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Knowledge, attitudes, and practices regarding antibiotic use and resistance among veterinarians and animal health professionals in Wasit Governorate, Iraq

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Abstract

Background and Aim: Antimicrobial resistance (AMR) is one of the most pervasive health concerns worldwide in veterinary and human medicine. The inadequate use of antibiotics in the veterinary sector has contributed to antibiotic resistance (ABR), which negatively affects animal and human health. This study aimed to evaluate awareness about knowledge, attitude, and practice concerning the use of antibiotics and AMR among veterinarians and other practitioners in the field of animal health in the Wasit Governorate of Iraq.

Materials and Methods: This study included 129 veterinarians and animal health workers from various areas of Wasit Governorate (Suwayra, Numaniyah, Kut, and Al-Hai) in eastern Iraq, southeast of Baghdad. Participants' personal information (age, sex, education, employment history, region, workplace, and current position) and knowledge, attitudes, and behaviors regarding antibiotic usage and resistance were collected using a questionnaire. The Statistical Analysis System (SAS, 2018) was used to analyze the data.

Results: Based on 16 knowledge evaluation questions, only 43.75% had good knowledge, and 56.25% had fair to poor knowledge of antibiotic usage and AMR. There is a lack of understanding of the threat of treatment-resistant bacteria (34.88%). Similarly, there are some gaps in the understanding of the link between efficient management procedures in agriculture and the prevention of resistance development (36.43%). As per the 13 attitude questions, this research found that only 38.46% of the participants had a positive view on antibiotic usage and ABR, while the rest of 61.54% had a neutral view. High rates of participants (80.62%) considered it of great importance to provide sufficient antibiotic doses, proper management, immunization, and the use of animal antibiotics only when necessary and with veterinary assistance. Based on the six questions, our research found that half of the participants had excellent practices regarding antibiotic usage and resistance, whereas the other half had poor to moderate habits. There was a highly significant correlation ($p \leq 0.01$) between the knowledge and attitude of the participants in this study, as well as a significant correlation ($p \leq 0.05$) between the knowledge and practices and between the attitudes and practices of the participants.

Conclusion: Participants' compliance was poor despite having moderate knowledge of antibiotic use and AMR. Implementing educational and training programs may enhance veterinarians and animal health workers' understanding, attitude, and behavior.

Keywords: antimicrobial resistance, antimicrobial stewardship, knowledge, attitude, and practice, veterinary profession, Wasit province.

Introduction

The increasing incidence of antimicrobial resistance (AMR) is a growing concern in human and animal health care worldwide [1, 2]. At this stage, the causal relationship between AMR and antibiotic misuse or inappropriate use has been well established [3–7]. Eventually, even the most common diseases become intractable because all bacteria can become resistant to all antibiotics [8–11]. By 2050, antibiotic-resistant diseases will be responsible for the deaths of almost 10 million people every year [12]. Because AMR can be transmitted from one person or animal to another in a variety of ways, with direct touch, the food chain, and environmental routes being included in these categories [13, 14], a collaborative strategy based on the principles of "One Health" is required to combat this complex issue [15].

Many nations and international organizations have included a One Health approach in their strategies to combat antibiotic resistance (ABR). The 2024 United Nations General Assembly High-Level Meeting of the Quadripartite Organizations (Food and Agriculture Organization of the United Nations (FAO), United Nations Environment Program (UNEP), World Health Organization (WHO), and World Organization for Animal Health (WOAH) on AMR presented a unique opportunity for global leaders to invest in immediate actions while ensuring

future security through effective national and international strategies to protect animal health, guarantee food safety and security, prevent environmental degradation, and so strengthen economies against the continuous threats posed by AMR [16]. Essential measures include enhancements in antimicrobial use (AMU), more effective regulation and legislation, and increased monitoring, stewardship, infection control, sanitation, animal husbandry, and the exploration of alternatives to antimicrobials [15]. The development of ABR has been accelerated by misuse in both animals and humans, as well as their use as growth boosters in livestock [17]. According to sufficient evidence, inappropriate antibiotic use is positively correlated with the rate of resistance development [18, 19]. Because there is a degree of overlap between the antimicrobials used in human and veterinary medicine [20], it is critical to avoid using antibiotics that are essential to human health whenever possible. To prevent the development of ABR, it is crucial to use antibiotics prudently in animal and human health systems [18]. While studies on the dangers of antibiotic overuse have garnered considerable attention in human medicine [21], they are still in their infancy in veterinary medicine. A comprehensive approach to maximizing and rationalizing the use of antimicrobials is known as antimicrobial stewardship (AMS) [22]. The Access, Watch, and Reserve (AWaRe) classification system by the World Health Organization (WHO) was developed in 2017 as an antibiotic stewardship program. It was a recommendation that was a significant step toward the control of AMR. The WHO AWaRe framework classifies antibiotics according to their spectrum of activity and capacity to acquire resistance [23]. The Access category includes antibiotics used as first- and second-line treatment for infections. The Watch category includes broad-spectrum antibiotics with a higher risk of developing resistance. The Reserve category includes last-resort medicines for multidrug-resistant illnesses [24]. In veterinary medicine, managing stewardship is of the utmost importance because, when implemented correctly, it may aid in reducing the spread of AMR [25]. Increasing biosecurity measures [26], monitoring AMR [27], and monitoring antibiotic usage on farms [27] are viable options for achieving this goal. It is believed that low-income nations, which have fewer veterinary facilities, less effective animal husbandry, and less access to antibiotics, have a higher incidence of reckless or irresponsible use [28]. Inadequate monitoring of withdrawal periods before slaughter, along with incorrect treatment and/or dosage of antibiotics, can lead to the end products of animals containing antibiotic residues and pathogens that are resistant to these drugs [29]. In Iraq, several studies have linked inadequate veterinary care management to the rise of ABR [30–37]. However, no published studies have examined the knowledge, attitude, and practice (KAP) of Iraqi veterinarians and animal health professionals regarding antibiotic use and AMR. Research from other countries has shown that animal health workers' KAP is important for understanding their degree of knowledge on the responsible use of antibiotics and the avoidance of the development of ABR [19]. An example of this would be research conducted among veterinarians in the Dutch, which found that veterinarians with a good attitude and favorable information about AMR positively affected AMU and positively influenced farmers [38].

Accordingly, this study aimed to determine the KAP regarding AMR and AMU among veterinarians and animal health professionals employed in several districts in Wasit province. This investigation reveals trends in veterinary antibiotic prescription. These data will be useful in developing a national education and advocacy plan to combat AMR, focusing on Wasit province.

Materials and Methods

Ethical approval and Informed consent

The Ethics Committee of the Middle Technical University in Baghdad, Iraq, approved this study (MEC Number:16). This approval was given in accordance with the principles that were established in the Helsinki Declaration of 1975. After receiving all the relevant information, the participants in the research were asked to formally confirm their participation in the study in writing.

Study period and location

The study was conducted from November 2023 to March 2024 at the Wasit government in the southern part of the middle region, southeast of Baghdad.

Study design and sample size

A descriptive cross-sectional survey was conducted with 129 veterinarians and animal health professionals from Wasit Governorate's biggest and most densely inhabited districts (Suwaira, Numaniyah, Kut, and Al-Hai). The Wasit governorate is located in the southern portion of the middle region, between longitudes 32–44 and 46–36 and elevations 31–75 and 32–31. Kut, 176 km south of Baghdad, serves as the governorate's administrative center. It is one of Iraq's biggest governorates (17,153 km^2), with 1,149,059 people [36]. Furthermore, given the increased demand for red and poultry meat and eggs, there is an urgent need to enhance output to fulfill customer demands. Unfortunately, after terrorist attacks in many Iraqi governorates in 2016, a substantial number of families relocated to this governorate, exacerbating the need [36]. The sample size was calculated using the Cochran equation [39]. Based on the information collected from the Veterinary Department, the sample size was calculated to be 130 depending on a conservative proportion estimate of 50% and a margin of error of 5% at the 95% confidence level with the help of the following formula:

$$n_0 = (Z^2 \times pq/e^2)$$

n_0: Sample size
p: Population size
q: 1 – p
e: The margin of error
Z: Z value extracted from a Z-table

First, the researcher went to handy locations (such as veterinary clinics, private veterinary hospitals, veterinary health centers, slaughterhouses, animal farms, and the College of Veterinary Medicine) to gather data. Data were collected from 151 participating veterinarians, para-veterinarians, and animal healthcare professionals who were available throughout the study. Only 129/151 qualified individuals who were contacted for the survey completed the survey. A total of 18 participants did not take part for a variety of reasons, including being too busy with work (n = 9), not being interested (n = 5), and not seeing the point of the study (n = 4). They decided not to participate anymore. Four people who wanted to participate in the poll did not do so because they did not answer any question. Among 129/151 participants, the total response rate was 85.4%. The data collector was responsible for explaining the self-administered questionnaires to the participants upon request.

Questionnaire and data collection

Based on previous investigations [40-45], a questionnaire was designed to assess antibiotic usage and resistance to KAP. The introduction section of the questionnaire detailed the research goals, the participant's willingness to participate voluntarily, and the time required to complete the study. Following extensive content validity testing, three experts were consulted on the questionnaire's relevancy, simplicity, and significance in the original draft, which was then sent out for further assessment.

There were five sections in the questionnaire: In the first section of the study, we examined the participants' demographic information, including their chronological age, educational background, geographic region, job title, and level of expertise. The second section consisted of sixteen questions designed to gauge the participants' familiarity with antibiotic use and resistance. The participants' general understanding was assessed using knowledge questions. A variety of choices, including yes/no and "I don't know" options were provided for this. For each answer, two were recorded as accurate, one as "not know," and zero as "incorrect." Possible scores ranged from zero to –32. The attitude toward antibiotic use and resistance was probed in the third segment. Questions ranging from "strongly agree" to "strongly disagree" were used to convey these sentiments in 13 separate inquiries. Each attitude-related question was scored on a 5-point Likert scale: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree. Grades were between 13 and 65. The fourth section of the survey asked participants to describe their current behavior regarding the use of antibiotics. Each correct answer scored as 1 and an incorrect scored as 0. There were six questions in this section. Good results were defined as total scores ≥50% of the maximum scores for KAP; bad or unsatisfactory results were defined as lower scores. In section five, we asked where people heard about ABR and how often they took it.

The questionnaire's reliability was pre-tested on seven veterinarians and animal health professionals (5% of the participants) who had comparable characteristics but were not surveyed. This approach aimed to identify vague questions. Cronbach's alpha was used to evaluate internal consistency: 0.5 or below indicates poor dependability, 0.6–0.7 is medium, 0.7–0.8 is acceptable, and more than 0.8 is excellent [46].

Statistical analysis

The Statistical Analysis System (SAS, 2018) program, version 9, 6th ed. (N.C., USA), was used to detect the effects of different factors on the study parameters [47]. To better understand the demographic data and evaluate the participants' measurements, descriptive statistics (frequencies, percentages, mean values, and standard deviations) were used. The Chi-square test was used to compare percentages (0.05 and 0.01 probability) and to estimate the correlation coefficient between variables in this study.

Results

Demographic information about the participants

The details of the participants are presented in Table-1. Males constituted 75/129 participants (58.14%). Ages 30–39 accounted for over half of the participants (58/129, 44.96%), with individuals aged 50 and older making up the smallest age group (14/129, 10.85%). Regarding educational attainment, most participants had a bachelor's degree (63/129, 48.84%), whereas the minority held only a primary school degree (5/129, 3.88%). On top of that, the majority of our participants were Kut residents (91/129, 70.54%), the profession of livestock production supervisors was the least represented (9/129, 6.98%), while veterinarians were the most represented (60/129, 46.51%). In addition, 76/129 (58.91%) of the veterinary professionals surveyed had 0–10 years of experience, whereas 19/129 (14.73%) had more than 20 years. The distribution of samples according to demographic information differs statistically ($p \leq 0.01$), except for gender ($p = 0.064$) (Table-1).

Knowledge of antibiotic use and AMR among participants

Table-2 summarizes participants' knowledge. Although 49/129 (37.98%) of participants answered that antibiotics could cure any sickness, 85/129 (65.89%) of participants answered that whether or not medicating healthy animals would prevent them from becoming sick. One hundred out of 129 (77.52%) believed that animals should only receive antibiotics at the recommended dosage. Eighty-nine out of 129

Table-1: Distribution of the study population according to demographic information.

Demographic information	Number	Percentage	p-value
Gender			
Male	75	58.14	0.064 NS
Female	54	41.86	
Total	129	100	
Age groups			
20–29 years	29	22.48	0.0001**
30–39 years	58	44.96	
40–49 years	28	21.71	
>50 years	11	10.85	
Total	129	100	
Qualifications			
Uneducated	7	5.43	0.0001**
Primary	5	3.88	
Secondary	6	4.65	
Diploma	13	10.08	
Bachelor	63	48.84	
Masters	29	22.48	
Ph. D	6	4.65	
Total	129	100	
Areas			
Suwaira	31	24.03	0.0001**
Kut	91	70.54	
Numaniyah	6	4.65	
Al Hai	1	0.78	
Total	129	100	
Work place			
Veterinary hospital	13	10.08	0.0001**
Veterinary health center	25	19.38	
Private veterinary clinic	33	25.58	
Others	58	44.96	
Total	129	100	
Current position			
Animal health supervisor	14	10.85	0.0001**
Livestock extension officer,	20	15.50	
Livestock production officer	26	20.16	
Livestock production supervisor	9	6.98	
Veterinarian	60	46.51	
Total	129	100	
Years in veterinary practice			
0–10 years	76	58.91	0.0001**
11–20 years	34	26.36	
>20 years	19	14.73	
Total	129	100	

Highly significant **($p \leq 0.01$)

(68.99%) advocated against using antibiotics to accelerate animal growth, whereas 90/129 (69.77%) suggested that reducing the recommended dose could diminish the effectiveness of antibiotics. Less than half of the participants 62/129 (48.06%) suggested prolonging the antibiotic course, even if the patient's condition showed signs of improvement. Less than half of the participants 62/129 (48.06%) suggested prolonging the antibiotic course even if the patient's condition showed signs of improvement. In addition, over half of those who participated in the survey noted the importance of waiting a certain amount of time before consuming meat (92/129, 71.32%) or milk (83/129, 64.34%) from animals treated with antibiotics. In addition, 75/129 (58.14%) of those who were surveyed believed that antibiotics may have repercussions if used for purposes other than treatment. The results also indicated that only 45/129 (34.88%) of people knew that antibiotic-resistant bacteria are dangerous because they are so hard to cure, and only 47/129 (36.43%) knew that appropriate management techniques in agriculture can help prevent the development of resistance. Only 43.75% of those who completed the survey had excellent knowledge (above average), whereas 56.25% had a fair to poor understanding of antibiotic usage and AMR (Figure-1). According to participants' knowledge questions, there were statistically significant variations ($p \leq 0.01$) in the participants' answers (Table-2).

Attitudes toward antibiotic use and ABR

Table-3 displays the survey results regarding participants' attitudes. A total of 68/129 participants (52.71%) strongly agreed that AMR is an increasing concern in both human and veterinary medicine. On the other hand, no participants strongly disagreed with this statement, and only 10/129 participants (7.75%) disagreed or were indifferent. According to the survey results, less than half of the participants 58/129 (44.96%) strongly agreed that if we do not take immediate action, it will become an even more significant issue in the near future. The participants also reached a substantial consensus, with 106/129 (82.17%) strongly agreeing or agreeing that we should outlaw the purchase of antibiotics without a prescription. In addition, 94/129 (72.87%) of the participants agreed or strongly agreed that administering antibiotics at the appropriate dosage can prevent the development of resistance. More than half of the people who participated in the survey 68/129 (52.71%) agreed or strongly agreed that the improper use of antibiotics in animals could lead to the development of ABR in humans. The unrestricted use of antibiotics in farm animals is a significant contributor to the development of resistance to bacterial diseases in people, according to 94/129 (72.87%) participants who agreed or strongly agreed with this statement. When examining the possibility of dispensing antibiotics, the majority of participants 112/129 (86.82%) agreed or strongly agreed that store and product registration, availability of prescriptions, and presence of a veterinarian at the store were positive factors. It is interesting to note that up to 104/129 (80.62%) of those who participated in the survey expressed a great deal of worry about the fact that the right dose of antibiotics, effective management, immunization, and advice from a veterinarian were the keys to avoiding and using antibiotics in animals in an appropriate manner. In a very unlikely situation, the negative consequences of antibiotic abuse on animals, people, and the environment were not a

Table-2: Participants' response on knowledge.

Questions	Responses n (%)			p-value
	Correct	Incorrect	I do not know	
Antibiotics are prescribed for all infections, including viral infections	73 (56.59)	49 (37.98)	7 (5.43)	0.0001**
Antibiotics should be administered at the correct doses and dosages for all types of animal species.	100 (77.52)	26 (20.16)	3 (2.33)	0.0001**
Administering antibiotics to animals that are not sick will prevent them from becoming sick in the future	81 (62.79)	33 (25.58)	15 (11.63)	0.0001**
If one animal in the herd is sick, all other animals in the same herd should be given antibiotics to prevent infection.	85 (65.89)	36 (27.91)	8 (6.20)	0.0001**
Antibiotics should be administered to promote animal growth	89 (68.99)	26 (20.16)	14 (10.85)	0.0001**
Using a dosage lower than the recommended dose affects antibiotic efficiency	90 (69.77)	24 (18.60)	15 (11.63)	0.0001**
Antibiotics can be stopped immediately when sick animals do not show any signs	62 (48.06)	54 (41.86)	13 (10.1)	0.0001**
Antibiotic withdrawal periods should be maintained to avoid drug residues in meat and its products.	92 (71.32)	19 (14.73)	18 (13.95)	0.0001**
Milk and milk products from cows treated with antibiotics can be consumed during treatment.	83 (64.34)	22 (17.05)	24 (18.60)	0.0001**
Nontherapeutic antibiotic use does not cause any consequences	75 (58.14)	35 (27.13)	19 (14.73)	0.0001**
Any bacteria will become resistant once it is exposed to an antibiotic	42 (32.56)	72 (55.81)	15 (11.63)	0.0001**
Infections caused by antibiotic-resistant bacteria can make surgical procedures dangerous	45 (34.88)	70 (54.26)	14 (10.85)	0.0001**
A resistant bacterium can be spread between animals and humans	81 (62.79)	38 (29.46)	10 (7.75)	0.0001**
Practicing good animal hygiene can prevent the development of antimicrobial resistance.	47 (36.43)	72 (55.81)	10 (7.75)	0.0001**
Antibiotics can be stored at any location that is easy to use.	84 (65.12)	34 (26.36)	11 (8.53)	0.0001**
Antibiotics should not be stored for later use	62 (48.06)	53 (41.09)	14 (10.85)	0.0001**
p-value	0.0001**	0.0001**	0.0086**	---

Highly significant **($p \leq 0.01$)

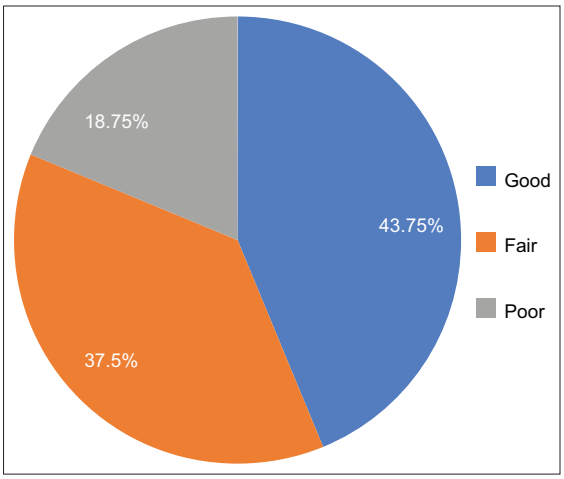

Figure-1: Overall knowledge of the contributors; level of assessment: Poor (M.S. ≤ 0.94), Fair (M.S.=0.95–1.37), Good (M.S. ≥ 1.38). M.S.=Mean of score.

major concern for 70/129 (54.26%) of participants. Only 38.46% of the participants exhibited favorable views toward the use of antibiotics and ABR, whereas 61.54% exhibited neutral attitudes about these topics (Figure-2). According to the participants' attitude questions, there were statistically significant variations ($p \leq 0.01$) in the participants' answers (Table-3).

Participants' antibiotic use and ABR practices

The participants' actions regarding antibiotic use and resistance indicated that 99/129 (76.74%) correctly identified prolonged illness with underlying bacterial infections as a sign of antibiotic use (Table-4). On the other hand, 40/129 (31.01%) participants said that they had taken antibiotics for all kinds of situations. 80/129 of the participants (62.02%) stated that they independently prescribed antibiotics, which were unaffected by the owner's expectations. A few participants administered antibiotics for a period of 1 day (6.98%) or 5 days (10.85%), despite 40.31% of the participants providing medicines until the animal recovered. We determined that most participants (114/129, 88.37%) should choose an antibiotic based on the type of bacteria present. More than half of the survey participants stated that the prescribed dosage of the antibiotic, not the animal's size, determined the amount of antibiotic administered (85/129, 65.89%). On the other hand, 33.33% of the participants had inadequate practices regarding antibiotic usage, whereas 50.00% of the participants exhibited excellent practices regarding antibiotic use and ABR (Figure-3). According to the participants' practice questions, there were statistically significant variations ($p \leq 0.01$) in the participants' answers (Table-4).

Estimation of the correlation coefficient between participants' axes

Table-5 displays the correlation coefficient calculation between the participants' axes. Based on statistical analysis, it can be observed that there exists a highly significant correlation ($p \leq 0.01$) between the knowledge and attitude of the individuals who participated in this study. In addition, there was a

Table-3: Participants' response on attitude.

Questions	Responses n (%)					p-value
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	
AMR affects veterinary and human health significantly	68 (52.71)	51 (39.53)	9 (6.98)	1 (0.78)	0 (0)	0.0001**
Without immediate action, AMR will worsen in the next years	58 (44.96)	44 (34.11)	16 (12.40)	4 (52.71)	7 (3.10)	0.0001**
Over-the-counter antibiotics should be prohibited	46 (35.66)	60 (46.51)	20 (15.50)	2 (1.55)	1 (0.78)	0.0001**
To prevent the spread of antibiotic resistance, it is important to provide the appropriate dosage of medications	34 (26.36)	60 (46.51)	26 (20.16)	6 (4.65)	3 (2.33)	0.0001**
Animals given incorrect drugs can cause human antibiotic resistance	30 (23.26)	38 (29.46)	30 (23.26)	28 (21.71)	3 (2.33)	0.0001**
Uncontrolled antibiotic use in farm animals contributes to human bacterial resistance	35 (27.13)	59 (45.74)	26 (20.16)	7 (5.43)	2 (1.55)	0.0001**
Dispensing antibiotics without prescription should be restricted	69 (53.49)	43 (33.33)	12 (9.30)	3 (2.33)	2 (1.55)	0.0001**
Before administering antibiotics, obtain the animal's history and symptoms	64 (49.61)	40 (31.01)	15 (11.63)	8 (6.20)	2 (1.55)	0.0001**
Antibiotics may make healthy animals grow larger, quicker, fatter, and produce more eggs	25 (19.38)	48 (37.21)	15 (11.63)	27 (20.93)	14 (10.85)	0.0001**
You advise farmers to vaccinate their animals to limit the use of antibiotics	48 (37.21)	53 (41.09)	20 (15.50)	4 (3.10)	4 (3.10)	0.0001**
Customers must be informed to use antibiotics for treatment whenever they are prescribed.	26 (20.16)	75 (58.14)	20 (15.50)	7 (5.43)	1 (0.78)	0.0001**
Antibiotics are routinely administered without prescription because clients know how to use it.	23 (17.83)	36 (27.91)	29 (22.48)	13 (10.08)	28 (21.71)	0.0001**
Insufficient data exists on the association between animal antibiotic use and human antimicrobial resistance	20 (15.50)	45 (34.88)	33 (25.58)	16 (12.40)	15 (11.63)	0.0001**
p-value	0.0001**	0.0001**	0.0001**	0.0003**	0.0047**	---

Highly significant **($p \leq 0.01$). AMR=Antimicrobial resistance

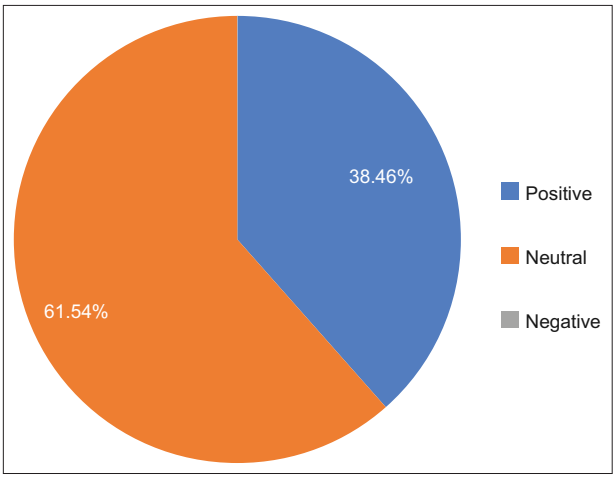

Figure-2: Overall attitudes of the contributors; level of assessment: Negative (M.S. ≤ 2.77), Neutral (M.S. = 2.78–4.09), Positive (M. S. ≥ 4.10). M.S.= Mean of score.

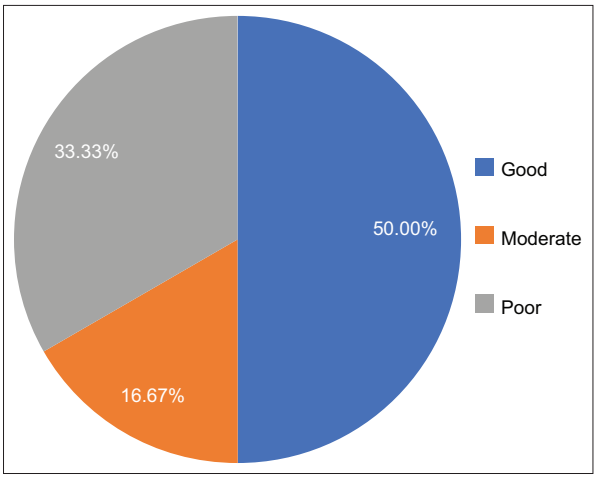

Figure-3: Overall practices of the contributors; level of assessment: Poor (M.S. ≤ 0.41), Moderate (M.S. = 0.42–0.64), Good (M.S. ≥ 0.65). M.S. = Mean of score.

significant correlation ($p \leq 0.05$) between knowledge and practices, as well as between the attitudes and practices of the individuals who participated in this study (Table-5).

Information sources of participants

Senior specialists (30/129, 23.26%), veterinary publications (24/129, 18.6%), the internet, and veterinary websites (23/129, 17.83%) were the primary sources of information to participants regarding antibiotic usage and ABR. Other sources, including the Merck Manual, training programs, television, OIE principles and guidelines, account for 52/129 (40.31%) (Figure-4).

Discussion

Numerous studies have demonstrated that solid knowledge and appropriate practices can predict accurate KAP for AMU and AMR [48, 49]. This research investigated how veterinarians and animal health professionals throughout Wasit governorate perceive, discuss, and deal with AMR and antibiotic use. To

Table-4: Participants' response on practice.

Questions	Number (%)	Correct (%)	Incorrect (%)	p-value
You prescribe antibiotics for what type of animal cases				
Any type of case	40 (31.01)	30 (23.26)	99 (76.74)	0.0001**
Animals with rhinitis	40 (31.01)			
Animals with diarrhea	19 (14.73)			
Prolonged illness with underlying bacterial disease	30 (23.26)			
I do not read the prospectus before using antibiotics				
Yes	26 (20.16)	103 (79.48)	26 (20.16)	0.0001**
No	103 (79.48)			
I decide to prescribe or administer antibiotics to animals and is not influenced by the animal owner's decision?				
Yes	80 (62.02)	80 (62.02)	49 (37.98)	0.0001**
No	49 (37.98)			
How many days do you usually prescribe (duration of antibiotic treatment) antibiotics for an animal?				
1 day	9 (6.98)	52 (40.31)	77 (59.69)	0.0001**
3 days	34 (26.36)			
5 days	14 (10.85)			
7 days	20 (15.5)			
Until the animal recovers	52 (40.31)			
Think about the type of bacteria involved in infection of an animal before selecting an antibiotic				
Yes	114 (88.37)	114 (88.37)	15 (11.63)	0.0001**
No	15 (11.63)			
Administration of large doses of antibiotics to large animals and small doses to small animals by looking at the size of the animals rather than the recommended dose?				
Yes	44 (34.11)	85 (65.89)	44 (34.11)	0.0001**
No	85 (65.89)			

Highly significant **($p \leq 0.01$)

Table-5: Estimation of correlation coefficient between participants' axes.

Participants' axis	Correlation coefficient-r	p-value
Knowledge of participants		
Attitudes of participants	0.81**	0.0052
Knowledge of participants		
The practices of participants	0.37*	0.0371
Attitudes of participants		
The practices of participants	0.42*	0.0355

Significant *($p \leq 0.05$), Highly significant **($p \leq 0.01$)

our knowledge, this is the first study to determine of KAP among animal health professionals in Wasit governorate.

The majority of participants held bachelor's and master's degrees. This reflects the progress that has taken place in veterinary medicine over the last few years, as universities have been responsible for producing a significant number of graduates and post-graduate veterinarians who can practice in this field. In addition, the increasing number of women in the veterinary profession reflects Iraq's ongoing efforts to promote gender equality. These findings are consistent with those of previous research by Ting *et al.* [42].

Only 43.75% of participants scored higher than the mean knowledge score, indicating that participants had a low level of understanding of antibiotic usage and AMR. These findings surpass previous results by Wangmo *et al.* [43], which indicated a low level of understanding about antibiotics and AMR among participants in Bhutan, with only 38.8% ranking as having the mean score. The data on participants' awareness levels suggest that low awareness among those who participated in the survey is the cause. Lack of awareness regarding antibiotic use and AMR may lead to the prescription of unnecessary antibiotics. Although 56.25% of the participants scored below the mean for knowledge, over 84/129 (65%) accurately answered eight of the 16 knowledge-related questions. There was a significant difference between these findings and the results obtained from previous research by Wangmo *et al.* [43], which showed that more than 90% of the participants provided accurate responses to eight of the 17 knowledge questions. The answer rate was higher when the questions were more general like asking about the importance of correctly delivering the correct amount and dosage of antibiotics, completion of the antibiotic course, and use of preventative therapies. However, the response rate decreased significantly when more detailed questions. These findings are consistent with previous studies by Wangmo *et al.* [43] and Chea *et al.* [44].

More than half of the participants (67/129, 51.96%) either gave incorrect responses or were unsure about the exact duration of antibiotic therapy, indicating that the question was poorly understood. While the length of time an antibiotic treatment should last is currently debated, one factor contributing to resistance development is the over- or under-dosing

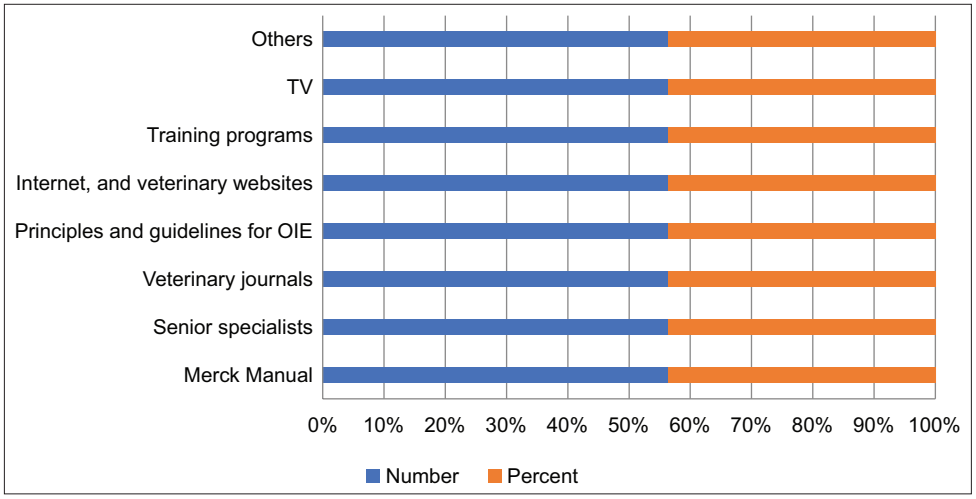

Figure-4: Sources of participants' information.

of antibiotics [50, 51]. Although several participants were aware of the necessary time off when prescribing or taking antibiotics, it is concerning that over one-third of them stated that antibiotics are effective against any illness. This is consistent with a study conducted in Cambodia [44].

In addition, compared with Timor-Leste (59.9%) [42], Bhutan (76.5%) [43], and South Africa (93.4%) [45], 56.59% of participants correctly recognized that drugs did not kill or suppress viruses in our study. Furthermore, only 42/129 (32.56%) of the participants in this survey had heard of ABR and correctly identified that it reduced the effectiveness of medicines, indicating an insufficient understanding of the topic. This percentage matched that of Timor-Leste (29.0%) [42] but was much lower than that of Bhutan and South Africa, where 95.4% and 100% of participants, respectively, said that antibiotic-resistant germs are hard to cure and that veterinarians should only give the drugs when required [43, 45]. In contrast to smallholder pig farmers in Timor-Leste, who were unable to define ABR, participants had a better understanding of the topic, which is encouraging [52].

When asked about the threat that diseases resistant to antibiotics pose to surgical operations, only 45/129 (34.88%) of people answered that the threat was valid. Furthermore, 62/129 (48.06%) correctly stated that we should not administer antibiotics to animals for their safety. These findings are in stark contrast to those from South Africa [45] in which >60% of participants understood the dangers of antibiotic storage for animals, and nearly all participants acknowledged the threat of antibiotic-resistant infections during surgical procedures.

This study's findings may differ from those of the South African study because of the different populations studied; the latter study only included veterinarians. This highlights the need for more extensive and nationwide awareness and training programs to gather sufficient information to prevent the overuse of antibiotics.

Nearly one-third of those surveyed had a positive view of antibiotic usage and resistance, whereas a large percentage (61.54%) were neutral. Table-3 and Figure-2 indicate participants' attitudes toward antibiotic usage and resistance. Nearly all participants (119/129, 92.24%) agreed or strongly agreed that AMR is a significant problem in human and veterinary medicine. This finding agrees with that of most veterinarians in Serbia and Bhutan (92.7% and 96%, respectively) [40, 43]. Veterinarians in Serbia and Australia [40, 53] hold varying perspectives on whether AMR will escalate into a more significant issue if current actions do not expedite; our study's participants, at 102/129 (79.1%) versus 99/110 (90.0%) and 370/403 (91.8%), respectively, were less inclined to share this view. This could be attributed to the lower level of views in this research, which included participants with varying degrees of experience.

On the other hand, more than half of the participants were aware that the antibiotics are the factor in the overall issue of AMR. In a similar vein, more than 60% of veterinarians in Australia stated that their AMU only had a small influence on AMR [54]. However, in Kentucky, United States, most veterinarians believed that inappropriate AMU contributed to the selection of AMR [55]. Livestock and poultry management uses several antibiotics, both for medicinal and non-therapeutic purposes, including growth supporters and prophylactics [56]. Despite previous research by Kudale *et al.* [56] indicating that antibiotic efficiency is diminished due to antibiotic overlap between animals and humans, there is a lack of evidence in Iraq, specifically in Wasit province. A lack of understanding about this issue could be detrimental because the absence of personal responsibility for adverse consequences decreases the likelihood of change [57]. This is of utmost significance because studies have shown that veterinarians and other professionals in the animal healthcare industry can substantially impact farmers' attitudes toward AMR and antimicrobial use [58].

Furthermore, up to 104/129 (80.62%) of those who participated in the survey expressed a great deal of worry about the fact that the right dose of antibiotics, effective management, immunization, and advice from a veterinarian were the most important factors in avoiding and appropriately using antibiotics in animals. These findings are consistent with those of Cambodia [44]. It is possible to prevent infections without using antimicrobials using efficient and relevant methods, such as appropriate animal husbandry, adequate biosecurity, and immunization [59].

Researchers in the Netherlands have found that optimistic and well-versed veterinary professionals in AMR can make a difference in the fight against AMU [38]. The findings of our research, on the other hand, revealed that participants had relatively little understanding of the etiology of AMR. The results showed that participants often failed to acknowledge the possibility of resistant bacteria spreading through interactions with other people [60] and animals [61]. This indicates that educating professionals in the animal health field and veterinarians about the AMR problem through various educational initiatives requires significant effort. Therefore, we must focus our efforts on judicious AMU by coordinating the training of resident veterinary experts and directing further research toward the discovery of antibiotic alternatives for the treatment of this potentially fatal infection.

Of the total participants, half (50%) had poor to moderate antibiotic use (Figure-3). While 100/129 (77.52%) of the participants believed that all animals should receive antibiotics at the proper dosage, 44/129 (34.11%) reported that they do so, giving large animals more medicine and smaller animals less. Consultation with -animal health specialists revealed that 30/129 (23.26%) had prescribed antibiotics for prolonged bacterial illness, and a read of the prospectus before administering antibiotics was performed by 103/129 (79.48%). With over half of our participants (80/129, 62.02%) saying that customers had no say in the prescription choice, we can be certain that our animal health staff will not feel pressured to write unnecessary antibiotic prescriptions. Research from Denmark [61] and the United States [62] yielded similar conclusions. This means that customers cannot force doctors to prescribe antibiotics they do not need. The fact that 114/129 (88.37%) considered the specific bacteria responsible for an illness when choosing an antibiotic was also encouraging. With this information, we can better target infection-causing microbes using appropriate medications. It is concerning that some of participants administered antibiotics for rhinitis 40/129 (31.01%), diarrhea 19/129 (14.73%), and any other condition 40/129 (31.01%). This further demonstrates the misuse of antibiotics in practice, potentially accelerating the emergence of AMR in Iraq. Implementing guidelines and effective control of its use have been one strategy to counteract rising drug resistance. Antimicrobial recommendations could be one way to make antibiotic use more reasonable since their implementation was linked to a large drop in antibiotic prescriptions and a rise in the use of older antibiotics [63]. In this regard, the AWaRe classification indicates that antibiotics are more likely to be restricted and prescribed less excessively or incorrectly. The WHO's AWaRe tool predicts that by 2023, 60% of antibiotic prescriptions will be categorized as Access. Adhering to the WHO AWaRe framework resulted in lower antibiotic use and improved AMS [23].

Statistically, there was a highly significant correlation between the knowledge and attitude of the participants ($p = 0.0052$), while there was a significant correlation between the knowledge and practices ($p = 0.0371$) and between the attitudes and practices ($p = 0.0355$) of the participants in this study (Table-5). This could be due to the varied backgrounds of the people who participated in this research. It may also be because people in various parts of the world use different protocols and methods.

The veterinary profession should adopt proper prescription practices even if no law in our nation requires veterinarians to use AMS programs. Despite shifting antimicrobial prescription patterns, veterinarians encounter several challenges in their daily work, one of which is the possibility of sluggish behavior changes due to a lack of ongoing professional development in AMS [43]. According to the findings that we obtained (Figure-4), the participants gained the majority of their knowledge on antibiotic usage and ABR from senior experts (30/129, 23.26%), veterinary periodicals (24/129, 18.6%), the internet, and veterinary websites (23/129, 17.83%). Contributors reportedly used various websites to expand their understanding of AMU and AMR. Because of the development of various communication tools, the Internet has emerged as the most effective and widespread method of obtaining information on most subjects. In previous research by Wangmo *et al.* [43] from Bhutan, the sources of information participants referred to were radio (13/219, 5.9%), the internet and social media (102/219, 19.7%), and training programs (144/219, 38%).

In order to combat the spread of ABR, the WHO has proposed a One Health strategy that its member nations are encouraged to replicate in their programs [64]. Improving the management of AMR may include measures to maintain the efficacy of current antimicrobials, notably by curtailing their improper use, especially in large numbers. To reduce the spread of antibiotic-resistant bacteria as well as over prescription and excessive use of antimicrobials and infections, improvements in hygiene, infection control, water quality, sanitation, and pollution control from poorly implemented waste management practices employed by residences, companies, and industrial

sites are necessary, as they aggravating environmental resistance [15].

It is vital to note that this study was conducted in a single governorate, and it is possible that the results cannot be generalized to other locations. This result is due to the research's limited scope within a single governorate. Therefore, to better understand the issue, a large-sample study representative of different provinces is necessary. Despite these limitations, our findings have major implications for reducing the misuse and overuse of antibiotics, which will eventually decrease AMR.

Conclusion

A large proportion of animal health professionals and veterinarians, according to our results, need more knowledge and different attitudes about antibiotic usage and resistance, as well as bad practices regarding the use of antibiotics. A number of socioeconomic characteristics, most notably education level, are associated with their KAP regarding antibiotic usage and resistance. As a result, it is of the utmost importance to raise knowledge about the appropriate use of antibiotics and ABR, and it is also important to promote the use of alternative methods. In addition, to minimize the amount of antibiotics used and the amount of resistance that they develop, authorities should implement restrictions on the delivery, purchase, and use of antibiotics without prescription. In addition, the global action plan on AMR should encourage the implementation of the One Health strategy to combat AMR. This approach can tackle AMR from every angle: the environment, all ecological systems, animals, agriculture, and humans. Scientists and experts in medicine, agriculture, the environment, and animal husbandry must therefore work together to combat AMR. The WHO's AWaRe framework should also be followed in all sectors in terms of infection management. Authorities may find this research valuable in establishing strategies to fight ABR because it offers baseline data on the KAP of workers in the veterinary profession regarding antibiotic usage and resistance.

Author's Contributions

MHGK: Designed the study, collected the samples, analyzed the data, and drafted and revised the manuscript. The author has read and approved the final manuscript.

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Competing Interests

The author declares that she has no competing interests.

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