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Knowledge, attitudes and practices towards use of antibiotics and resistance among under graduate veterinary students in Nigeria

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ABSTRACT

Aim: Purpose of the study was to assess the knowledge, attitudes and practices (KAP) related to antibiotic use and resistance among 350 undergraduate veterinary students in Nigeria.
Method and materials: A cross-sectional study design was used and the data were collected via a structured questionnaire.
Results: High levels of awareness about antibiotics (98.29%) and AMR (96.57%), but low familiarity with Nigeria's AMR National Action Plan (24.57%) and its pillars (18.57%). Misconceptions persisted, including the belief that antibiotics can hasten recovery from viral infections (50.00%). Inappropriate practices such as stopping antibiotics when symptoms subside (41.14%) and self-medication (37.71%) were reported. Despite these issues, students exhibited a strong willingness to engage in AR prevention with 92.86% agreeing that veterinary professionals have a role to play.
Conclusion: It was concluded that there is significant gap in knowledge, attitudes and practices associated with antibiotic use and resistance among veterinary students in Nigeria.

Keywords: Antibiotic use; resistance; veterinary students; Nigeria

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Introduction

Antimicrobial resistance (AMR) is a multifaceted global health challenge that threatens effectiveness of antibiotics in both human and veterinary medicine. It poses serious implications for public health, food security and ecosystem stability (Muloi *et al*., 2018 and Abunna *et al*., 2023). The emergence and spread of AMR are primarily driven by indiscriminate and inappropriate use of antimicrobials in humans, animals and agriculture (Mahajan *et al*., 2014 and Sitotaw and Philipos, 2023).

Additional factors, including self-medication, over-the-counter antibiotic availability, suboptimal prescribing practices, and socio-cultural perceptions of drug use, further exacerbate the problem (Jairoun *et al*., 2019).

The consequences of AMR are profound. Resistant bacterial infections reduce treatment options, prolonged hospital stays, increase medical costs and are associated with elevated morbidity and mortality (Prestinaci *et al*., 2015). In 2019 alone, AMR was directly responsible for an estimated 1.27 million deaths globally and contributed to nearly 5 million deaths overall (Talebi *et al*., 2019). Low and middle-income countries (LMICs), including Nigeria, bear a disproportionate burden of AMR-related deaths due to poor hygiene, limited diagnostic capacity, weak regulatory oversight and high dependence on antibiotics to compensate for their weak health infrastructure (Chapot *et al*., 2021; Kariuki *et al*., 2022). The

economic impact is equally significant. Projections by World Bank estimated that AMR could result in an additional US$1 trillion in healthcare costs and a global GDP loss ranging from US$1 trillion to US$3.4 trillion annually by 2030 (Talebi *et al*., 2019).

Veterinarians and veterinary paraprofessionals are critical stakeholders in AMR mitigation. As stewards of animal health, they influence antibiotic prescription practices and can advocate for responsible antimicrobial use (Shah *et al*., 2019; Sakr *et al*., 2020). Alarmingly, more than half of the global antimicrobial consumption occurs in animals, and they are often for non-therapeutic purposes such as growth promotion in food animals (Wall *et al*., 2016). The misuse of antibiotics in veterinary practice, including prophylactic administration and treatment of viral infections under the pretext of preventing secondary bacterial infections, contributes significantly to the spread of resistant pathogens. Despite global and national efforts, including the WHO Global Action Plan on AMR and Nigeria's National Action Plan (NAP), many implementation challenges remain. Nigeria launched its first AMR NAP in 2017 and revised it in 2024.

While policy frameworks have been established, enforcement, funding, active surveillance and awareness among key stakeholders, especially future prescribers, are still limited. Regulatory gaps persist, with widespread access to antibiotics through unlicensed vendors and promotional practices that encourage irrational drug use. Veterinary students represent the next generation of antimicrobial prescribers, and they are key to the future success of AMR containment strategies. However, in Nigeria, the integration of AMR topics into veterinary curricula is still pending despite policy recommendations. Moreover, while numerous studies have examined AMR-related knowledge, attitudes, and practices (KAP) among medical students, fewer have focused on veterinary students, particularly in sub-Saharan Africa (Anyanwu et al., 2018). This study aimed to assess the knowledge, attitudes, and practices regarding antibiotic use and AMR among undergraduate veterinary students in Nigeria. Understanding these baseline indicators is crucial for informing educational reforms, guiding national policy implementation, and strengthening the One Health approach to AMR mitigation.

Materials and Methods

The study was conducted according to guidelines of the University of Jos Ethical Committee (UJ/FPS/F17-00379). Informed consent was obtained from all participants.

Study Area: The study was carried out at all campuses of Faculty of Veterinary Medicine in Nigeria. The country has 15 Veterinary Schools, of which only 11 are fully accredited by the Veterinary Council of Nigeria (VCN) and the National University Commission (NUC). But for this survey, only students from 14 of the faculties responded. Additionally, 9 out of these 14 faculties are located in the Northern part of the country (NE = 2, NW= 4, NC = 3), while the remaining in the southern part of the country (SW = 2, SE = 2, and SS = 1) (Fig. 1).

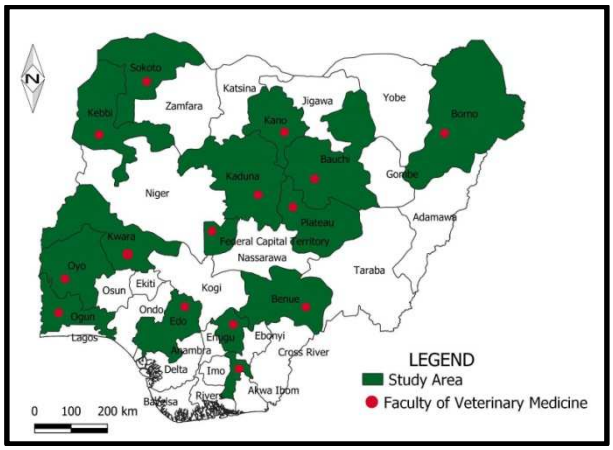

Fig 1. Distribution of veterinary schools in Nigeria

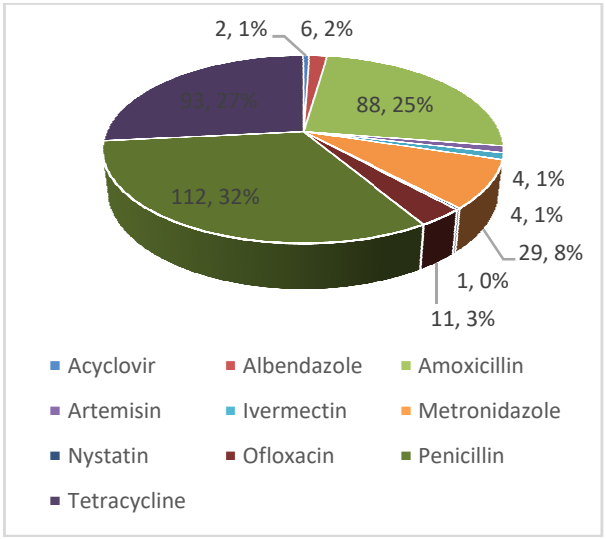

Fig. 2. Drugs identified by the respondents as antibiotics

Study design: A cross-sectional self-assessment survey was conducted among students of Faculty of Veterinary Medicine to evaluate their level of KAPs with regards to antibiotic use and antibiotic

resistance. Calculation for single population proportion was used to determine the sample size to be used in this study based on the assumed parameters; a knowledge prevalence of 33.2% as reported by Odetokun *et al*. (2019), 95% confidence level, an error margin of 5% and 10% non-response rate using A-Chi Squared Inc. sample size calculation for cross-sectional studies with percentage as outcome (https://app.chisquares.com/sample-size) as in the formula below.

$$n = \frac{Z_{\alpha}^2 \times \pi \times (1 - \pi)}{\varepsilon^2}$$

Where:
· n is the required sample size overall
·Zα is the Z-score corresponding to the desired level of confidence (e.g., 1.96 for a 95% confidence level).
· π is the expected prevalence or proportion of the outcome in the population
· 1-π is the probability of the outcome not happening.
· ε is the margin of error.
Based on these parameters, we calculated a total sample size of 379 as the minimum number of students to be enrolled for the study. Of the 379 students, only 350 students filled the questionnaire for participation (the response rate was 92.3%). The study adopted a qualitative approach using a pretested 58-point structured questionnaire shared by sending a web-link (https:forms.gle/dtYqbKGWBYnepGjS6) through social media (WhatsApp) and email, and lasted from September 27th, 2023 to December, 6th 2023.
Questionnaire Design and Data collection: The questionnaire was developed after reviewing relevant literature, and it was modified to address all the research gaps on antibiotic use and antibiotic resistance ((Talebi *et al*., 2019; Odetokun*et al*., 2019; Kalam *et al*., 2022). The design, content, scope, clarity and comprehension of the questionnaires were examined and assessed by subject-matter experts. Based on information gathered from literature review on knowledge, attitudes, and practices of veterinary students and experts' opinions, a set of closed-ended questions were designed to ensure data collection and improve response rates from the cross-sectional survey. The questionnaire was divided into 4 sections; 1-Veterinary Students' demographics (6 questions); 2-Knowledge About Antibiotics and Antimicrobial Resistance (18 questions); 3 - Attitudes Towards Antibiotic Resistance and Antibiotic Use (26 questions), and 4-Practices Regarding Antibiotic Use and Antibiotic Resistance (8 questions). Fifteen students and 10 subject matter specialists participated in piloting the research study to assess the validity and reliability of each question. The pilot data were not included in this study but were used to adjust the questions based on the generated feedback.
Data Analysis: Data cleaning was done using the z-value comparison for the identification of outliers and subsequent removal. Percentages of the frequency of responses was determined using Microsoft excel (2019) and data collected with the questionnaire which include sociodemographic distribution of respondents as well as responses to the questions were analysed statistically using Chi-square in JMP version 17 and P-value < 0.05 was considered statistically significant.

Results and Discussion

A total of 350 undergraduate veterinary students participated in the study. These respondents comprise 58.0% males and 42.0% females. The majority of respondents (53.43%) were aged between 21–24 years, with 94.57% identifying as single (unmarried). The distribution of the students (Table 1) revealed that all levels were represented with 100 level being the least (3.42%) and 600 level being the most represented (28.29%) (Fig 1). Fourteen institutions participated in this study, however, only 3 universities recorded a higher number of participants; namely University of Jos (21.43%), Ahmadu Bello University, Zaria (18.86%) and Yakubu Gowon University formerly University of Abuja (17.14%).

Table 1. Demographic details of respondents

PARAMETER	FREQUENCY (%)	X^2	P-VALUE
Gender			
Male	203(58.00)	8.9986	0.0027
Female	147(42.00)		
Age (Years)			
16-20	33(9.43)	121.2385	<.0001
21-24	187(53.43)		
25 and Above	130(37.14)		
Marital status			
Married	19(5.43)	337.5409	<.0001
Single	331(94.57)		

Knowledge assessment revealed a high level of awareness: 95.43% knew about antimicrobials, 98.29% were familiar with antibiotics, and 96.57% were aware of antibiotic resistance. This was evident in the 83.71% of students refuting the therapeutic effectiveness of using antibiotics in treating viral infection, while 98.57% correctly affirmed its use in treating bacterial infection (Table 2). However, only 24.57% and 18.57% had knowledge of Nigeria's AMR National Action Plan and its pillars. A significant majority (83.71%) correctly identified that antibiotics cannot treat viral infections, while 98.57% acknowledged their effectiveness against bacterial infections. Despite this, misconceptions persisted: 50.00% believed antibiotics could hasten recovery from flu-related illnesses. Furthermore, 6.29% supported over-the-counter antibiotic use, and 57.43% endorsed antibiotics for disease prevention. Interestingly, when asked to select which drugs from a list of drugs were antibiotics, a minority population of the students identified Acyclovir, Artemisinin, Albendazole, Nystatin and Ivermectin (Fig. 2). Also, the students indicated the academic curriculum as their major sources of information on antibiotics and antibiotic resistance (Fig. 3).

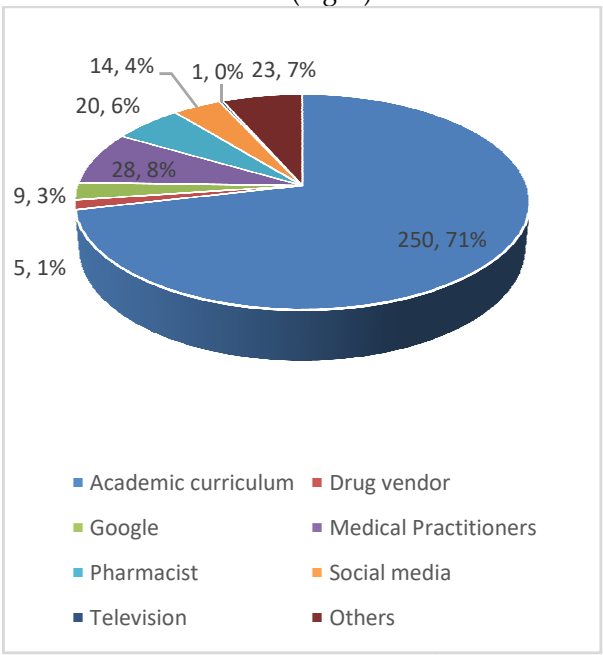

Fig. 3. Common sources of information on antibiotics

Attitudinal findings revealed that 85.14% believed antibiotics are abused in Nigeria, and 90.00% agreed that antibiotic resistance poses a risk to themselves or their families. Importantly, 92.86% agreed that antibiotics should only be used when prescribed, and 89.71% recognized vaccination as a disease prevention strategy. A majority (76.57%) supported introducing a dedicated course on rational antibiotic use. Regarding practices, 41.14% admitted to stopping antibiotics once symptoms improved, and 37.71% used antibiotics without medical guidance. Furthermore, 21.71% had used antibiotics to treat common colds, and 12.29% did not check expiration dates. Only 70.00% disposed of expired antibiotics after use. The factors that determine their choice of accessing antibiotics included expiry date of the drug, the brand and trade name, and the standard of the drug store/pharmacy (Fig. 4). Many of the students kept the antibiotic remnants at the end of the course of treatment. Others threw it in garbage, gave it out to others, or buried them (Fig. 5).

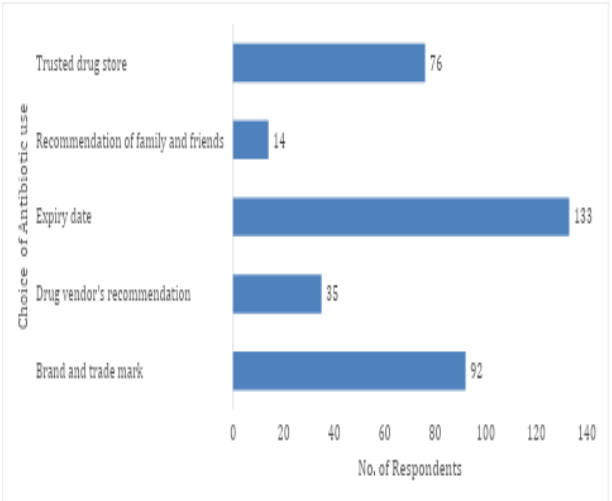

Fig 4. Factors considered by veterinary students in purchasing antibiotics

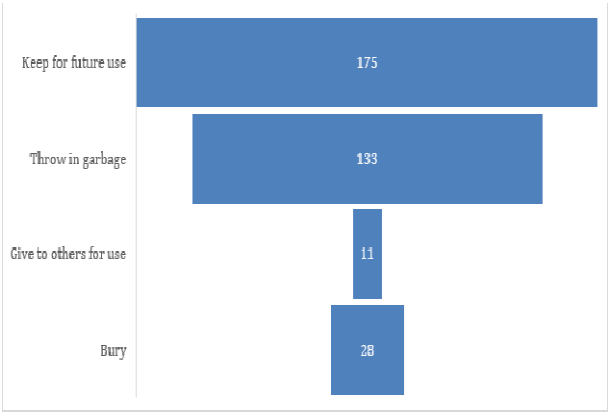

Fig 5. Practices of respondents with respect to leftover antibiotics

Table 2. Knowledge on antibiotic use and antibiotic resistance amongst veterinary students in Nigeria (n = 350)

QUESTIONS	RESPONSES	FREQUENCY (%)	X^2	P-VALUE
Do you know about antimicrobials?	Yes	334(95.43)	355.2	<.0001
	No	16(4.47)		
Are you familiar with the concept of antibiotics?	Yes	344(98.29)	424.5	<.0001
	No	6(1.71)		
Do you think antimicrobials are different from antibiotics?	Yes	256(73.14)	77.9	<.0001
	No	94(26.86)		
Do you know about antibiotic resistance?	Yes	338(96.57)	380.6	<.0001
	No	12(3.43)		
Do you know any antibiotics that are prohibited or banned for use in humans or livestock, fisheries and agriculture?	Yes	207(59.14)	11.7	0.0006
	No	143(40.86)		
Can antibiotics be used to cure infections caused by viruses?	Yes	57(16.29)	174.1	<.0001
	No	293(83.71)		
Can antibiotics be used to cure infections caused by bacteria?	Yes	345(98.57)	432.7	<.0001
	No	5(1.43)		
Do you think the use of antibiotics will speed up the recovery of colds, coughs and other diseases caused by the common flu virus?	Yes	175(50.00)	NA	NA
	No	175(50.00)		
Should antibiotics be purchased/obtained without prescription from the Pharmacies?	Yes	22(6.29)	320.8	<.0001
	No	328(93.71)		
Should antibiotics be used according to prescription?	Yes	350(100)	NA	NA
	No	0(0.00)		
Do you think the frequency of use of antibiotics will decrease the efficacy of drugs?	Yes	292(83.43)	170.8	<.0001
	No	58(16.57)		
Can antibiotics be used for disease prevention?	Yes	201(57.43)	7.7	0.0054
	No	149(42.57)		
Do you know about the AMR National Action Plan (2017-2022)?	Yes	86(24.57)	94.8	<.0001
	No	264(75.43)		
Are you aware of the AMR Pillars in the National Action Plan?	Yes	65(18.57)	149.2	<.0001
	No	285(81.43)		

Table 3. Attitudes of undergraduate veterinary students with regards to antibiotic use and antibiotic resistance (n = 350)

FACTORS	RESPONSES	FREQUENCY (%)	X^2	P-VALUE
Antibiotics is a problem in Nigeria.	Yes	204(58.29)	100.0	<.0001
	No	91(26.00)		
	I don't know	55(15.71)		
Antibiotics are abused in Nigeria.	Yes	298(85.14)	404.0	<.0001
	No	30(8.57)		
	I don't know	22(6.29)		
Antibiotic resistance can affect you or any member of your family or your pets.	Yes	315(90.00)	494.3	<.0001
	No	21(6.00)		
	I don't know	14(4.00)		
It is very important to get more information on Antibiotics.	Yes	334(95.43)	617.8	<.0001
	No	10(2.86)		
	I don't know	6(1.71)		
When a disease in an individual cannot be treated with antibiotics, is that a serious problem?	Yes	77(22.00)	112.6	<.0001
	No	60(17.14)		
	I don't know	213(60.86)		
Antibiotics should only be used when prescribed by a doctor.	Yes	325(92.86)	559.2	<.0001
	No	18(5.14)		
	I don't know	7(2.00)		
Vaccination can prevent disease.	Yes	314(89.71)	491.2	<.0001
	No	24(6.86)		
	I don't know	12(3.43)		
Vaccination helps to reduce the use of antibiotics.	Yes	269(76.86)	288.6	<.0001
	No	55(15.71)		
	I don't know	26(7.43)		
Is it necessary for your faculty to add a course on rational use of antibiotics?	Yes	268(76.57)	292.5	<.0001
	No	60(17.14)		
	I don't know	22(6.29)		
Please rate your interest in learning more about antibiotics.	Highly Interested	141(40.29)	56.2	<.0001
	Interested	154(44.00)		
	Not interested	55(15.71)		
Have you ever attended any training/conference/seminar/workshop on antibiotics?	Yes	107(30.57)	54.2	<.0001
	No	243(69.42)		
Have you ever attended any training/conference/seminar/workshop on antibiotic resistance?	Yes	121(34.57)	33.8	<.0001
	No	229(65.43)		
Antibiotics can protect both humans and animals.	Yes	315(90.00)	496.4	<.0001
	No	23(6.57)		
	I don't know	12(3.43)		
Antibiotic abuse is the main source of bacterial resistance.	Yes	302(86.29)	437.5	<.0001
	No	37(10.57)		
	I don't know	11(3.14)		
When using antibiotics correctly, there is less risk of developing resistance.	Yes	305(87.14)	443.1	<.0001
	No	30(8.57)		
	I don't know	15(4.29)		
Inappropriate use or half course of antibiotics leads to	Yes	305(87.14)	444.6	<.0001

antibiotics resistance.	No	31(8.86)		
	I don't know	14(4.00)		
Poor infection control practices by veterinarians and other health care professionals will cause spread of antibiotic resistance.	Yes	268(76.57)	290.6	<.0001
	No	59(16.86)		
	I don't know	23(6.57)		
Use antibiotics/antimicrobials by following guidelines, description and regulation.	Yes	327(93.43)	575.2	<.0001
	No	18(5.14)		
	I don't know	5(1.43)		
Everyone should follow the full course of antibiotics.	Yes	325(92.86)	570.5	<.0001
	No	22(6.29)		
	I don't know	3(0.85)		
When a disease in an animal can't be treated with antibiotics, how serious do you think it could be?	Yes	79(22.57)	68.0	<.0001
	No	79(22.57)		
	I don't know	192(54.86)		
It is important to use antibiotics as growth promoters in livestock production.	Yes	94(26.86)	29.7	<.0001
	No	90(25.71)		
	I don't know	166(47.43)		
It is important to use antibiotics as growth promoters in food animals.	Yes	73(20.86)	67.3	<.0001
	No	86(24.57)		
	I don't know	191(54.57)		
Is it necessary to apply hygiene and biosecurity measures in livestock & fisheries activities?	Yes	336(96.00)	636.9	<.0001
	No	11(3.14)		
	I don't know	3(0.86)		
Students can contribute to the work being done to control antibiotic resistance.	Yes	325(92.86)	559.2	<.0001
	No	18(5.14)		
	I don't know	7(2.00)		
There is a link between human, animal and environmental health in terms of antibiotic resistance.	Yes	331(94.57)	597.6	<.0001
	No	13(3.71)		
	I don't know	6(1.71)		

Table 4. Practice on the use of antibiotics among veterinary students in Nigeria

Questions	RESPONSES	FREQUENCY (%)	X^2	P-VALUE
Do you stop the use of antibiotics as soon as you feel better?	Yes	144(41.14)	11.0	0.0009
	No	206(58.86)		
Do you use antibiotics without the doctor's instructions?	Yes	132(37.71)	21.3	<.0001
	No	218(62.29)		
Do you ask the doctor to prescribe antibiotics for a common cold?	Yes	76(21.71)	118.9	<.0001
	No	274(78.29)		
Do you check the expiration date of antibiotics before using?	Yes	307(87.71)	224.3	<.0001
	No	43(12.29)		
If the antibiotic expired, what would you do?	Continue using	2(0.57)	321.6	<.0001
	Discard	103(29.43)		
	Stop using and discard appropriately	245(70.00)		
Do you use antibiotics for the following symptoms: fever, obstructed nose, headache, coughing and common cold or catarrh?	Yes	157(44.86)	3.7	0.0541
	No	193(55.14)		
Can antibiotics be used to cure infections caused by fungi?	Yes	78(35.45)	18.8	<.0001
	No	142(64.55		

The findings of the study indicated that veterinary students demonstrated a generally good understanding of the basic concepts of antibiotics and antimicrobials. Over 90% of respondents reported being familiar with the terms "antimicrobials," "antibiotics," and the concept of resistance resulting from their misuse. This knowledge was reflected in the responses, with 83.71% correctly rejecting the notion that antibiotics are effective against viral infections, and 98.57% affirming their appropriate use in treating bacterial infections (Table 2). These results were consistent with the findings of Huang *et al*. (2013), who reported similarly high awareness among Chinese medical students regarding the ineffectiveness of antibiotics for viral illnesses.

Nevertheless, some misconceptions still persist. Approximately 26.86% of students were unable to distinguish between antibiotics and antimicrobials, and 40.85% were unaware of antibiotics banned or prohibited in human, veterinary, and agricultural use. Notably, 50% of students believed antibiotics could hasten recovery from illnesses such as the common cold or flu conditions typically caused by viruses. Contrary, Huang *et al*. (2013) reported that only 27.4% of students accurately recognized that antibiotics are ineffective against viral infections like cold and cough.

Understanding of veterinary students' knowledge and perceptions is vital as they are future prescribers and key actors in promoting antibiotic stewardship. Despite growing global attention to antimicrobial resistance (AMR), studies remain limited on veterinary students' awareness levels (Kovacevic *et al*., 2020; McClelland *et al*., 2022). For instance, research from Croatia and Serbia showed that 42.8% of students believed veterinary medicine contributed minimally or not at all to AMR. In Nigeria, Odetokun *et al*. (2019) reported that while only 25% of veterinary students were aware of global AMR mitigation efforts, 87% of them expressed strong interest in learning more about AMR.

A multicenter study by Hardefeldt *et al*. (2018) in Australia revealed a gap in perception between preclinical and clinical students, with preclinical students often lacking critical knowledge on antimicrobial use (AMU). Similar patterns were noted in Bangladesh and South Africa, where knowledge of AMR and AMU improved with academic progression (Smith *et al*., 2019; Chapot *et al*., 2021). These findings highlight the need to harmonize veterinary curricula to ensure a consistent and progressive acquisition of AMR-related competencies across training levels.

Regarding antibiotic procurement practices, all students (100%) disagreed with the over-the-counter (OTC) purchase of antibiotics, aligning with the findings of Kanneppady *et al*. (2019), where 77.3% of students opposed obtaining antibiotics without a prescription. Additionally, 83.43% recognized that suboptimal dosing could contribute to resistance development—another positive indication of awareness. However, 57.43% reported using antibiotics prophylactically, while only 42.57% adhered to prescription-based use. This supports the findings of Precha *et al*. (2024), which reported a high prevalence (82.72%) of antibiotic use for disease prevention. Such practices underscore a significant knowledge gap regarding the risks of prophylactic antibiotic use and its role in promoting resistance.

Amoxicillin, penicillin, and tetracycline were the most frequently recognized antibiotics, cited by 25.14%, 32.00%, and 26.57% of respondents, respectively (Fig 1). The majority (71.43%) cited the academic curriculum as their primary source of information on antibiotics (Fig. 2), which is consistent with Precha *et al*. (2024), where 55.20% of students reported similar sources. However, awareness of the Nigerian National Action Plan on AMR remains critically low. A substantial proportion of students (75.43%) were unaware of the plan, and 81.43% had no knowledge of its core pillars. This points to a significant gap in exposure to national AMR policies and highlights the need for curricular integration of such strategic frameworks.

Overall, the students demonstrated a solid understanding of antibiotic use and the consequences of antibiotic resistance (Table 3). While 26% of students did not perceive antibiotics as a problem in Nigeria, a greater proportion (58.29%) acknowledged it as a significant concern. Notably, 85.14% attributed the problem to widespread misuse and its impact on both humans and animals through resistance development (a view supported by 90% of respondents). To address this issue, 95.43% of students emphasized the importance of access to accurate information about antibiotic use and resistance as a means to raising awareness.

A large majority (92.86%) reported that they only use antibiotics when prescribed by a

healthcare professional. Additionally, 89.71% believed that vaccination could help prevent disease, and 76.86% acknowledged that it could reduce the need for antibiotic use. Introducing a course dedicated to the rational use of antibiotics in the undergraduate veterinary curriculum was supported by 76.57% of respondents who felt it would enhance awareness and help mitigate the risks of resistance in line with the One Health approach. Furthermore, a significant proportion of students expressed interest in expanding their knowledge on antimicrobial resistance (AMR) and antimicrobial use (AMU), with 44% reporting interest and 40.29% indicating a high level of interest.

The observed knowledge gaps may stem from limited exposure to formal discussions on these topics. Approximately 69.42% of students had never attended any academic training, seminar, or workshop related to antibiotic use or resistance. Nonetheless, students demonstrated awareness of the primary causes of resistance, citing misuse, incomplete treatment courses, and poor infection control as major contributors. Their responses reflected sound understanding of best practices for antibiotic use-such as completing prescribed courses (92.86%), following physician guidance (93.43%), and using antibiotics appropriately (86.29%)—in agreement with findings from Chapot *et al*. (2021) in Bangladesh.

Support for hygiene and biosecurity in livestock and fisheries was strong (96%), and nearly all students (94.57%) recognized the interconnectedness of human, animal, and environmental health under the One Health paradigm. A majority (92.86%) also agreed that students have an important role to play in combating antibiotic resistance. However, full comprehension of the severity of antimicrobial resistance was lacking. More than half (54.86%) of respondents were unaware of the seriousness of infections caused by multidrug-resistant bacteria, and 22.57% dismissed them as insignificant. Additionally, confusion existed around the use of antibiotics for growth promotion in livestock and food animals: 47.43% were unsure about its appropriateness, 26.86% supported the practice, and 20.86% agreed with it outright. These findings underscore the urgent need to raise awareness among veterinary students and the public about the risks associated with using antibiotics for non-therapeutic purposes, including growth promotion.

While many students exhibited good practices regarding antibiotic use, a significant number reported behaviors indicative of poor antibiotic stewardship. For instance, 41.14% discontinued antibiotic use once they felt better; 37.71% admitted to using antibiotics without a prescription (Table 4); 50.44% saved leftover antibiotics for future use; 38.48% disposed of used antibiotics in the garbage (Fig 6). These findings were in agreement with the study by Regidi and Mallika (2019) among medical students in Southern India where similar trends were observed. This study reported that 37.8% used antibiotics without medical advice, 44.1% stopped early, 56.9% kept leftovers, and 50.1% shared them with others. These patterns point to gaps in knowledge and behavior, highlighting the need for targeted awareness campaigns. Conversely, Shahpawee *et al*. (2020) reported better antibiotic practices among undergraduate students in Darussalam, likely influenced by effective education and stronger regulatory frameworks.

In terms of antibiotic purchasing behavior, 78.29% of students rightly disagreed with using antibiotics to treat the common cold. Furthermore, 55.14% recognized that symptoms like fever, nasal congestion, headache, and cough do not warrant automatic antibiotic use. Most students (64.55%) understood that antibiotics cannot treat fungal infections (Table 4). Regarding safe purchasing practices, 87.71% emphasized the importance of checking expiration dates, and 70% recommended proper disposal of expired antibiotics. When asked about key considerations before buying antibiotics, 38% prioritized checking expiry dates, while others focused on the brand (26.29%) and the type of drug store (21.71%) (Fig 5). Similar awareness levels were reported by Chapot *et al*. (2021) in Bangladesh, although the authors noted the need to further strengthen veterinary education on antibiotic use. While antibiotic use is relevant across both human and veterinary medicine, this study focused solely on veterinary students, and this may limit the generalizability of findings for broader policy development. Additionally, as a cross-sectional study, it could not establish causal relationships. Data collection via self-administered questionnaires also introduced potential recall bias, possibly leading to over- or underestimation of antibiotic usage patterns.

Conclusion

It was concluded a significant gap in knowledge, attitude and practices associated with antibiotic

usage and resistance among veterinary students. While raising professionals' knowledge and comprehension of AMR to encourage responsible use is a crucial part of mitigation solutions, legal frameworks and the enforcement of regulations in all areas must be put in place to assist this effort. Therefore, to effectively address the issue of AMR in a "One Health" approach, educational interventions must be integrated into a multi-sectoral strategy involving policy makers, health practitioners, stakeholders in animal production, pharmaceutical corporations, and consumers. Other fields such as the environmental sciences and medical science students can probe issues related to AMR to evaluate the loopholes and possible attitudes and practices that will help in mitigating the war against AMR.

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