

## Determination of knowledge levels and attitudes of clinician veterinarians working in Thrace region towards antibiotic use

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### Abstract

Antimicrobial resistance (AMR) has become a global problem due to widespread antimicrobial use in human and veterinary medicine. AMR affects health systems by leading to prolonged and severe illnesses, high mortality rates, and treatment failures caused by resistant microorganisms. As antibiotics are the most widely used drugs in veterinary medicine, veterinarians' knowledge, attitudes and practices regarding antibiotic use are crucial in combating AMR. In this cross-sectional study, an online questionnaire of 20 questions was administered to clinician veterinarians and members of the Trakya Chamber of Veterinarians and 60 participants answered the questionnaire. In the current survey, 98 % of veterinarians agree that AMR is an important public health problem and emphasize that focusing on rational antibiotic use in veterinary medicine is a critical area to slow the development of AMR. Only 10 % of the respondents stated that they take into account antibiotic requests from patient owners, 68.3 % stated that they rarely use off-label drugs and 16.7 % stated that they often use them. Of those respondents, 16.7 % stated that they routinely perform antibiograms. Regarding education, 41.7 % of veterinarians had received training on rational antibiotic use. When asked about their preferred type of training, 56.7 % favored online training, while 35 % preferred face-to-face sessions. The results indicate that veterinarians play a significant role in combating AMR and that more awareness and education are needed in this field.

**Keywords:** Antibiotic misuse; Antimicrobial stewardship; Antimicrobial resistance; Rational antimicrobial use; Prescription habits; Public health impact; Veterinarians.

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## Study contribution

Antimicrobial resistance (AMR) is a global concern due to the widespread use of antimicrobials in human and veterinary medicine. Understanding the knowledge, attitudes, and practices of veterinarians regarding antibiotic use is of great importance in addressing this problem. In this cross-sectional study, a questionnaire was administered to clinician veterinarians working in the Thrace region to assess their perspectives on AMR. The results showed that almost all respondents recognized AMR as an important public health problem and emphasized the importance of rational antibiotic use in veterinary medicine to combat its development. These findings highlight the important role that veterinarians play in the fight against AMR and underline the need for greater awareness and education in this area. Efforts should be made to promote responsible antibiotic use among veterinarians to reduce the risks associated with AMR and protect animal and public health.

## Introduction

Antimicrobial resistance has reached a level of concern globally due to the large use of antimicrobials in human and veterinary medicine over the past 50 years.<sup>(1)</sup> Infection with resistant microorganisms can have dire consequences, such as prolonged and more severe illnesses, higher mortality rates, extended hospital stays, increased rates of treatment failure jeopardizing the protection of patients undergoing surgeries and other medical procedures, as well as escalating healthcare costs.<sup>(2)</sup> It has been reported that the spread and sharing of AMR can be limited through rational antibiotic use, infection control, immunization, promoting good practices in the food supply, and screening, treatment, awareness, and education to control person-to-person transmission.<sup>(3)</sup>

Antibiotics, the most commonly used group of medicines in veterinary medicine, are used to cure and prevent diseases as well as to stimulate growth.<sup>(4)</sup> The intensive use of antibiotics in veterinary medicine is primarily associated with the treatment of infectious diseases. Ideally, therapeutic interventions should be guided by precise pathogen identification and antimicrobial susceptibility testing. However, it is common practice to apply antimicrobial treatment to the entire livestock population to control pathogen spread, leading to antibiotic overuse as uninfected animals are also treated with antibiotics.<sup>(5)</sup> Furthermore, the number of companion animals has significantly increased in recent years in developed countries, and it is anticipated that this trend will continue with continuous growth.<sup>(6)</sup>

However, increased contact between animals and humans also increases the risk of infection and transmitting antibiotic resistance. Therefore, veterinary health policies, hygiene practices, and animal health measures are very important to understand the transfer of resistance between humans and animals and to reduce the risk of such transfer. Research in this area can provide the basis for developing strategies to reduce the risks of such contamination.<sup>(7, 8)</sup>

The complex interactions between microorganisms from different environments facilitate gene flow and the spread of AMR among humans, animals, and the environment.<sup>(5)</sup> The One Health approach is crucial in global efforts to combat AMR, which involves addressing the problem from the perspectives of animal, human, and environmental health.<sup>(9)</sup> One Health is defined as a collaborative effort

of multiple health science professions and related disciplines to achieve optimal health for people, animals, wildlife, plants, and the environment.<sup>(10)</sup>

In 2015, the World Health Organization (WHO) established the Global Action Plan on AMR, endorsed at the sixty-eighth World Health Assembly, and has consistently highlighted AMR as a health priority. The plan focuses on five goals: to increase awareness of AMR, strengthen knowledge through research, reduce the incidence of infection, optimize the use of antimicrobials, and develop sustainable approaches for new interventions.<sup>(11)</sup> Antimicrobial stewardship (AMS), an organizational healthcare strategy, is designed to promote, improve, monitor, and evaluate the rational use of antimicrobials to preserve their future effectiveness, along with the promotion and protection of public health.<sup>(12)</sup>

Türkiye established the National Antimicrobial Resistance Surveillance System in 2011 and joined the Central Asian and Eastern European Surveillance of Antimicrobial Resistance network under the WHO affiliation.<sup>(13)</sup> In the field of veterinary medicine, the Ministry of Agriculture and Forestry prepared the "Action Plan for Antimicrobial Resistance Monitoring and Control Strategies in Veterinary Medicine" to combat AMR.<sup>(14)</sup> Although the development of AMS in veterinary medicine has been slower than in human medicine, the growing evidence of a worldwide crisis of multiple resistance in human medicine and the potential influence of antimicrobial use and resistance selection in animals have given a boost to AMS in veterinary medicine.<sup>(15)</sup>

A limited number of studies have been conducted in Türkiye to determine the knowledge, attitudes, and behaviors of veterinarians regarding antibiotic use and AMR.<sup>(16)</sup> However, studies conducted in other countries have shown that the knowledge, attitudes, and behaviors of veterinarians towards rational antibiotic use are of great importance in terms of the prevention of AMR.<sup>(17–28)</sup> The main objective of this study is to determine the knowledge, attitudes, and behaviors of practicing veterinary clinicians in the Thrace region regarding antibiotic use and AMR. Additionally, the results of this study will help identify gaps in rational antibiotic use in veterinary medicine and provide guidance for regulatory activities in this area.

## Materials and methods

### *Ethical statement*

This study was approved by Tekirdağ Namık Kemal University Non-Interventional Clinical Research Ethics Committee on December 27, 2022 (Research Protocol Number: 2022.237.12.15). Before starting the online survey, participants were presented with the information contained in the Informed Consent Form, and only those who voluntarily chose to participate in the study proceeded by clicking the continue button to participate in the survey. Responses to the questionnaire were only accessible to the researchers.

### *Study area*

Thrace is a region located in northwestern Türkiye and includes the provinces of Edirne, Kırklareli, and Tekirdağ. Geographically, Thrace is situated approximately between 41.8217° N, 26.3678° E in the northwest and 41.0319° N, 28.0076° E in the southeast. Thrace region is one of the most fertile agricultural lands in Türkiye

and is also very important in terms of animal husbandry. The region is an ideal region for animal husbandry with its large pastures, fertile soils, and water resources. Various animal species such as cattle, buffalo, sheep, and goats are raised in the region. Especially dairy cattle breeding is quite common in the Thrace region. Thrace region is also the zone where most horses are raised in Türkiye. There are 283 licensed veterinary practices in the region.

### *Study design and data collection*

This research is a descriptive cross-sectional survey. The sample was not specifically selected; instead, the target group included all veterinarians working as clinicians in the Thrace Region. All veterinarians were included regardless of gender, age, title and specialty. An online survey platform was used to reach veterinarians quickly and allow them to answer the questions at their convenience. The questionnaire was presented to the participants between January 1, 2023, and April 30, 2023. IP restrictions were imposed to prevent the survey from being completed more than once by the same person.

A questionnaire consisting of 20 questions in total has been prepared to see the general perception of the knowledge level and attitudes of veterinarians toward antibiotic use. The link to the questionnaire was sent to the participants via social media tools and e-mail with the help of the Thrace Chamber of Veterinarians. Before starting the survey, the information in the "Informed Consent Form" was presented to the participants and only those who voluntarily agreed to participate proceeded by pressing the continue button. A total of 60 veterinarians responded to the questionnaire.

### *Data analysis*

The data were downloaded as a .sav file from the surveey.com website, where the survey was conducted, and missing responses were checked. The questionnaires completed by the participating veterinarians were analyzed using SPSS 26.0 software, and the results were shown as percentage distribution.

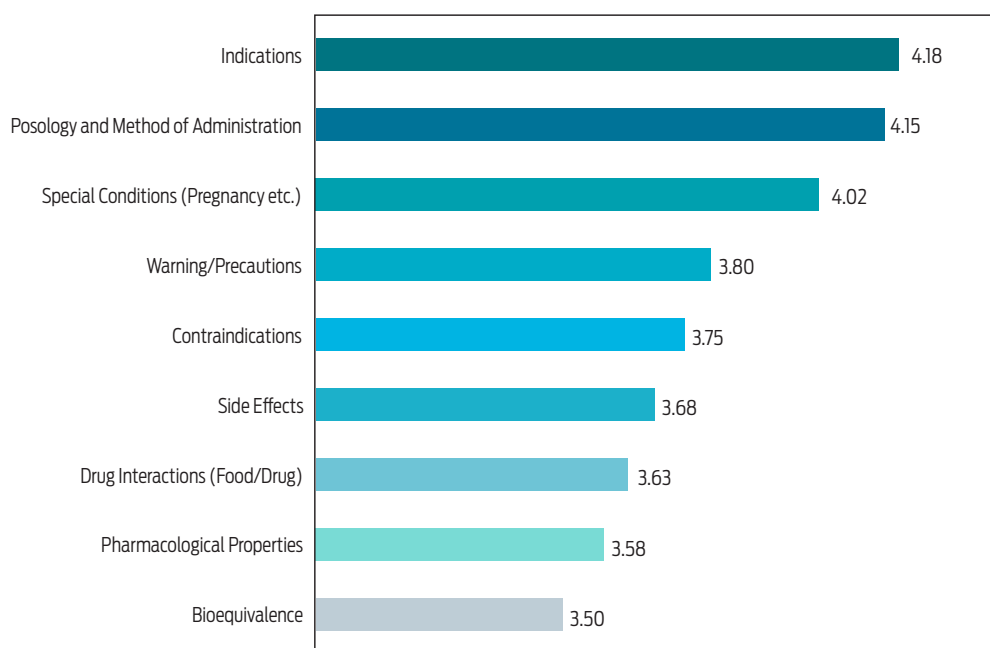
## **Results**

In the present study, 46.7 % of the participants were between 30–39 years of age, and the highest proportion of professional experience was 31.7 % with 4–10 years of work experience. While 53.3 % of the participants are mainly working in the field of cattle/small ruminants, the remaining 46.7 % of the participants are working in the pet field. Demographic data of the participants are presented in [Table 1](#).

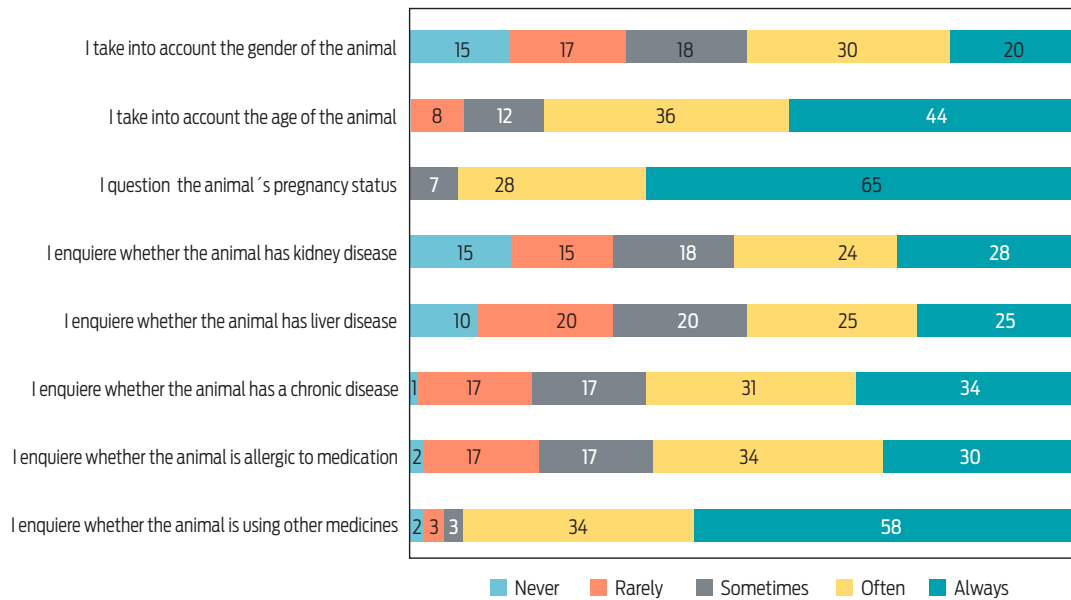
According to the survey results, there are differences in the level of knowledge of veterinarians about antibiotics. Indications have the highest mean score of 4.18 %, followed by posology and method of administration with 4.15 %. Bio-equivalence ranked last with a rate of 3.50 %. To determine the participants' opinions about their level of knowledge about antibiotics, the question "What are your opinions about your level of knowledge about antibiotics?" was asked. The answers are presented in [Figure 1](#).

**Table 1.** Demographic profile of veterinarians

Demographic factors	Percentage (%)
<b>Gender</b>	
Female	11.7
Male	88.3
<b>Age group</b>	
24–29	20.0
30–39	46.7
40–49	21.7
50–59	11.6
60 years and above	0
<b>Range of working years</b>	
0–3	15.0
4–10	31.7
11–15	21.7
16–19	5.0
20 and above	26.6
<b>Employed institution</b>	
Clinic	83.3
Polyclinic	0
Animal hospital	16.7
<b>Qualification</b>	
DVM	83.0
Specialists/PhD	17.0
<b>Private clinical practice</b>	
Bovine/Ovine	53.3
Pet	46.7



**Figure 1.** Participants' level of knowledge about antibiotics. Questions were scored on a 5-point Likert scale (1 = very bad; 5 = very good) and are displayed here in order of highest to lowest mean score.

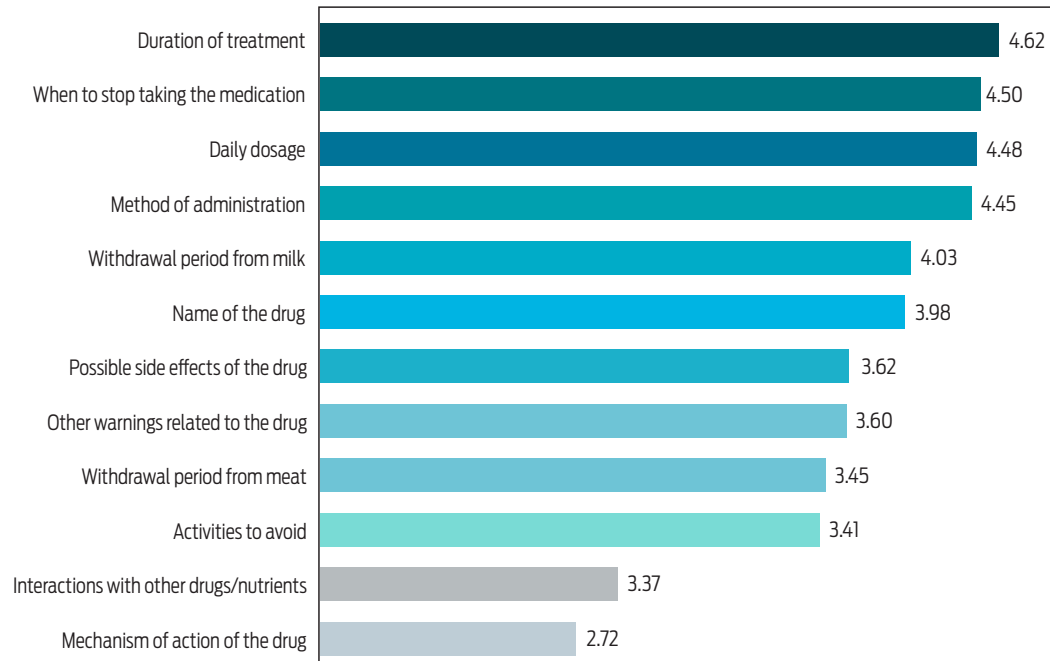


**Figure 2.** Anamnesis information used when prescribing/administering antibiotics (% rate).

According to the data obtained on which anamnesis information is utilized by veterinarians when prescribing or administering antibiotics, certain anamnesis information is taken into consideration at higher rates. Sixty-five percent of them always and 28 % of them frequently care about evaluating pregnancy status. Regarding the questioning of other medicines used, 58 % always and 34 % frequently consider this information. When questioned about drug allergies, 30 % always and 34 % frequently consider this information. Regarding the questioning of chronic diseases, 34 % always and 31 % frequently consider this information. In the questioning of liver disease, 25 % always and 25 % frequently consider this information. The anamnesis information used while prescribing/ administering antibiotics is presented in [Figure 2](#).

According to the results of the questionnaire, the frequency with which veterinarians inform the patient owner about the antibiotic prescribed/administered varies in different aspects. The highest mean scores were obtained for the duration of treatment (4.62), and the next highest mean scores were obtained for When to stop taking the medication (4.50), daily dosage (4.48), and method of administration (4.45), indicating that veterinarians usually adequately convey this information to the patient owner. However, the lowest mean scores were obtained for Interaction with other drugs/nutrients (3.37) and mechanism of action (2.72). The frequency of the information given by the participants to the patient owner about the antibiotics they prescribed is presented in [Figure 3](#).

When asked about the most frequently used information sources during antibiotic prescribing and administration, 45 % of the participants stated pharmacology books as the most frequently used information source. In addition, 21.7 % indicated *Vademecum*, 13.3 % the internet, 8.3 % colleagues, and 6.7 % promotional activities of pharmaceutical companies as the most frequently used sources. As for antibiotic groups, 23.4 % stated beta-lactams, 15 % fluoroquinolones, 14.4 % tetracyclines, and macrolides as the most frequently prescribed antibiotics. Information sources and the most frequently preferred groups in antibiotic prescriptions are shown in [Table 2](#).



**Figure 3.** What do you think about the frequency of the information you give to the patient’s owner about the antibiotic you prescribed/administered? Questions were scored on a 5-point Likert scale (1 = completely disagree; 5 = completely agree) and are displayed here in order of highest to lowest mean score.

**Table 2.** Information sources and most preferred groups in antibiotic prescriptions

Question/responses	Percentage (%)
<b>Which information sources do you use the most when prescribing/administering antibiotics?</b>	
Pharmacology books	45.0
Vademecum	21.7
Internet	13.3
Colleague	8.3
Promotional activities of pharmaceutical companies	6.7
Drug information software programmes	5.0
<b>Please tick the antibiotic groups you prescribe/administer most frequently (You can tick more than one option).</b>	
Betalactams	23.4
Fluoroquinolones	15.0
Tetracyclines	14.4
Macrolides	14.4
Sulfonamides	12.9
Aminoglycosides	11.4
Other	4.0
Lincosamides	3.0
Amphenicols	1.5



**Table 3.** Percentage distribution of veterinarians' views on antibiotic resistance. Questions were scored on a 5-point Likert scale (1 = completely disagree; 5 = completely agree)

What do you think about antibiotic resistance?	1	2	3	4	5
Resistance of bacteria to antibiotics is an important public health issue.	0	0	1.7	40.0	58.3
Prescribing antibiotics to patients influences the possible development of bacterial resistance to these drugs.	3.3	8.3	11.7	48.3	28.3
I believe that new antibiotics will be launched to solve the resistance problem.	5.0	13.3	23.3	31.7	26.7
Antibiotic use in animals is an important cause of resistance to bacterial infections in humans.	0	11.7	10.0	43.3	35.0
The two most important causes of antibiotic resistance are self-medication and antibiotic abuse.	0	0	8.3	26.7	65.0
Prescription antibiotics should be more controlled.	1.7	0	8.3	33.3	56.7

Almost all participants, 98.3 %, agreed that AMR is an important public health problem. There was 76.6 % agreement on the effect of antibiotic use on the development of resistance. Furthermore, 58.4 % of veterinarians believe that new antibiotics will be introduced to solve the resistance problem. There was 78.3 % agreement that antibiotic use in animals is an important cause of bacterial resistance in humans. Spontaneous drug use and antibiotic misuse are recognized by 91.7 % as the main causes of antibiotic resistance. 90 % of veterinarians think that prescription antibiotics should be more strictly controlled. Percentage distribution of veterinarians' opinions on antibiotic resistance is shown in [Table 3](#).

According to the survey results, most respondents believe that rational antibiotic use in veterinary medicine is a key area that needs to be focused on, with a significant percentage of 69.5 %. In this study, only 16.7 % of the participants stated that they routinely performed antibiograms. 68.3 % of the participants stated that they are rarely and 16.7 % stated that they frequently prescribe off-label antibiotics. While 56.7 % of the respondents considered the economic dimension of animal owners when prescribing antibiotics, 31.7 % sometimes considered it and 11.6 % never considered it. While the rate of those who took into consideration the demands of animal owners while prescribing antibiotics was only 10 %, the rate of those who sometimes took into consideration was 33.3 % and the rate of those who never took into consideration was 56.7 %. The rate of those who think that the information about antibiotics given by veterinarians to animal owners is sufficient is 16.7 %. While the rate of those who received training on rational antibiotic use or antibacterial resistance was 41.7 %, the rate of those who did not receive training was 58.3 %. When asked which type of training they would like to receive on rational antibiotic use, 56.7 % stated that they preferred online training, while 35 % stated that they preferred face-to-face training. Findings on rational antibiotic use and training needs of veterinarians are shown in [Table 4](#).

## Discussion

In this study, we evaluated the knowledge, attitudes, and behaviors related to antibiotic use and AMR among veterinarians working as clinicians in the Thrace region. Veterinarians' knowledge and attitudes toward antibiotic use is an important factor



**Table 4.** Findings on rational antibiotic use and training needs of veterinarians

Question/Responses	Percentage (%)
<b>Which sectors do you think should be focused on to slow down the development of resistance to antibiotics?</b>	
Rational antibiotic use in veterinary medicine	69.5
Hygiene on farms	10.2
Hygiene during preparation and consumption	1.7
Rational antibiotic use in human medicine	18.6
<b>Do you routinely perform antibiograms?</b>	
Yes	16.7
No	83.3
<b>Do you prescribe/administer off-label antibiotics (administering a different type, dosage regimen, dose interval, and duration different from the package insert information)?</b>	
No	15.0
Rarely	68.3
Frequently	16.7
<b>Do you consider the economic dimension of antibiotics when prescribing/administering antibiotics to your patients?</b>	
Yes	56.7
Sometimes	31.7
No	11.6
<b>When prescribing/administering antibiotics to your patients, do you take into account the antibiotic requests of the patient owner?</b>	
Yes	10.0
Sometimes	33.3
No	56.7
<b>Do you find the information you give to the animal owner about the antibiotics you prescribe/apply sufficient?</b>	
Yes, because if it is not applied correctly, effective treatment cannot be provided	80.0
Partly, for medicines that require specialized use	18.3
No, not enough time	1.7
<b>Have you ever received training on rational antibiotic use or antibacterial resistance?</b>	
Yes	41.7
No	58.3
<b>What kind of training would you like to receive about rational use of antibiotics in veterinary medicine?</b>	
Do not want to buy	8.3
I would like to receive online education	56.7
I would like to receive face-to-face training	35.0

in preventing AMR. When prescribing antibiotics, veterinarians should consider not only the active ingredient but also factors such as age, species, and disease status of animals. Therefore, regular education and training of veterinarians on antibiotic use plays a critical role in developing an effective antibiotic use strategy.

In the current survey, 98 % of veterinarians considered AMR to be an important public health problem and identified the rational use of antibiotics in veterinary medicine as the most important area to focus on to slow the development of AMR. While antibiotic use in food-producing animals is thought to be one of the primary sources of antibiotic resistance in humans, the specific impacts of this use on human health have yet to be fully resolved.<sup>(29)</sup> Limiting interventions only to antibiotics used in animal health is insufficient to reduce infections in humans caused by antibiotic-resistant bacteria. It is estimated that 75 percent of diseases linked to resistant bacteria are caused by healthcare-associated infections.<sup>(30)</sup> It is therefore important to recognize that the contribution of the human health sector also plays an important role in addressing this problem and to provide a balanced perspective. Indeed, more progress has been made in animal health than in human medicine.

In the European Union/European Economic Area (EU/EEA), since 2016, the average consumption of antibiotics in humans has been reported to be higher than in food-producing animals. Between 2011 and 2020, the amount of antibiotics consumed by humans in the EU/EEA decreased by 23 %, while the amount of antibiotics used in food-producing animals decreased by 43%. Notably, in 2018, humans consumed more antibiotics at 133 mg per kilogram compared to food-producing animals, which consumed 105 mg per kilogram. This shows that, after adjusting for biomass, humans consume a higher proportion of antibiotics than animals.<sup>(31–33)</sup>

The most commonly prescribed/used antibiotic groups by veterinarians participating in the survey are beta-lactams (23.4 %), fluoroquinolones (15%), tetracyclines (14.4 %) and macrolides (14.4 %). As of 2019 data, Tetracyclines hold the foremost position as the most extensively utilized antimicrobial agents in the realm of animal health, comprising a prevalence rate of 35.6 %, while penicillin claim the second position with a prevalence rate of 13.3 %.<sup>(31)</sup> These two classes of antibiotics are part of the World Organisation for Animal Health list of veterinary important antimicrobial agents,<sup>(34)</sup> but are not on the top priority list of critically important antimicrobial agents for human health according to WHO.<sup>(32)</sup> Less than 20% of antimicrobials used in animals are of the highest priority and critical importance for human health. Fluoroquinolones and third and fourth-generation cephalosporins, which are on the World Health Organization's list of highest-priority critical antimicrobial agents, represent 3.4% and only 0.6 % of the total amount, respectively.<sup>(31)</sup> These results suggest that veterinarians tend to prescribe less of the critical antimicrobial agents of the highest priority for human health.

Sources of information on antibiotic practices and prescriptions of veterinarians vary. In this study, participants stated that pharmacology books were the most utilized source of information when prescribing/administering antibiotics. In a study conducted in the United States, the majority of veterinarians reported that they received information about antimicrobials and their use from textbooks,<sup>(25)</sup> but in another study conducted in the United Kingdom, veterinarians reported that they relied on their own experience.<sup>(35)</sup> The use of the antibiogram improves the effectiveness of treatment by supporting the correct selection of antibiotics, reduces

the overuse of antibiotics, and makes a significant contribution to the fight against antimicrobial resistance. It is therefore considered a critical tool in the fight against AMR.<sup>(36)</sup> In this study, only 16.7 % of the participants stated that they routinely performed antibiograms. This points to the need for comprehensive training to raise awareness about the benefits of routine antibiograms.

In practice, veterinarians face challenges in prescribing antibiotics due to factors such as farmers' demand and company policies. Their prescribing behavior is influenced by farmers' attitudes towards antibiotics, biosecurity measures, and socio-economic factors. The decision-making of veterinarians is largely based on their knowledge of antibiotic resistance and adherence to guidelines.<sup>(37–40)</sup> In this study, only 10 % of the participants stated that the patient owner took into account their antibiotic requests. Studies have shown that pet owner demands influence veterinarians to prescribe antibiotics. Although there is evidence to suggest that pet owner demands can influence veterinarians' antibiotic prescribing decisions,<sup>(35, 41)</sup> it is crucial to consider this issue within the broader context of responsible antibiotic use. Veterinarians must balance client expectations with their professional judgment and expertise to ensure optimal animal health outcomes while minimizing the risk of antibiotic resistance.

In veterinary medicine, the use of off-label medicines due to gaps between indications or species, other than the use of approved veterinary medicines, plays an important role. In this study, 68.3 % of the participants stated that they rarely used off-label drugs and 16.7 % stated that they frequently used off-label drugs. The use of off-label medicines should be handled with caution, especially when it is a practice that is not widely used or for purposes other than those foreseen by the legislation.<sup>(42)</sup> In this study, only 41.7 % of veterinarians received training on rational antibiotic use. When the participants were asked how they would like to receive training, 56.7 % preferred online training, and 35 % preferred face-to-face training. Continuous education and dissemination of information on rational antibiotic use are crucial in the fight against AMR. Improving AMS knowledge is essential as part of the control of antimicrobial resistance in both human health and the veterinary sector.<sup>(28, 43)</sup>

Of the veterinarians surveyed, 58.4 % agreed that the development of new antibiotics could provide a solution to the problem of antibiotic resistance and stated that they were optimistic about this. Although participants were hopeful about the development of new antibiotics against AMR, the development of new antibiotics is a complex, costly, and time-consuming process due to scientific, regulatory, and economic challenges. Over the past 40 years, only a small portion of the antibiotics introduced to the market represent new compound classes, with the majority being derived from already-known chemical structures.

Additionally, the most recent discovery of a new antibiotic class dates back to the 1980s decade.<sup>(44)</sup> The biggest challenge in the development of antibiotics is financial. While the cost of developing a new antibiotic is estimated at \$1.5 billion, the average annual revenue after approval is only \$46 million. This economic gap causes pharmaceutical companies to shy away from new antibiotic research.<sup>(45, 46)</sup> Despite a decline in the discovery of new antibiotics, the resistance rates among common bacterial pathogens are at concerning levels.

For instance, median rates as high as 42 % for third-generation cephalosporin-resistant *E. coli* and 35 % for Methicillin-resistant *Staphylococcus aureus*

(MRSA) in 76 countries are clear indicators of the severity of this issue.<sup>(47)</sup> Considering that antimicrobials are indispensable tools for treating and preventing infectious diseases, it becomes even more important to focus on maintaining the efficacy of existing antimicrobials as no significant new molecule discoveries have been made in recent years.<sup>(48)</sup> In this context, the rational use of existing drugs in the fight against antimicrobial resistance has become a critical strategy to slow the development of resistance and extend the life of existing treatments.

## Conclusions

This study was conducted to evaluate the knowledge, attitudes, and behaviors of veterinarians regarding antibiotic use and antimicrobial resistance. The findings emphasize that veterinarians are aware of the seriousness of AMR and the importance of rational antibiotic use. However, some challenges and shortcomings in antibiotic prescribing were revealed. For example, factors such as low rates of antibiograms, significant off-label drug use, and the fact that the most frequently prescribed/administered antibiotics are on the list of drugs critical for human medicine may pose a problem in terms of rational antimicrobial use. Therefore, it is important to maintain regular education and information activities among veterinarians. In addition, veterinarians need to be vigilant about adhering to patients' needs and clinical guidelines in their prescribing decisions. The results of this study suggest that veterinarians play an important role in combating AMR and that education and awareness-raising efforts should be increased.

## Data availability

The original datasets used in this research and if applicable, supporting information files, are deposited and available for download at the SciELO Dataverse repository doi:10.48331/scielodata.M51ZXU.

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## Conflicts of interest

The authors declare that they have no potential conflict of interest concerning the authorship and/or publication of this article.

## Author contributions

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