



Assessment of Knowledge, Attitude and Practice of Animal Owners towards Antimicrobial Drug Resistance and Use in and Around Dessie, Northern Ethiopia

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Article Information

Received: May 02, 2026

Accepted: May 15, 2026

Published: May 20, 2026

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Citation: Fentahun S, Melese M, Walelign T, keno S, (2026). "Assessment of Knowledge, Attitude and Practice of Animal Owners towards Antimicrobial Drug Resistance and Use in and Around Dessie, Northern Ethiopia". Journal of Veterinary Medicine and Science, 3(1); DOI: 10.61148/3065-7075/JVMS/052.

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Abstract

The nutritional and economic potential of livestock systems are compromised by the emergence and spread of antimicrobial resistance. The major driver of resistance is misuse, overuse and under dose of antimicrobial drugs. A cross-sectional study was conducted from May 2022 to January 2023 with the objective of evaluating the knowledge, attitudes, and practices of livestock owners towards AMU and AMR in and around Dessie. Structured questionnaire was designed and administered for 422 animal owners. The majority of the animal owners (61.1%) were men, and 45.5% were between the ages of 31 and 50. About 45.7% of animal owner was illiterate, despite the fact that 52.8% of the owners of animals hadn't heard about antimicrobial use and antimicrobial resistance. Farmers (72.3%) were unaware of improper use of antimicrobials in animal can cause AMR. 10.4% of animal owners didn't believe that non drug preventive measures can impede AMR. Despite the reality, 41.7% of respondents administered antimicrobials to their livestock to treat various infections. The respondents 39.3% and 18.2% were purchased their antimicrobials without a prescription from private pharmacies and local dispensers, respectively. Among the total respondents, 57.3% did not administer all the recommended drugs, even though the animals got well. In conclusion, these necessities the need for awareness creation on AMU and AMR. Hence, ongoing community awareness campaigns, training on safe veterinary drug handling and administration, and long-term improvement of animal health service delivery through a well-regulated private service are critical.

Keywords: Antimicrobial use, Antimicrobial Resistance, Attitudes, Knowledge, practice

Abbreviation

AMR	Antimicrobial Resistance
AMU	Antimicrobial Use
FAO	Food and Agricultural Organization
GP	Growth Promoter
KAP	Knowledge, Attitudes and Practices
PG	Prostaglandin
POCT	Point-Of-Care Tests
WHO	World Health Organization

1. Introduction

Ethiopia is rich in livestock and is believed to have the largest livestock population in Africa. The central statistical agency report indicated there are about 60.39 million cattle, 31.30 million sheep, 32.74 million goats, 56.06 million poultry, 2.01 million horses, 8.85 million donkeys, 0.46 million mules, and 1.42 million camels in the sedentary areas of the country (CSA, 2018). However, despite the presence of this huge livestock population, Ethiopia is not exploiting its livestock resources as expected due to a number of factors such as animal diseases, recurrent droughts, infrastructure problems, rampant animal diseases, poor nutrition, poor husbandry practices, a shortage of trained manpower, and a lack of government policies for disease prevention and control (ILRI, 2009). The widely prevalent livestock diseases are major constraints to Ethiopian livestock development (Shitaye *et al.*, 2007); as a result, our veterinary clinicians use antimicrobials and antibiotics for the treatment of these diseases. Veterinary antimicrobial drugs are used in the livestock sector either rationally or irrationally. Rational use of veterinary antimicrobial drugs is based on effective administration of antimicrobials: only use antimicrobials when necessary, use the most appropriate antimicrobial, and use the correct dose (Ali, 2019). Whereas irrational use of drugs occurs when "too many medicines are prescribed per patient, injections are used where oral formulations would be more appropriate, antimicrobials are administered in inadequate doses or duration, prescriptions do not follow clinical guidelines, and patients self-medicate inappropriately or do not adhere to prescribed treatment" (Dar Odeh *et al.*, 2010). The misuse and overuse of various antimicrobial agents in the health care setting and the agricultural industry are regarded as major contributors to the emergence of antimicrobial resistance (Dadgostar, 2019).

Farmers, in particular those who raise livestock, give their animals a variety of antimicrobial by mixing them with their feed or water. So, compared to non-food animals, the frequency of AMR in canine, equine, and feline species is lower (Farber *et al.*, 2010). The development of AMR and drug residue in foods of animal origin is all consequences of using antimicrobials in animal production (Hosain *et al.*, 2021). AMU in animal production for growth promotion, prophylaxis, and metaphylaxis; but AMU without professional monitoring; and/or AMU following inferior diagnostic techniques are specific, preventable practices that are acknowledged as major causes of AMR (Fatoumata, 2008). Antimicrobial-resistant bacteria can spread to human and animal populations through food, water, and the environment (Ogbonne *et al.*, 2021).

The American Veterinary Medical Association has advised that "judicious use of antimicrobial in food-producing animals" should concentrate on the use of antimicrobial when they are essential for the treatment, prevention, and management of infections with a verified diagnosis (Barber *et al.*, 2002). Contrary to this advice, antimicrobials are recklessly employed across the animal food chain in various parts of the world. Multi-sectoral and integrated awareness creation for animal producers is required, and it should be implemented across a variety of countries, showing a diversity of status in the economic development of their livestock sectors (Watson *et al.*, 2019). This will help limit the contribution of animal production to the global health threat of AMR by educating animal farmers and drafting suitable regulations regarding the use

of AMU and AMR (Nakagawa *et al.*, 2015). Even though various studies have been conducted on antimicrobial use and AMR in different parts of Ethiopia, no previous work has been done on assessing the knowledge, attitude, and practice of animal owners regarding antimicrobial use and antimicrobial resistance in and around Dessie. Therefore, the objectives of this study were:

- To assess the status of farmers' knowledge, attitude, and practice on veterinary antimicrobial drug use and resistance.
- To identify factors associated with farmers' KAP on antimicrobial drug resistance.

2. Materials And Methods

2.1 Study Area and Study Population

The study was conducted from May 2022 to January 2023 in and around Dessie town. Primary data was collected from five districts, namely Gerado, Boru, Kutaber, Hayq, and Dessie. Dessie is located approximately 401 kilometers north-east of Addis Ababa, at a latitude of 11° 07' 59.81 N and a longitude of 39° 37' 59.83 E. It is the capital city of the South Wollo Zone. It has an elevation ranging from 2400–2550 m above sea level. The mean annual minimum and maximum temperatures are 11.7°C and 24°C, respectively. The mean annual relative humidity is about 60%. The annual rainfall ranges from 1090 to 1200 mm, and the area experiences bimodal rainfall patterns with a short rainy season that occurs from February to March and a long rainy season that starts at the end of June and lasts until February. There are 19, 52374 cattle, 1538406 sheep, 1390763 goats, 40250 horses, 30134 mules, 664223 donkeys, and 65306 chickens in the area (DFEDB, 2015).

Kutaber is found in the South Wollo Zone, Amhara Region. It is located at 11° 12' 36"–11° 18' 36" N latitude and 39° 31' 12"–39° 34' 12" E longitude. The Kutaber region contains both highland and lowland areas. The average minimum and maximum rainfall range between 500 and 955 ml in the short and long rainy seasons. The average annual temperature is 22 °C, and mixed agriculture is the main occupation of the population of the area. The major livestock reared in the area are sheep, goats, cattle, poultry, and equines. According to statistical data, Kutaber Woreda has a livestock population of 69, 720 cattle, 65, 727 sheep, 53, 304 goats, 18, 005 horses, and 104, 737 chickens (Wondmnew *et al.*, 2019).

Anorthern Ethiopian town named Hayq. It is named after Lake Hayq, which is two kilometers to the east of the city and the location of the Istifanos Monastery, a significant structure in the history of the Ethiopian Church. The Tehuledere woreda, in the south wollo Zone of the Amhara Region, is 28 kilometers north of Dessie. The town is located there. Its latitude and longitude are 11° 18' N and 39° 41' E, and its elevation is 2,030 meters (6,660 feet) above sea level. For the questionnaire survey, the study population was all animal owners who were > 18 years old, present in the livestock market at the time of the study, and all household animals (bovine, ovine, poultry, and equine).

2.2 Sample Size Determination

The sample size for assessing animal owners' KAP towards AMU and AMR was calculated based on the suggestions of Bartlett *et al.* (Bartlett *et al.*, 2021). Bartlett and his research team suggested that for every type of cross-sectional survey, the following formula is more appropriate than others:

$$n = z^2 * p * (1 - p) / e^2$$

Where

n = is the required sample size.

p = is the percentage occurrence of a state or condition.

z = is the value corresponding to the level of confidence required.

e = the maximum percentage error allowed is denoted by

Since there was no study done about the KAP of animal producers towards AMR and AMU in the study area, 50% for the p -value, 95% (1.96) for the z -value, and 5% for the e -value were taken.

The total sample sizes from Dessie Town, Boru, Hayq, Kutaber, and Gerado were 72, 67, 82, 112, and 89, respectively. As a result, the total sample size for this study was 422.

2.3 Study Design

A cross-sectional study was conducted from May 2022 to February 2023 to evaluate the awareness, attitude, and practices of the household head attendants towards antimicrobial drug resistance and antimicrobial drug use.

2.4 Data Collection

A well-structured questionnaire and interview were administered to 422 animal owners. The questionnaire was designed to assess the practices, attitudes, and knowledge (KAP) of animal owners towards AMU and AMR in and around Dessie. In each study area, the largest open livestock market was chosen, and the animal owners in these markets were interviewed. All animal owners, regardless of educational background, were participating in the survey as a source of information. The questionnaire had four sections and contained close-ended questions such as those about respondents' socio-demographic characteristics, knowledge of

animal owners towards AMU and AMR, the respondent's attitude about AMU and AMR, and the practice of antimicrobial drugs and its contribution to AMR. The survey questioners were first created in English and translated into the local language (Amharic) at the time of the survey.

2.5 Data Analysis

All responses were exported to Microsoft Excel (Microsoft Excel, Windows version 2010). Then the recorded questionnaires were analyzed using STATA software version 14 and evaluated descriptively. The knowledge score of the respondent towards antimicrobial use, antimicrobial resistance, and residue was dichotomized based on a modification of Bloom's cutoff point for knowledge, attitude, and practice studies. The knowledge scores above 80% were categorized as having good knowledge, while those who scored below 80% were considered to have poor knowledge (Gebretsadik *et al.*, 2021).

3. Results

3.1 Demographic Characteristics of the Animal Owner's

A total of 422 respondents were included in this survey study. Most of the respondents in the current study were rural residents (68.2%), and most of the participants were rural residents (61.1%). Group of 31–50 years in the study area, the majority (35.7%) of animal owners had raised two species. The majority of participants (45.7%) were uneducated (farmers), while others had primary, secondary, tertiary, and secondary diplomas and degrees (Table 1).

Table 1: Demographic characteristics of the animal owners

Characteristics	Categories	Frequency	Percent (%)
Age	18-30	78	18.5
	31-50	192	45.5
	>50	152	36.0
Sex	M	258	61.1
	F	164	38.9
Educational level	Illiterate (farmer)	193	45.7
	Primary school	111	26.3
	Secondary school	34	8.1
	Tertiary school	17	4.0
	Diploma	51	12.1
	Degree	16	3.8
Residence	Rural	288	68.2
	Urban	134	31.8
District	Boru	67	15.9
	Dessie town	72	17.1
	Gerado	89	21.1
	Kutaber	112	26.5
	Hayq	82	19.4
Animal ownership	One species	125	29.6
	Two species	151	35.8
	Three species	104	24.6
	Four species	42	10.0

3.2 The knowledge of animal owner's towards AMU and AMR

Out of the total number of respondents, the majority (72.3% and 73.2%) of animal owners were not aware that improper use of antimicrobials in animals can cause AMR and didn't know about the side effects of antimicrobial drugs respectively. 47.2 % of

animal owners didn't have knowledge about rational AMU and the development of AMR. 55% of the animal owners were not aware that the administration of a proper dose of a drug can prevent the development of AMR (table 2).

Table 2: The knowledge of animal owner's towards AMU and AMR

Statements/Questions	Responses	Frequency	Percent %
Do you know or heard of AMU and AMR?	Yes	223	52.8
	No	199	47.2
Do you know using animal-origin food products before the end of the withdrawal period can promote AMR development in humans?	Yes	158	37.4
	I don't know	264	62.6
Do you know over-use of antimicrobials facilitate the development of AMR?	Yes	131	31
	I don't know	291	69
Do you know improper use of antimicrobials in animal can cause AMR?	Yes	117	27.7
	I don't know	305	72.3
Do you know antimicrobials have side effects?	Yes	113	26.8
	I don't know	309	73.2
Do you know calculation of administered dose of a drug can prevent AMR?	Yes	190	45
	I don't know	232	55

3.3 The attitude of animal owner towards AMU and AMR

The modality scale was used to test the attitude of the respondent about AMU and AMR with five modalities (strongly agree, agree, neutral, disagree, and I don't know). As it is indicated in Table 3, the majority of the respondents (41%) agreed on the necessity of

professional advice before using antimicrobials. From the total sample size, 30.8% and 38.2% of the respondents did not think improper use of antimicrobials leads to treatment failure, and they did not think use of non-drug disease prevention measures can impede AMR, respectively.

Table 3: The attitude of animal owner towards AMU and AMR

Questions	Response	Frequency	Percent (%)
Do you think improper use of antimicrobials result in treatment failure?	strongly agree	72	17.1
	Agree	98	23.2
	dis agree	64	15.2
	Neutral	58	13.7
	I don,t know	130	30.8
Do you think using antimicrobials for the purpose of animal production facilitate the development of AMR?	strongly agree	25	5.9
	Agree	88	20.9
	dis agree	93	22
	Neutral	78	18.5
	I don't know	138	32.7
Is AMR in food producing animals is not important for public health?	Strongly agree	35	8.3
	Agree	93	22
	Dis agree	71	16.8
	Neutral	76	18

	I don't know	147	34.8
Is professional advice before using antimicrobials advisable?	Strongly agree	110	26.1
	Agree	173	41.0
	Dis agree	44	10.4
	Neutral	50	11.8
	I don't know	45	10.7
Do you think use of non-drug disease preventive measures can impede AMR?	Strongly agree	24	5.7
	Agree	115	27.3
	Dis agree	44	10.4
	Neutral	77	18.2
	I don't know	162	38.2

3.4 The practice of animal producers towards AMU and AMR

The animal producers' AMU and AMR practices were tested using five practice-related questions (Table 4). The majority of the respondents from the total sample size (58.3%) were animal owners who increase the dose and frequency of drug administration when their animals are not recovered. The percentage of animal owners who obtained the drug from a local dispenser was 18.2%,

and the majority (42.7%) of respondents took their animals to the clinic for treatment. (23%) of the participants gave drugs to their animals on their own. The majority (50%) of the participants were administered drugs by taking them into a veterinary clinic. A minimum of 27.5 percent of all participants use drugs for disease prevention.

Table 4: The practice of animal owners towards AMR and AMU

Questions	Responses	Frequency	Percent (%)
What did you do when your animals got sick?	Take to vet clinic	211	50.0
	Consult veterinarian	114	27
	treat by my self	97	23
Where did you got antimicrobial?	Veterinary clinic	179	42.2
	Veterinary Pharmacy	166	39.3
	local dispenser	77	18.2
Did you increase the dose and frequency of drug administration when the animals are not recovered?	Yes	246	58.3
	No	176	41.7
Did you administer all the recommended drugs even though the animals got recovered?	Yes	180	42.7
	No	242	57.3
For what purpose did you use antimicrobials commonly?	Treatment	176	41.7
	Prevention	116	27.5
	Increase production	130	30.8

1. Discussion

Antimicrobial resistance (AMR) has been recognized as a global health problem. Monitoring of antimicrobial use (AMU) provides useful information for policy development to mitigate AMR risk and therefore, it has been recommended by international organizations (WHO, 2007).

From the total participants (422) in the current study, the majority (72.3% and 73.2%) of animal owners were not aware that improper use of antimicrobials in animals can cause AMR and didn't know about the side effects of antimicrobial drugs respectively.

Comparable findings include: 70% of the livestock keepers in Ethiopia (Gemeda *et al.*, 2020), 90% of the animal owners in Bingöl, Turkey (Ozturk *et al.*, 2019), and 60% of the animal producers in Malaysia (and below). Sadiq *et al.* (2018) reported 68.5% of the animal farmers had insufficient knowledge about AMR (Berghiche *et al.*, 2018). And 92.5% of livestock and aquaculture owners in Vietnam were not aware of the proper AMU and had a poor understanding of AMR formation (Khan *et al.*, 2020). Farmers didn't know about the side effects of using antimicrobials may be due to a lack of exposure to communication

and mass media sources, which provide less information about antimicrobials in general in developing countries like Ethiopia. Another finding of the current study was that 55% of participants were unaware of low or excessive antimicrobial use could lead to antibiotic resistance or unaware of calculation of administered dose of a drug can prevent AMR, which was consistent with a previous study in Ethiopia (57.1%) (Geta and Kibret, 2021). None of the participants in the current study (62.6%) observed the antimicrobial withdrawal period from an animal organ. Smaller than the current finding (3%) of animal producers in Vietnam (Pham-Duc *et al.*, 2019) were not knowledgeable about the withdrawal period and its relation to AMR formation. Only 30% of the animal owners in Ethiopia (Gemedu *et al.*, 2020) had information about the withdrawal period of antimicrobials from animal products; this may be due to most of the participants were illiterate. Sixty nine percent (69%) of the livestock owners who participated in the present study don't know that overuse of antimicrobials in animal production can increase the development of AMR. According to previous reports, the most important factors for the spread and development of AMR were the misuse, underdoing, or overuse of antimicrobials in animals (Castro *et al.*, 2016), a lack of knowledge about prudent antimicrobial use, and antimicrobial resistance (Jin *et al.*, 2010). This could be due to lack of essential drugs, lack of laboratory test for confirmatory diagnosis and lack of capacity building training for professionals.

The attitude of animal producers towards AMU and AMR

In the current study, (38.2%) of animal owner was ignorant that alternative AMU in animal production (biosecurity, immunization, excellent husbandry, and veterinary practices) could help to reduce the emergence of AMR. Inversely, 96% of the alternatives to AMU, such as immunization, may be important for lowering the formation of AMR, according to the Vietnamese livestock producers (Pham-Duc *et al.*, 2019). Additionally, the Tennessee cattle producers acknowledged that the most significant AMU alternative in the beef production industry is immunization (Ekakoro *et al.*, 2019). In the present investigation, 26.1% of the animal owners actually agreed that it is important to get professional assistance before administering antimicrobials in animal production, which is higher than the current finding (95% of livestock producers in Vietnam) (Pham-Duc *et al.*, 2019). Animal producers with a positive attitude to have professional assistance towards AMU and AMR are critical to reduce the generation and transmission of AMR. In the current study, 16.8% of the animal owners abstained from seeking professional advice on whether AMU in animal production may have an adverse effect on human health as a result of AMR, whereas, in contrast, 95% of livestock farmers in Vietnam (Martin *et al.*, 2015) agreed that using irresponsible AMU in animal production could be harmful to the public's health. The turkey and rabbit farmers in Italy (Di Martino *et al.*, 2019) may be people who believed negatively that AMR only occurred when antimicrobials were used on humans.

The practice of animal producers towards AMU and AMR

41.7% of the animal owners in the current study employed antimicrobials for therapeutic purposes. Likewise, an extensive proportion (69%) of livestock farmers in Vietnam (Kim *et al.*, 2013), 38% of livestock producers in the African country (Neuner *et al.*, 2004) and a lesser proportion (28.6%) of Swiss farmers (Ferroni *et al.*, 2020) confirmed that their primary use of antimicrobials was for therapeutic purposes. According to this

research, large fractions (42.2%) of animal producers have purchased antimicrobials from veterinary clinics, whereas 39.3 % and 18.1% have obtained antimicrobials from veterinary pharmacies and local drug stores respectively. Unlike to this study, 83% of livestock farmers in several African countries (Caudell *et al.*, 2020), and the majority (89%) of livestock producers in Vietnam (Pham-Duc *et al.*, 2019) obtain their antimicrobial from agro vet-pharmacies. In the current study, veterinarians administered the majority (50 %) of drug to their animal whereas 23 % of the producers self-administered their own animals. The percentage of livestock farmers in African country who administered their own antimicrobials was higher than (53%) the current finding (Caudell *et al.*, 2020), this may be most of the participant take their animals to the vet clinic when the animals sick.

5. Conclusion And Recommendations

Mitigation of antimicrobial resistance and rational use of veterinary drugs along the animal origin food chain requires understanding of animal owner's knowledge, attitude and practice towards AMU and AMR in animal health and production. The current study revealed that a number of animal owner's workers have inadequate knowledge, negative attitudes and poor practice towards antimicrobial use and antimicrobial resistance. Such lack of knowledge, wrong beliefs, and inappropriate practices of antimicrobial can be considered as the main factor for the development of drug resistance. Therefore, based on the above conclusion the following recommendations are forwarded:

- ✓ Awareness creation for animal owners should be conducted on rational use of antimicrobial drugs.
- ✓ Using alternative approaches like non drug disease preventive measures should be encouraged.
- ✓ Integrated AMU governance among all individuals, sectors, and actors regardless of their geographic locations, educational background and economic status should be applied.

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