners' Knowledge, Attitude and Practice towards Antimicrobial Usage and Resistance in Amhara Region, Ethiopia

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ABSTRACT

Antibiotic resistance is a major concern for humans and animals, especially in less developed countries such as Ethiopia. Livestock owners often misuse antibiotics, use incorrect doses, and ignore instructions for proper medication use. The present study aimed to evaluate the knowledge, attitudes, and practices regarding antimicrobial use (AMU) and antimicrobial resistance (AMR) in Ethiopia. A cross-sectional study was conducted to assess livestock owners' knowledge, attitudes, and practices (KAP) regarding antibiotic use, antibiotic residues, and antibiotic resistance in Ethiopia. Structured interviews were conducted with eligible participants to gather insights on their perceptions and self-reported practices related to AMU and AMR. A survey involving 240 livestock owners assessed their backgrounds, knowledge, attitudes, and practices. Among the livestock owners, 84.6% were men, 36.2% had only completed primary education, and 88.8% were aware of AMR and AMU. Antimicrobial use and AMR were not comprehended by 58.8% of respondents. A significant number of respondents mistakenly believed that antibiotics were effective against viral infections. Additionally, 76.7% of respondents reported consuming animal-derived products at home from animals treated with over-the-counter medications without observing the recommended withdrawal periods, even though 75% of respondents were aware of the antibiotic withdrawal periods for ill animals. In the present study, 47.9% of respondents reported giving antibiotics to their animals in the past month, primarily for illness prevention or treatment. There was a significant association across KAP scores and gender, education, income, and farming experience. Although livestock owners have adequate knowledge and positive attitudes toward antibiotic use, many still engage in practices that may contribute to AMR.

Keywords: Antimicrobial use, Antimicrobial resistance, Drug residue, Livestock owner, Veterinary

INTRODUCTION

In developing countries such as Ethiopia, the increasing demand for animal- derived food products has led to a substantial rise in the use of antimicrobials in food animal production. Global antimicrobial consumption in livestock was projected to increase by approximately 67% between 2010 and 2030 (Van Boeckel et al., 2015; Ibrahim et al., 2020).

Ethiopia possesses the largest livestock population in Africa, with an estimated 59 million cattle, 30.7 million sheep, 30.2 million goats, 56.87 million poultry, and 11 million equine (CSA, 2017). Despite this extensive livestock resource, the sector's productivity remains below its potential (FAO, 2019). Several factors contribute to low livestock productivity, including traditional husbandry practices, poor genetic potential, inadequate nutrition, and a high prevalence of infectious diseases (Belay et al., 2012; CSA, 2017). Antimicrobial use (AMU) plays a critical role in animal health management and is widely used for therapeutic purposes, disease prevention such as prophylaxis and metaphylaxis, and, in some countries, growth promotion (Clement et al., 2019). However, inappropriate and excessive use of antimicrobials has become a major concern for animal and public health. In Ethiopia, the regulation and supervision of veterinary AMU are still quite limited, and livestock owners often have easy access to veterinary medicines without adequate professional guidance. Such practices may contribute to the emergence and spread of antimicrobial resistance (AMR) among animals and humans (Clement et al., 2019).

Antimicrobial resistance is a growing global health threat that reduces the effectiveness of antimicrobial medicines, resulting in treatment failure, increased morbidity and mortality, and higher economic losses in livestock production (Murray et al., 2022). Resistant pathogens can spread between animals and humans through direct contact, contaminated environments, and consumption of animal-derived food products such as meat and milk (Van Boeckel et al., 2019). Pathogens, including *Salmonella* spp. and *Escherichia coli*, have been identified as important zoonotic organisms capable of transmitting resistant strains to humans, posing significant public health risks (Ngangom et al., 2019; Almansour et al., 2023).

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Several studies conducted in Ethiopia have reported the presence of antimicrobial residues in foods of animal origin and inappropriate AMU practices among livestock owners (Gebeyehu et al., 2021; Gemeda et al., 2021). The livestock sector, which plays a vital role in income generation and livelihoods, is increasingly threatened by the misuse of commonly used veterinary medicines.

Assessing livestock owners' knowledge, attitudes, and practices (KAP) regarding AMU and AMR is essential for developing effective intervention strategies (Gemeda et al., 2020). These assessments provide essential insights for developing awareness campaigns, educational programs, and policies aimed at promoting the responsible use of antimicrobials and preventing AMR. In urban and peri-urban areas such as Debre Markos, Ethiopia, where veterinary services and livestock activities are prevalent, assessing livestock owners' KAP can play a key role in enhancing antimicrobial stewardship and protecting public health (Yizengaw et al., 2026).

Although KAP is a key determinant of AMU practices, limited information is available regarding these factors among livestock owners in Debre Markos, Ethiopia. Livestock owners often purchase veterinary medicines without prescriptions, administer antimicrobials without professional consultation, and fail to observe recommended withdrawal periods (Gemeda et al., 2020). Furthermore, weak regulatory enforcement and unrestricted access to veterinary medicines may facilitate inappropriate AMU and accelerate the development of AMR (Gebeyehu et al., 2021).

The lack of baseline data on AMU and AMR in the study area represents a significant evidence gap and should be considered essential for developing effective behavioral and policy strategies. Therefore, the present study aimed to assess livestock owners' KAP regarding AMU and AMR practices in the Amhara Region, Ethiopia.

MATERIALS AND METHODS

Ethical approval

The present study was approved by the Ethics Committee of the East Gojjam Zone Livestock Development Office, Ethiopia (No. 0054EHLDF/2025) on December 18, 2025. All participants received a thorough explanation of the study's goal, and prior to the interview, informed verbal consent was acquired. Participants received assurances that the data they provided would be kept private and used exclusively for the present study. Respondents were free to leave the study at any time without facing any repercussions, as participation was entirely voluntary.

Study location

The study was conducted in Debre Markos city, located in East Gojjam Zone of the Amhara National Regional State, Ethiopia, from September to November 2025 (Figure 1). Debre Markos serves as the administrative center of East Gojjam Zone and is situated in Northwestern Ethiopia, approximately 300 km from Addis Ababa and 265 km from Bahir Dar, the regional capital. Geographically, the city is located at 10º 21′ North latitude and 37º 43′ East longitude.

East Gojjam Zone comprises 18 districts and 7 urban administrations. The area is characterized by diverse agro-ecological conditions, with approximately 60% of the land classified as highland and 40% as midland. The elevations range from 2,800 to 4,100 meters above sea level, and the annual rainfall ranges between 900 and 1,200 mm (CSA, 2017).

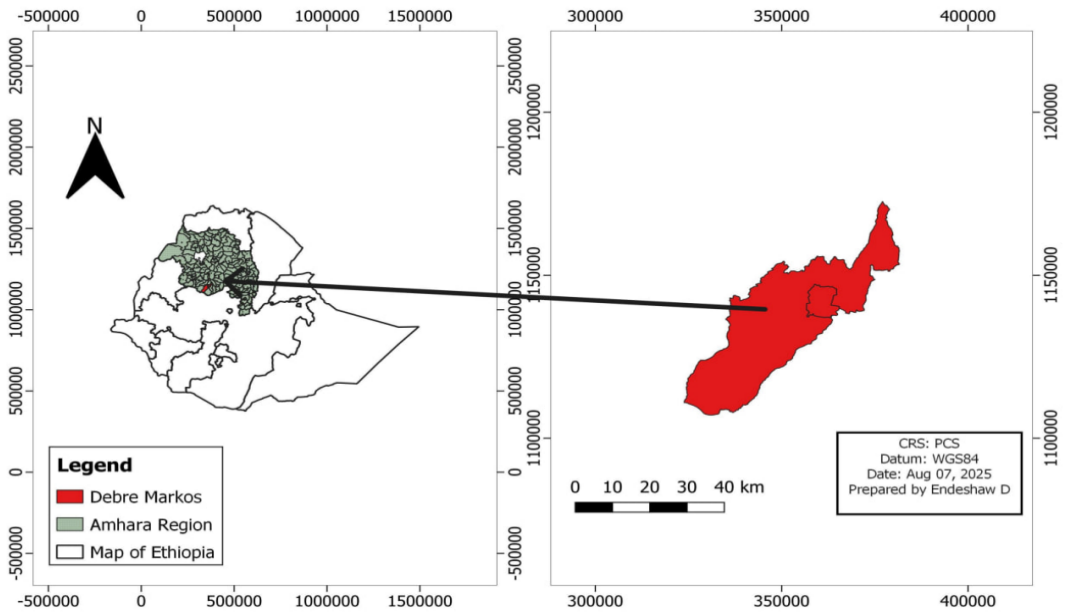

Figure 1. The study area, Debre Markos City, Ethiopia. Source: Generated using ArcGIS software version 3.1 (Designed by authors)

The zone has an estimated 342,000 households (CSA, 2017) and is predominantly characterized by a mixed crop-livestock production system. The major livestock species raised in the area include cattle, sheep, goats, equines, and poultry. The population in and around Debre Markos City is highly dependent on livestock production and veterinary services for their livelihoods, making the area a suitable and strategic location for conducting this study (CSA, 2017).
The study included 240 livestock owners living in Debre Markos town who were actively involved in livestock production. The study included livestock owners raising cattle, sheep, goats, poultry, and equine. The inclusion criteria were: being a livestock owner actively involved in livestock production and management, aged 18 years and above, and their willingness to participate in the study. Exclusion criteria included individuals who were unwilling to participate, did not own livestock, were aged less than 18 years old, or were unable to provide reliable information during the interview.

Study design and period

A cross-sectional study was conducted to assess KAP of livestock owners on AMU, AMR, and antimicrobial residues. The study was conducted from September to November 2025.

Sample size and sampling method

A multistage sampling method was used. First, kebeles were selected randomly, followed by systematic random selection of livestock owners.

The sample size for this field study was determined using a single population-based formula for cross-sectional surveys to assess KAP (Lwanga and Lemeshow, 1991). Because no prior study had documented the percentage of livestock owners with sufficient KAP regarding AMU and AMR in the study area, a 95% confidence level (Z = 1.96), a5%margin of error(e = 0.05), and an expected proportion of 50% (p = 0.5) were assumed.

$n = Z^2p(1-p)/e^2 = (1.96^2 \times 0.5 \times 0.5)/(0.05^2)$

The initial sample size was 384 participants. A finite population correction was applied because the total number of livestock-owning households in the chosen kebeles of Debre Markos town in Ethiopia was 500, which was less than 10,000. The corrected sample size, nf = n/[1 + (n/N)], where nf was the final sample size following correction, n was the original sample size (384), and N was the overall population size (500), was used to calculate the corrected sample size. The total number of participants was 218, calculated as follows.

nf = 384/[1 + (384/500)] = 384/1.768 = 218 participants

After adding a 10% contingency for potential non-response and missing questionnaires (218 + [218 × 0.10] = 240), the final sample size for the study was 240 livestock owners (Lwanga and Lemeshow, 1991). The additional 10% was added only during sample size determination to account for possible nonresponse and incomplete questionnaires. The additional 10% was not applied during data analysis and therefore did not introduce bias, resulting in a total sample size of 240 respondents.

Data collection methods

A standardized semi-structured questionnaire was developed and used to assess the livestock farmers' KAP. The questionnaire was initially developed in English and translated into the Amharic language for the interview process to ensure clarity and effective communication with the participants. To ensure the cooperation of livestock owners and to obtain reliable data, the objectives of the study were clearly explained before the start of each interview.

Study variables

The dependent variable of the study was the level of KAP related to AMU and AMR among livestock owners. The independent variables include different demographic and related factors such as age, gender, educational background, occupation, income level, access to veterinary services, and exposure to training on AMU and AMR.

Data analysis

Data collected through interviews were entered into Microsoft Office Excel 2010 for data cleaning and coding, and then exported to SPSS version 20 for statistical analysis. Descriptive statistics were employed to summarize the data, with frequencies and percentages calculated for categorical variables including respondents' socio-demographic characteristics and their KAP regarding AMU and AMR. The current results were presented in tables to facilitate the clear interpretation of the findings.

The association between respondents' socio-demographic characteristics and their KAP levels was assessed using Chi-square ($\chi 2$). A p-value of less than 0.05 was considered statistically significant ($p < 0.05$).

RESULTS

Socio-demographic characteristics of the respondents

According to the socio-demographic analysis, most respondents were male (84.6%). Regarding educational status, 36.2% of the participants had completed primary school. The majority of respondents (88.3%) were married. In terms of income, 47.5% reported a monthly income of less than 5,000 Ethiopian birr. Regarding farming experience, 30.4% had worked in the livestock sector for five or more years (Table 1).

Table 1. Socio-demographic characteristics of participants in Debre Markos, Ethiopia in 2025

Household variables	Categories	Frequency	Percentage
Sex of respondent	Male	203	84.6
	Female	37	15.4
Age	≤ 30 years	60	25
	31-40 years	113	47
	41-50 years	47	19.5
	≥ 51 years	20	8.3
Education level	Not able to read and write	68	28.3
	Primary school	87	36.2
	High school	38	15.8
	College/University	47	19.6
Marital status	Single	28	11.7
	Married	212	88.3
	Divorced/Widowed	0	0
Monthly income in Ethiopian birr	< 5000	114	47.5
	5000-15,000	96	40
	> 15,000	30	12.5
Years of farming experience (years)	< 5	114	47.5
	5-10 years	73	30.4
	11-15 years	31	12.9
	≥ 16 years	10	4.2

Knowledge of antimicrobial use, resistance, and residue

The study findings indicated that livestock owners' understanding of medication residues, AMU, and AMR differed. While the majority of respondents (80.8%) were aware that antibiotics are used to treat bacterial illnesses, 58.7% mistakenly believed that antibiotics were effective against viral infections. Although 51.7% of respondents were aware that resistant bacteria can spread from animals to people, over half of the respondents (60%) knew that the misuse or overuse of antibiotics might contribute to AMR. Only 31.7% of respondents were aware that AMR can result from inappropriate AMU, which includes early treatment termination, incorrect dosage, failure to adhere to the recommended treatment duration, and the use of inappropriate medicines. Furthermore, 92.5% of respondents acknowledged the possible health hazards connected to antibiotic residues in food products of animal origin, and 75% of respondents were aware of the withdrawal time after antimicrobial treatment. Fewer respondents mentioned overcrowding and poor hygiene (19.2%) and inadequate feeding (27.9%) as potential causes of treatment failure. Only 64.6% of respondents identified AMR as a contributing factor in treatment failure. Additionally, 68.3% of respondents linked treatment failure to insufficient diagnostic testing before treatment, 67.1% pointed to poor-quality medicines, and 65.4% identified the inappropriate choice of antimicrobial agents as potential causes. Overall, livestock owners recognized antibiotic use as the primary factor but had limited awareness of indirect contributors, such as poor hygiene and inadequate diet, that contribute to treatment failure (Table 2).

As can be seen in Figure 2**,** the respondents reported that antimicrobial treatment failure may be caused by a number of factors. Antimicrobial resistance was reported by 64.6% of the respondents, while 68.3% mentioned inadequate diagnostic testing prior to treatment. In addition, 67.1% linked treatment failure to poor-quality medications, and 65.4% to inappropriate AMU. Overcrowding or poor sanitary practices (80.8%) and poor feed quality (72.1%) were identified as significant contributing factors. Approximately 95.8% of respondents reported self-prescription and unsupervised AMU by livestock owners as the most frequently reported cause of treatment failure.

Table 2. Knowledge about antimicrobial usage and resistance in Debre Markos, Ethiopia in 2025

Knowledge question	Categories respondents	Number	Percentage
Do you know that antibiotics are used to treat bacterial infections?	Yes	194	80.8
	No	46	19.2
Do you know that antibiotics do not work against viral infections?	Yes	141	58.8
	No	99	41.3
Do you know that misuse of antibiotics can cause resistance in animals?	Yes	144	60
	No	96	40
Can resistant bacteria spread from animals to humans?	Yes	124	51.7
	No	116	48.3
Do you know that incomplete antibiotic treatment can lead to resistance?	Yes	76	31.7
	No	164	68.3
Are you aware of the drug withdrawal period after antibiotic use?	Yes	180	75
	No	60	25
Do you know that antibiotic residues in animal products can affect human health?	Yes	222	92.5
	No	18	7.5
Do you know that AMR is a global public health problem?	Yes	107	44.6
	No	133	55.4

AMR: Antimicrobial resistance

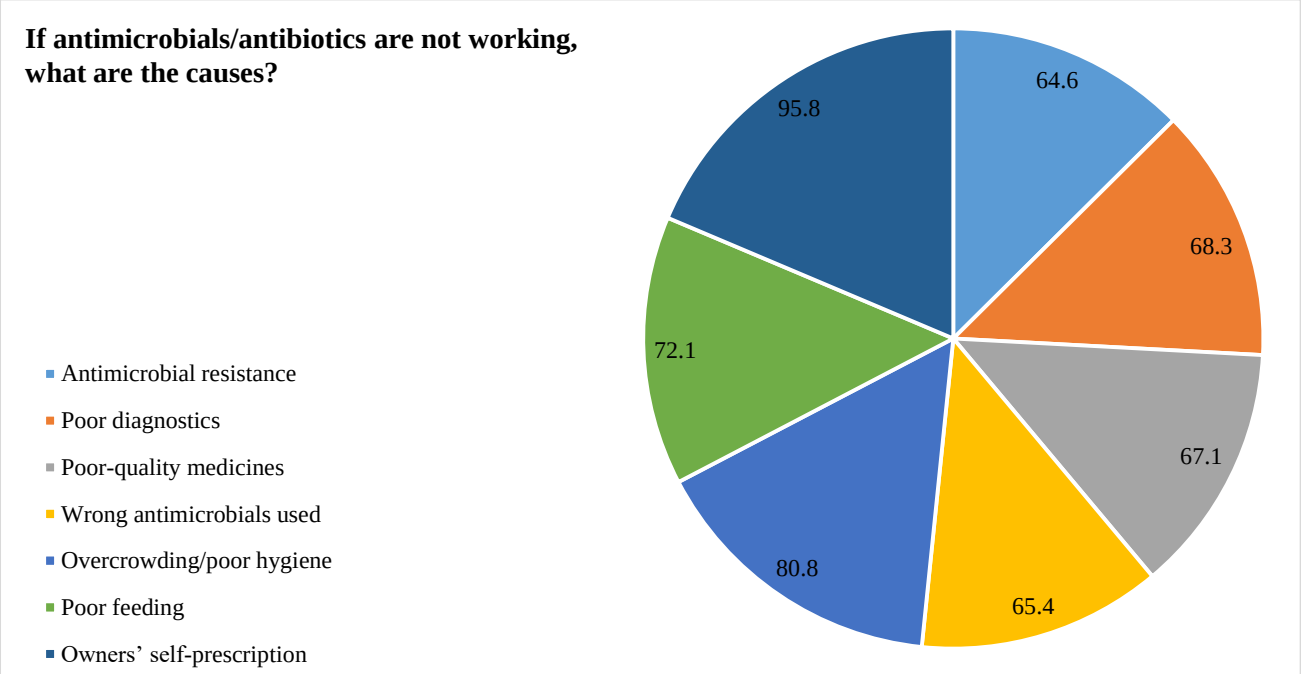

Figure 2. Perceived causes of antimicrobial treatment failure among livestock owners in Debre Markos, Ethiopia, in 2025

Attitudes toward antimicrobial use, resistance, and residue

Regarding the usage of antibiotics in animals, most responses were in agreement. Almost 88% of respondents highlighted the importance of performing diagnostic analyses prior to treatment. Nearly all respondents (99.9%) stated that antibiotics should only be administered under a veterinarian's prescription. A statistically significant proportion of respondents (87.4%) agreed that medicine misuse can lead to AMR ($p < 0.05$). Additionally, 80% of respondents mentioned that performing adequate farming practices such as biosecurity, vaccination, and hygiene helps reduce the demand for antibiotics. However, there was a lack of clarity regarding who was responsible for managing AMR; 75% of respondents believed that farmers should be responsible for managing AMR, while the rest of the respondents were either neutral or disagreed. Most respondents (92.2%) demonstrated a high level of awareness about Antimicrobial Resistance (AMR) and prudent (responsible) use of antibiotics in livestock farming. (Table 3).

Table 3. Attitude about antimicrobial usage and resistance in Debre Markos, Ethiopia in 2025

Characteristics	Categories respondents	Response		Chi-square tests	
		Number	Percentage	Value	Df
Antibiotics should only be used when prescribed by a veterinarian	Strongly agree	191	79.5	22.115	2
	Agree	49	20.4		
Laboratory testing before antibiotic use is important	Strongly agree	153	63.75	18.150	1
	Agree	87	36.25		
Antibiotic misuse in animals contributes to AMR	Strongly agree	182	75.8	262.022	8
	Agree	28	11.6		
	Strongly disagree	30	15.8		
Regulations on antimicrobial usage are necessary to prevent resistance	Strongly agree	123	51.25	95.282	10
	Agree	39	16.25		
	Neutral	28	11.66		
	Disagree	19	7.9		
	Strongly disagree	31	12.9		
AMR is a serious threat to animal health	Strongly agree	125	52.08	95.588	6
	Agree	78	32.5		
	Neutral	37	15.41		
AMR is a serious threat to public health.	Strongly agree	123	51.25	209.766	10
	Agree	47	19.58		
	Neutral	30	12.5		
	Disagree	29	12.08		
	Strongly disagree	11	4.58		
Proper farm biosecurity and vaccination can reduce antibiotic use.	Strongly agree	173	72.08	107.386	8
	Agree	9	3.75		
	Neutral	19	7.91		
	Disagree	10	4.1		
	Strongly disagree	29	12.08		
Farmers should be trained regularly about prudent antibiotic use	Strongly agree	140	58.3	183.74	8
	Agree	40	16.6		
	Disagree	20	8.3		
	Strongly disagree	40	16.6		

AMR: Antimicrobial resistance, DF: Degree of freedom

Practices toward antimicrobial use, resistance, and residue

A total of 47.9% of farmers reported using antimicrobials during the previous month, primarily for treatment (20.4%) or prevention (27.5%), while 52.1% did not use any antimicrobials. The majority of respondents (94.6%) used medications prescribed by experts and relied on veterinary advice. Triclabendazole (also known as Fasinex) and albendazole were antiparasitic medications, and tetracycline and penicillin were the most frequently reported antibiotics used by farmers. Half of the participants reported using antimicrobials only once a month, indicating that these agents were primarily employed infrequently. Medicines were primarily obtained from veterinary clinics (52.9%) and pharmacies (39.2%).

Additionally, incomplete treatment practices were observed; approximately 87.1% of respondents did not complete the full prescribed duration, primarily due to increasing prescription costs, and 12.1% of respondents quit treatment early. The majority of expired prescriptions (44.2%) were appropriately disposed of; however, numerous respondents were unable to verify the expiry date of the medications. Regarding withdrawal periods, the majority of respondents (76.7%) continued to use products from treated animals, while others reported using products at home or selling or providing milk or meat from treated animals to dogs, calves, or households (Table 4).

Table 4. Community response to each practice regarding antimicrobial usage and resistance in Debre Markos, Ethiopia in 2025.

Characteristics	Categories respondents	Response		Chi-square test	
		Number	Percentage	Value	Df
Have you ever prescribed antimicrobials for your animals in the last month?	Yes	115	47.90%	9.893	2
	No	125	52.10%		
If yes, why did you use antimicrobials?	To treat sick animals	49	20.40%	54.357	4
	As a preventive measure (Prophylaxis/Metaphylaxis)	66	27,5%		
If applicable, how did you choose the medication?	Based on recommendations from animal health professionals	203	84.60%	75.996	4
	Self-selection	28	11.70%		
	Recommendations from neighbors				
Who administers antimicrobials?	Veterinarians or animal health professionals	213	88.80%	106/479	4
	The animal owner (without a veterinarian)	18	7.50%		
Which antimicrobials are commonly used on your farm?	Albendazole	18	7.50%	242.943	12
	Tetracycline	49	20.40%		
	Penicillin	20	8.30%		
	Fasinex	28	11.70%		
	Don't know	45	18.70%		
How often did you use antimicrobials in the last month?	Once	116	48.30%	73.631	8
	2 to 5 times	96	40%		
	More than 5 times	19	7.90%		
	6 times	9	3.80%		
What are the sources of antimicrobials you use?	Veterinary pharmacy/drug shops	94	39.20%	111.366	4
	Veterinary clinic	127	52.90%		
	Both	19	7.90%		
Do you ever stop treatment before completing the prescribed course?	Yes	29	12.10%	14.899	2
	No	211	87.90%		
What are the main reasons for stopping antimicrobial treatment early?	Medication is not working/animal died	9	3.80%		
	Animal has shown improvement	10	4.20%		
	Saving for future use (stockpiling)	10	4.20%		
Do you give the full amount and complete course of medicine as written on the label?	Yes	209	87.10%	24.994	2
	No	31	12.90%		
What are the main reasons for not completing the prescribed medicine courses?	Not enough money	21	8.80%	24.994	4
	Thought it was enough	10	4.20%		
If the medicine has passed its expiry date, what do you do?	Do not use it	59	24.60%	78.374	4
	Throw it away	106	44.20%		
	Did not check the expiry date	75	31.20%		
What do you do with meat, eggs, or milk from animals that are being treated or in the withdrawal period?	Feed it to calves, dogs, or pets	184	76.70%	167.433	8
	Sell it to neighbors or contractors	38	15.80%		
	Use it at home	18	7.50%		

DF: Degree of freedom

Socio-Demographic determinants

The respondents' knowledge level was significantly correlated with several sociodemographic characteristics, including age, gender, monthly income, number of animals owned, education level, and marital status. ($p < 0.05$; Table

5). Attitudes exhibited a significant correlation solely with marital status, whereas knowledge level was strongly linked to sociodemographic variables (Table 6; $p < 0.05$).

Additionally, the study discovered a significant correlation between livestock owners' antimicrobial activities and several sociodemographic factors, including gender, marital status, and educational background ($p < 0.05$). Furthermore, a significant correlation was observed between proper practices and monthly income, with farmers earning more than 5,000 birr more likely to practice proper practices than those earning less than 5,000 birr ($p < 0.05$). Additionally, 84.21% of respondents over 40 years old demonstrated high-level proper habits ($p < 0.05$). On the other hand, AMU practice was not significantly impacted by the number of animals kept or farming experience (Table 7).

Table 5. Association of knowledge with socio-demographic characteristics in Debre Markos, Ethiopia in 2025

Socio-demographic characteristics	Categories Respondents	Low (%)	Moderate (%)	High (%)	P-value
Gender	Female	75.68	24.32	0	0.046
	Male	24.14	43.35	32.51	
Marital status	Married	36.32	36.79	32.14	0.027
	Single	0	67.86	57.45	
Educational level	College/university	0	42.55	57.45	0.003
	No formal education	55.88	29.41	14.71	
	Primary	44.83	33.33	21.84	
	Secondary	0	73.68	26.32	
Monthly income	5000 birrs	50.88	25.44	23.68	0.033
	5000-15000	19.79	50	30.21	
	> 15000	0	66.67	33.33	
Number of animals owned	20-49	0	50	25.45	
	< 20	35	39.55	100	0.047
Years of experiences	5-10 years	0	0	100	
	11-15 years	64.52	35.48	0	0.089
	> 16 years	10.47	55.81	33.72	
Age group	20-30	45.71	45.71	8.57	0.002
	31-40	31.86	39.82	28.32	
	> 40	15.79	35.09	49.12	

Table 6. Association of attitude with socio-demographic characteristics in Debre Markos, Ethiopia in 2025

Socio-demographic characteristics	Categories Respondents	Low (%)	Moderate (%)	High (%)	P-value
Gender	Female	75.68	0	24.32	0.865
	Male	77.34	0	22.66	
Marital status	Married	78.3	0	21.7	0.002
	Single	67.86	0	32.14	
Educational level	College/University	61.7	0	38.3	0.004
	No formal education	100	0	0	
	Primary	100	0	0	
	Secondary	70.83	0	29.17	
Monthly income	5000birr	100	0		0.054
	5000-15000	75	0	25	
	> 15000	100	0		
Number of animals owned	20-49	63.01	0	37	0.006
	< 20	75	0	25	0.058
Years of experiences	5-10 years	63.01	0	36.99	
	11-15 years	100	0		
Age group	31-40	91.15	0	8.85	0.701
	> 40	50.88	0	49.12	

Table 7. Association of practice with socio-demographic characteristics in Debre Markos, Ethiopia in 2025

Socio-demographic characteristics	Categories	Low (%)	Moderate (%)	High (%)	P-value
Gender	Female	24.32	24.32	51.35	0.044
	Male	15.27	23.15	61.58	
Marital status	Married	18.87	22.17	58.86	0.019
	Single	0	32.14	67.86	
Educational level	Primary	0	22.99	77.01	0.024
	No formal education	30.88	26.47	42.65	
Monthly income	5000birr	16.67	24.56	58.77	
	> 15000	33.33	0	66.67	0.037
Number of animals owned	20-49	50	0	50	
	< 20	13.64	25.45	60.91	
Years of experiences	5-10 years	35.48	0	100	0.076
	11-15 years	35.48	32.26	32.26	
	> 16 years	0	20.93	79.07	
Age group	20-30	24.29	20	55.71	0.002
	31-40	20.35	29.2	50.44	
	> 40	0	15.79	84.21	0.045

DISCUSSION

The observed discrepancy between livestock owners' knowledge and their AMU practices in the present study was consistent with a previous study conducted in Ethiopia, including Gemeda et al. (2020) who found that 72.3% of pastoralists did not follow the full treatment course, and Tufa et al. (2023), who reported that 94% of farmers had poor knowledge, but 80% still showed good behavior scores. Specifically, livestock owners frequently misused antimicrobials and demonstrated poor adherence to appropriate antimicrobial administration guidelines, despite having awareness of AMU and AMR practices.

Notably, the present study revealed a notable gap between livestock owners' knowledge and their practical application concerning antimicrobials. Although most participants were aware that antimicrobials are used to treat animal illnesses, their actual practices conflicted with this understanding. Key issues included non-prescribed administration, incomplete treatment courses, and non-adherence to recommended dosages or timelines. Such misuse accelerated AMR in livestock, ultimately threatening public health through potential foodborne transmission and environmental contamination pathways.

Additionally, the present study revealed a low level of awareness among livestock owners regarding the development and consequences of AMR, aligning closely with the findings of Gebeyehu et al. (2021). Similarly, Beyene et al. (2015) observed that the use of veterinary medicines in Ethiopia is frequently irrational, further evidence of widespread antimicrobial misuse. Notably, while 75% of respondents in the current study claimed to be aware of medicines withdrawal periods, they still engaged in high-risk behaviors, such as feeding calves or companion animals with products sourced from treated livestock. Such practices increased antimicrobial exposure, promoting the development of resistant bacteria. This result aligned with the findings of Gemeda et al. (2021), who reported higher levels of antimicrobial residues in animal products due to non-adherence to withdrawal periods and improper disposal methods.

The current results further indicated that many livestock owners failed to recognize how suboptimal management practices contributed to treatment failure. Notably, a large proportion of respondents disagreed that overcrowding, poor hygiene, and inadequate feeding practices contributed to disease occurrence and therapeutic failure. These findings suggested that livestock owners relied heavily on antimicrobials as a safety framework, while overlooking important animal husbandry and biosecurity practices. As McKernan et al. (2021) emphasized, robust biosecurity practices and proper animal management are indispensable factors of responsible AMU practices. Similarly, reports from the CSA (2017) indicated that traditional livestock production systems often facilitated disease transmission, underscoring the urgent need to strengthen husbandry practices alongside veterinary antimicrobial stewardship efforts.

Despite generally positive attitudes toward rational medicines administration, several inappropriate practices were identified. For instance, most participants agreed that antimicrobials should only be administered under veterinary prescription, reflecting strong confidence in professional veterinary advice and aligning with Food and Agriculture Organization (FAO) recommendations. However, this positive attitude did not consistently translate into practice, as self-prescription and early discontinuation of therapy were still documented. Similar behavioral gaps were noted by Tufa et al. (2023), who observed that treatments were often cut short due to perceived animal recovery, financial constraints, or a desire to save remaining medication for future use. Mckernan et al. (2021) and Tang et al. (2017) highlighted that non-compliance can lead to the spread of antimicrobial-resistant microorganisms, emphasizing how vital it is to follow prescribed treatments properly.

The present study demonstrated that most antimicrobials were sourced from private veterinary clinics and private pharmacies. However, insufficient regulatory oversight on veterinary medicine distribution, along with the ongoing availability of these medicines without a prescription, greatly contributed to their inappropriate use. Similar concerns regarding unrestricted or uncontrolled access to critical antimicrobials have been widely documented in the literature. Furthermore, the present study demonstrated a remarkable association between KAP outcomes and factors such as educational level, livestock-derived income, and years of herd management experience. These findings highlighted that interventions aimed at improving antimicrobial use should consider the distinct socioeconomic and educational backgrounds of livestock owners. Implementing focused awareness campaigns, customized farmer training sessions, and strengthened veterinary extension services can be essential for encouraging responsible AMU practices and reducing the broader risks of AMR (Gemeda et al., 2020).

The current findings reinforced the global concerns raised by WHO (2019) and FAO, WOAH, and WHO (2020) regarding the growing threat of AMR. Livestock-dependent communities continue to play a pivotal role in the emergence and dissemination of AMR, underscoring an urgent need for coordinated, multi-sectorial efforts. These initiatives should specifically aim to improve antimicrobial stewardship, reinforce national regulatory frameworks, and boost public awareness campaigns focused on responsible use of pharmaceuticals.

CONCLUSION

The present study revealed a substantial gap between livestock owners' knowledge and their actual AMU practice in Debre Markose City, Ethiopia. Many respondents demonstrated adequate knowledge of appropriate AMU practice and the risks associated with AMR. Inappropriate practices, including self-medication, early discontinuation of treatment, use of remaining antimicrobials, purchasing medicines without a veterinary prescription, and failure to observe withdrawal periods, remained common challenges among farmers and livestock owners. The lack of awareness regarding the importance of hygiene and nutrition for disease prevention indicated a significant shortfall in livestock management practices among farmers. Addressing these challenges requires strengthening veterinary extension services through farmer training and community awareness programs, enforcing regulations on antimicrobial sale and use, and improving animal husbandry and biosecurity practices. Further laboratory-based and longitudinal studies are recommended to monitor antimicrobial residue and resistance patterns in livestock and animal-derived food products across the Amhara region in Ethiopia.

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Authors' contributions

Getahun Simeneh conducted data collection, data analysis, and manuscript writing. Yibeltal Simeneh contributed supervision, data interpretation, and manuscript revision. All authors reviewed and approved the final edition of the manuscript.

Availability of data and materials

All data generated during the study are included in the present published article.

Competing interests

The authors declare no conflicts of interest.

Ethical considerations

All authors confirmed that this study is an original article and has not been published before, nor is it under consideration elsewhere. No AI tools were used for preparing the current study. The authors accept full responsibility for the originality of the study before submission and before publication.

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REFERENCES

Almansour AM, Alhadlaq MA, Alzahrani KO, Mukhtar LE, Alharbi AL, and Alajel SM (2023). The silent threat: Antimicrobial-resistant pathogens in food-producing animals and their impact on public health. Microorganisms, 11(9): 2127. DOI: https://www.doi.org/10.3390/microorganisms11092127

Belay D, Kechero Y, and Janssens GPJ (2012). Survey of major diseases affecting dairy cattle in Jimma town, Oromia, Ethiopia. Global Veterinaria, 8(1): 62-66. Available at: https://www.idosi.org/gv/GV8(1)12/11.pdf

Beyene T, Tesega B, and Dechassa A (2015). Rational veterinary drug use: Its significance in public health. Journal of Veterinary Science and Technology, 6(3): 233. DOI: https://www.doi.org/10.4172/2157-7579.1000233

Central statistical agency (CSA) (2017). Agricultural sample survey 2016/17: Livestock and livestock characteristics (Statistical Bulletin No. 585). Central Statistical Agency, Addis Ababa, Ethiopia. Available at: Ethiopian Statistics Service

Clement T, Olaitan AO, and Rolain JM (2019). Emergence of carbapenemase-producing Gram-negative bacteria in animals. International Journal of Antimicrobial Agents, 54(3): 287-297. DOI: https://www.doi.org/10.1016/ j. ijanti micag. 2019.06.001

Food and agriculture organization (FAO) (2019). The future of livestock in Ethiopia: Opportunities and challenges. FAO, Rome. Available at: https://www.fao. Org /ethiopia/resources/en/

Food and agriculture organization (FAO), World organization for animal health (WOAH), and World health organization (WHO) (2020). Tripartite joint action plan on antimicrobial resistance (AMR). Available at: https://www.Who.Int/publications/i/item/9789240003292

Gebeyehu DT, Bekele D, Mulate B, Gugsa G, and Tintagu T (2021). Knowledge, attitude and practice of animal producers towards antimicrobial use and antimicrobial resistance in Oromia zone, north eastern Ethiopia. PLoS One, 16(5): e0251596. DOI: https://www.doi.org/10.1371/journal.pone.0251596

Gemeda BA, Amenu K, Magnusson U, Dohoo I, Hallenberg GS, Alemayehu G, Desta H, and Wieland B (2020). Antimicrobial use in extensive smallholder livestock farming systems in Ethiopia: Knowledge, attitudes, and practices of livestock keepers. Frontiers in Veterinary Science, 7: 55. DOI: https://www.doi.org/10.3389/fvets.2020.00055

Gemeda BA, Assefa A, Jaleta MB, Amenu K, and Wieland B (2021). Antimicrobial resistance in Ethiopia: A systematic review and meta-analysis of prevalence in foods, food handlers, animals, and the environment. One Health, 13: 100332. DOI: https://www.doi.org/10.1016/j.onehlt.2021.100332

Ibrahim A, Abubakar S, and Bello A (2020). Antimicrobial resistance in food-producing animals: A global concern. Veterinary World, 13(10): 2110-2120. DOI: https://www.doi.org/10.14202/vetworld.2020.2110-2120

Lwanga SK and Lemeshow S (1991). Sample size determination in health studies: A practical manual. World Health Organization, Geneva. Available at: https://apps.who.int/iris/handle/10665/40062

McKernan DP, Byrne D, and Kelleher DP (2021). Antibiotic stewardship: Challenges and opportunities in the food-animal sector. Veterinary Sciences, 8(5): 92. DOI: https://www.doi.org/10.3390/vetsci8050092

Murray CJL, Ikuta KS, Sharara F, Swetschinski L, Aguilar GR, Gray A, Han C, Bisignano C, Rao P, and Wool E (2022). Global burden of bacterial antimicrobial resistance in 2019: A systematic analysis. The Lancet, 399(10325): 629-655. DOI: https://www.doi.org/10.1016/S0140-6736(21)0272 4-0

Ngangom BL, Muneer M, and Singh A (2019). Antibiotic residues in food animals and impact on public health. International Journal of Livestock Research, 9(12): 1-12. Available at: https://ijlr.org/ojs_journal/index.php/ijlr

Tang KL, Caffrey NP, Nóbrega DB, Cork SC, Ronksley PE, Barkema HW, Polachek AJ, Ganshorn H, Sharma N, Kellner JD, and Ghali WA (2017). Restricting the use of medically important antimicrobials in food-producing animals and its implications for antimicrobial resistance in food-producing animals and humans: A systematic review and meta-analysis. The Lancet Planetary Health, 1(8): e316-e327. DOI: https://www.doi.org/10.1016/S2542-5196(17)30141-9

Tufa TB, Biffa D, Molla W, Amenu K, and Wieland B (2023). Livestock producers' knowledge, attitude, and behavior (KAB) regarding antimicrobial use in Ethiopia. Frontiers in Veterinary Science, 10: 1167847. DOI: https://www.doi.org/10.3389/fvets.2023.1167847

Van Boeckel TP, Brower C, Gilbert M, Grenfell BT, Levin SA, Robinson TP, and Laxminarayan R (2015). Global trends in antimicrobial use in food animals. Proceedings of the National Academy of Sciences, 112(18): 5649-5654. DOI: https://www.doi.org/10.1073/pnas.1503141112

Van Boeckel TP, Pires J, Silvester R, Zhao C, Song J, Criscuolo NG, Gilbert M, Bonhoeffer S, and Laxminarayan R (2019). Global trends in antimicrobial resistance in animals in low-and middle-income countries. Science, 365(6459): eaaw1944. DOI: https://www.doi.org/10.1126/science.aaw1944

World health organization (WHO) (2019). Awareness of antimicrobial resistance: Factsheet. WHO, Geneva. Available at: https://www.who.int/news-room / factsheets/detail/antimicrobial-resistance

Yizengaw L, Yesigat H, Wondimagegnehu K, Tafere A, Yalew H, Habtie D, Teshager N, and Simeneh Y (2026). Knowledge, attitudes and practices regarding livestock diseases among residents of East Gojjam Zone, Amhara Region, Ethiopia. Veterinary Medicine and Science, 12(1): e70743. DOI: https://www.doi.org/10.1002/vms3.70743