Scientific Research Publishing

Health, 2020, 12, 1632-1639
https://www.scirp.org/journal/health
ISSN Online: 1949-5005
ISSN Print: 1949-4998

The Knowledge of Antibiotics in Veternary Students and Repercution in Human Health

Silvia D. Peña Betancourt[1], Silvia Denise Posadas Peña[2], Lyda Y. Parra-Forero[3]

[1]Departamento de Producción Agrícola y Animal, Laboratorio de Toxicología, Universidad Autonoma Metropolitana, Ciudad de México, Mexico
[2]Instituto de Estudios Superiores de Monterrey, Ciudad de México, México
[3]Departamento de Producción Agrícola y Animal, Ciudad de México, Mexico
Email: spena@correo.xoc.uam.mx, s.denisepp@gmail.com, lyparraf19@gmail.com

How to cite this paper: Betancourt, S.D.P., Peña, S.D.P. and Parra-Forero, L.Y. (2020) The Knowledge of Antibiotics in Veternary Students and Repercution in Human Health. *Health*, **12**, 1632-1639.
https://doi.org/10.4236/health.2020.1212119

Received: December 5, 2020
Accepted: December 28, 2020
Published: December 31, 2020

Abstract

The concept of single health is currently undoubtedly one of the most relevant in pandemic times, where humans and animals are together in the same world. Penicillin was discovered in the last century by Alexander Fleming, used against infectious agents mainly of bacterial types, such as *Staphylococcus aureus*, *Corynebacterium*, *Streptococcus*, *Brucella* and *Mycobacterium* are examples of cattle pathogens. The bacteria have developed defense mechanisms allowing them to survive in the host cell (mutation) even in the presence of antimicrobials (bacterial selection). The aim of the study was to examine the degree of knowledge of antibiotics through a structured survey of ten questions, addressed to eighty-six students from the Bachelor of Veterinary Medicine and Zootechnics in 2019. Based on the information collected and after analyzing their answers, 63.14% of the students work in Clinics and Universities, 89.47% recognize the need for a quantified prescription, 47.36% mentioned that the Veterinary Medicine can prescribe antimicrobials, 52.63% support the use of antimicrobials for all microorganisms including viruses, 52.63% use the labeling to consult the withdrawal time and 100% identify that it is the withdrawal time and the practices that lead to the development of antimicrobial resistance. It is concluded that most of the students identify malpractice as the trigger for bacterial resistance, however their knowledge is not adequate to avoid antibiotic resistance to humans. It is recommended to reinforce the courses of microbiology, pharmacology and virology in the Veterinary Medicine and Zootechnics degree, as well as to be updated on alternatives such as the use of phytobiotics.

Keywords

Antibiotics, Resistance, Bacteria, Veterinary, Students

1. Introduction

The first discovered antibiotic was penicillin by the researcher Alexander Fleming, from a fungus, of the genus Penicillium, which its powerful bactericidal effect was and has been used against Gram+ bacteria. Later, semi-synthetic penicillin such as Ampicillin, Amoxicillin and Cloxacillin, the latter resistant to the "penicillinase" released by *Staphylococcus aureus* appeared. However, bacteria have developed survival mechanisms such as selection that allows them to infect the host cell and multi-resist antimicrobials [1], such as the case of *Mycobacterium tuberculosis*, *Brucella abortus*, *Shigella dysenteriae*, *Listeria monicytogenes* and *Legionella pneumophila*, all with high virulence for cattle. For example, *Staphylococcus aureus*, the main agent of clinical mastitis, is resistant to Penicillin, Tetracycline and Cephalexin [2].

On the other hand, the transfer of resistant pathogens to humans through the food chain, such as the consumption of meat and milk [3] [4], leads to the misuse of antibiotics in animals, hence, affecting the public health.

According to the European Antimicrobial Consumption Surveillance Office, Spain ranks fifth as a consumer of broad-spectrum penicillin. Besides being considered one of the countries with the highest rates of bacterial resistance and exporter of these resistances worldwide [5] [6].

There are very few works that explore the knowledge about the correct use of antibiotics in those in charge of Animal Health. Therefore, a measure to avoid the misuse of antibiotics is to assess the level of knowledge. In the present study, we conducted a questionnaire to collect information from Veterinary Medicine students and support the subsequent performance of a risk analysis in human health.

2. Participants

A cross-sectional descriptive observational study with an analytical component was carried out during 2019, in three groups of students (30 students per group) from the BSc in Veterinary Medicine and Zootechnics. The student's knowledge about antibiotics was considered as the main variable. The structured survey consisted of ten questions that were elaborated as indicators of basic knowledge of the subject, carried out by the National Advisory Technical Council of Animal Health (**Table 1**). For the descriptive analysis of knowledge, four categories were considered: does not know insufficient knowledge, sufficient knowledge and optimal knowledge. For the data analysis, Microsoft Excel was used and the qualitative variables were expressed as percentages.

3. Results

Of the 86 student surveys, the majority answered all questions. The results of the informative indicators note the student status in which 25% work in veterinary clinics (**Figure 1**). From their responses, it was observed that 63.14% of the students work in clinics and universities (**Figure 2**), 61.45% recognize that antibiotics

Table 1. Evaluated indicators in the survey in 2019.

No. question	Question	Possible answers	Knowledge indicator
1	Occupation	Veterinary Medicine Student/Intern Certified veterinarian Nursing in Veterinary Medicine Livestock technician	Not applicable, informative
2	Workplace	Veterinary clinic Livestock or aquaculture production unit Universities/Research Center Manufacturing and marketing companies of pharmaceutical and food products Government institution	Not applicable, informative
3	Type of prescription required for antimicrobial products due to the level of risk of the active principle	Quantified	Sufficient and optimal knowledge
		No required prescription	No knowledge
		Simple	Insufficient knowledge
4	Licensed veterinarians and interns may prescribe antimicrobials	True False	Sufficient and optimal knowledge
5	Antimicrobials are used to treat the following microorganisms	Parasites Bacteria Mushrooms Virus All of the above	Sufficient and optimal knowledge No knowledge and Insufficient knowledge
6	Is antibacterial treatment a good option in respiratory diseases of viral origin?	True False	Sufficient and optimal knowledge No knowledge
7	What is the means you use most frequently to check the withdrawal time of antimicrobials?	Books Brochures and technical manuals Scientific articles Internet Labelled	Not applicable, informative
8	Did Mexico sign an agreement declaring the national strategy of action against antimicrobial resistance mandatory?	True False	Sufficient and optimal knowledge No knowledge
9	Practices that lead to the development of antimicrobial resistance in pathogens are	Breach of treatment time Indiscriminate use of broad-spectrum antimicrobials Wrong dosage All of the above	Sufficient and optimal knowledge No knowledge Insufficient knowledge
10	Existing regulation in Mexico that establishes the guidelines for the classification and prescription of veterinary antimicrobials	Agreement declaring the mandatory nature of the national action strategy against antimicrobial resistance NOM-064-ZOO-2000 and the agreement NOM-040-ZOO-1995	Sufficient and optimal knowledge No knowledge Insufficient knowledge
11	The withdrawal or storage time is	The time required to reach the ideal weight for commercialization of the animals The time established by the farm to comply with the "all in, all out" system Comply with the treatment time of the pharmaceutical product Allow maximum residue levels to be below those allowed by the health authority	Sufficient and optimal knowledge No knowledge Insufficient knowledge

Figure 1. Occupation from the sample population expressed in percentage.

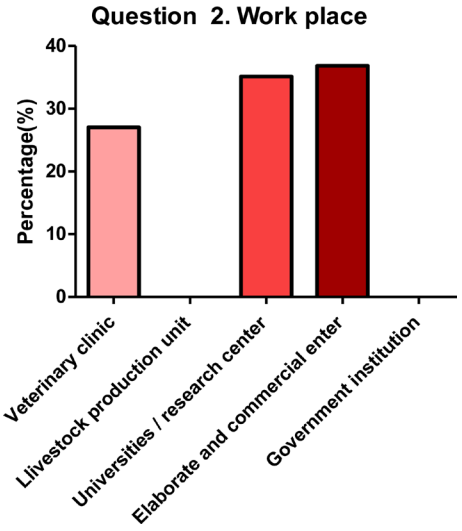

Figure 2. Workplace from the sample population expressed in percentage.

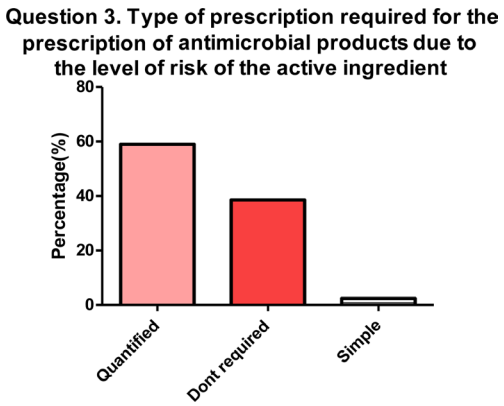

Figure 3. Type of prescription needed according to the sample population expressed in percentage.

should be prescribed by quantified prescription, while 38.55% do not recognize it as requirement (Figure 3); 48.27% assure that the Veterinary Medicine intern can prescribe antimicrobials and 51.73% that a student cannot prescribe antimi-

crobials (Figure 4); 21.34% use antimicrobials for all microorganisms including viruses which implies an incorrect knowledge (Figure 5); 20% possess a poor knowledge about the use of antimicrobials in viral diseases (Figure 6); 18.60% use the labeling to consult the withdrawal time of antimicrobials (Figure 7) and 88.23% identify the withdrawal time of an antimicrobial and the practices as factors that lead to the development of resistance to antimicrobials (Figure 8). 20% of the students have a low knowledge about the withdrawal time that must be respected in antibiotics used for production animals (Figure 9).

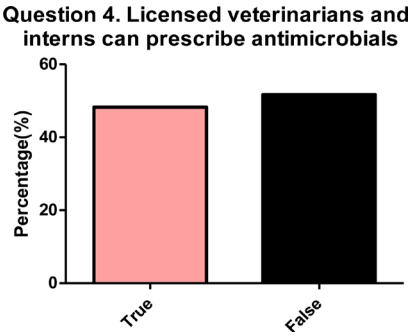

Figure 4. Percentage of the sample population that believe whether a veterinarian can prescribe antimicrobials or not.

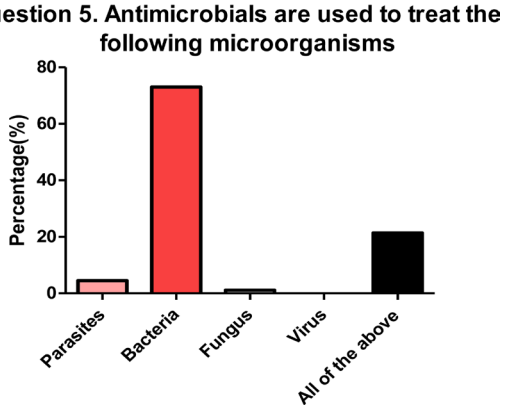

Figure 5. Percentage of the different microorganisms that can be treated by an antimicrobial according to the sample population.

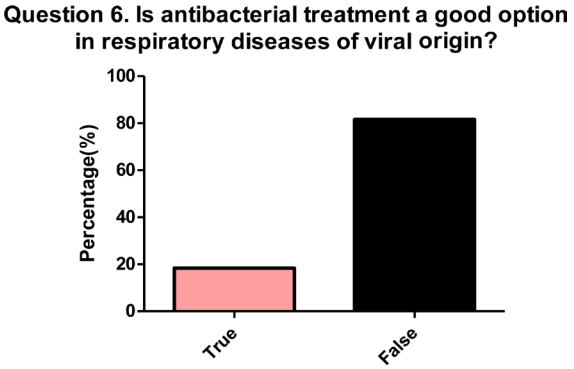

Figure 6. Percentage of the sample population that believes antibacterial treatment can be used for viral diseases.

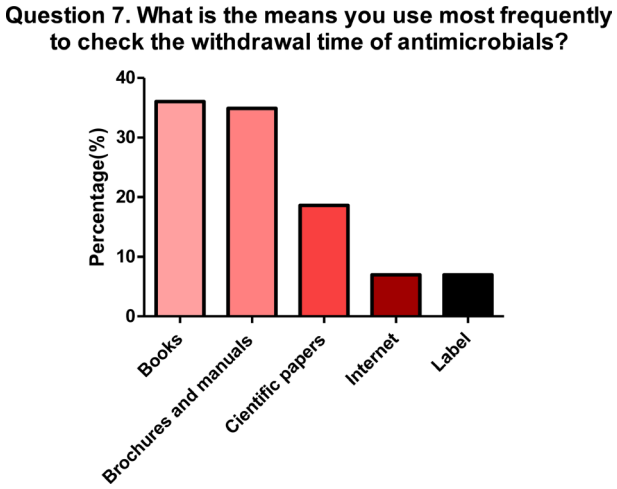

Figure 7. Most used means for withdrawal time expressed in percentage.

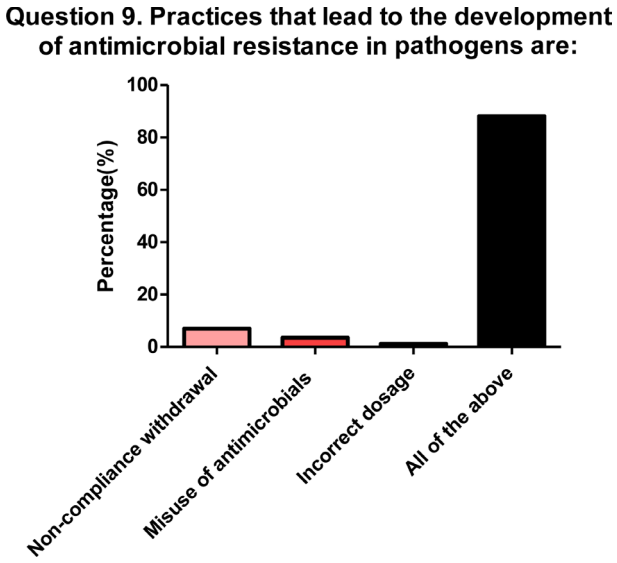

Figure 8. Practices that lead to antimicrobial resistance according to the sample population.

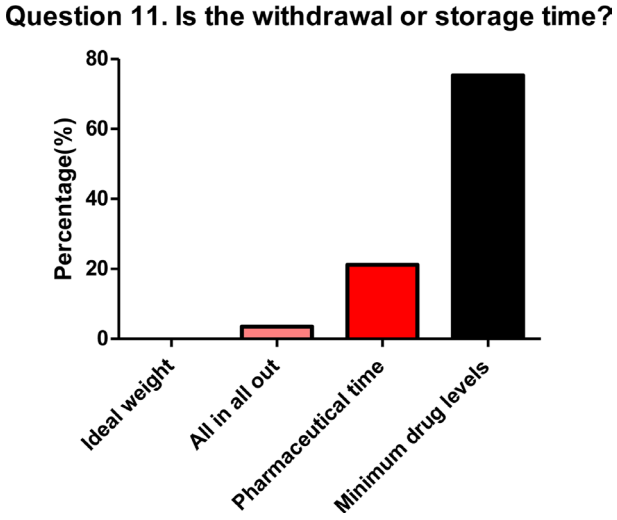

Figure 9. Withdrawal time in antibiotics used for production animals.

4. Discussion

The strategies to identify the knowledge of Veterinary Medicine students about antimicrobials turns out to be a watershed that enables real information in the animal health sector that supports a risk analysis study for human population. One of the most surprising results obtained in the study was the fact of not knowing that antimicrobials are for the exclusive use of bacteria, as identified in students from China by [7]. The authors exonerate the urgency of prioritizing education in health professionals. Hence, the areas of microbiology in the bachelor's study plan as well as pharmacology should be reinforced. If we compare the efforts made in Human Medicine to identify their degree of knowledge in people [8], it can be noted the poor knowledge or ignorance from most of the sample population. In addition, the importance of the veterinarians in animal health and food safety is relevant, as mentioned by [9] [10]. Currently there are advances to establish a rapid and safe diagnosis to identify the pathogenic agent of a disease. For example, molecular methods are available to detect resistance of bacteria to semi-synthetic penicillin, using the blaZ gene and ermC gene [11].

Therefore, an alternative solution to antimicrobial resistance of bacteria according to [12], are natural products. The antimicrobial properties of chemical compounds such as carvacrol, thymol, cineole, linalool, anethole, allicin, capsaicin, allyl isothiocyanate and piperine, have been obtained mainly from oregano, thyme, garlic, cloves, radish, chili, pepper, mint, cinnamon, anise, rosemary and sage [13]

5. Conclusion

The administration of antibiotics in production animals has several disadvantages, such as bacterial resistance, which makes disperse into human health. It is estimated that antibiotics will be restricted in most meat and milk importing countries by 2025. Meanwhile, the use of new therapies with products that are harmless to health and the environment should be foreseen. Such is the case of phytobiotics that have given good results as antibacterials.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Munita, J.M. and Arias, C.A. (2016) Mechanisms of Antibiotic Resistance. *Microbiology Spectrum*, **4**, 1-24. https://doi.org/10.1128/microbiolspec.VMBF-0016-2015

[2] Morris, S. and Cerceo, E. (2020) Trends, Epidemiologty and Management of Multi-Drug Resistant Gram Negative Bacterial Infections. *Antibiotics*, **91**, 196. https://doi.org/10.3390/antibiotics9040196

[3] Cota, E., Hurtado, L., Pérez, E. and Alcántara, L. (2014) Resistencia a antibióticos de cepas bacterianas aisladas de animales destinados al consumo humano. *Revista Iberoamericana de Ciencias*, **1**, 75-85.

[4] Doyle, M. (2012) Veterinary Drug Residues in Processed Meats-Potential Health Risk. Food Research Institute (FRI Briegfings). http://fri.wisc.edu/docs/pdf/t-RIBrief_vetDrgres.pdf

[5] Adriaenssens, N., Coenen, S., Versporten, A., Muller, A., Minalu, G. and Faes, C. (2011) European Surveillance of Antimicrobial Consumption (ESAC): Outpatient Antibiotic Use in Europe (1997-2009). *Journal of Antimicrobial Chemotherapy*, **6**, 3-12. https://doi.org/10.1093/jac/dkr453

[6] Silley, P., Simjee, S. and Schwarz, S. (2012) Surveillance and Monitoring of Antimicrobial Resistance Antibiotic Consumption in Humans and Animals. *Revue Scientifique et Technique*, **31**, 105-120. https://doi.org/10.20506/rst.31.1.2100

[7] Xiao, M.W., Xu, D.Z. and Herskebth, T. (2016) Massive Misuse of Antibiotic by University Students in China. *Lancet*, **388**, S94.

[8] Bernabé, M.E., Macarena Flores, D. and Fernando Martínez M. (2015) Grado de conocimiento del antibiótico prescrito en pacientes ambulatorios. *Atención Primaria*, **47**, 228-235. https://doi.org/10.1016/j.aprim.2014.04.014

[9] García, P., Gastelurrutia, M.A., Baena, M.I., Fisac, F. and Martínez, F. (2009) Validación de un cuestionario para medir el conocimiento de los pacientes sobre sus medicamentos. *Atención Primaria*, **41**, 661-668. https://doi.org/10.1016/j.aprim.2009.03.011

[10] Kristensson, J., Modig, S., Midlöv, P., Rahm, I. and Jakobsson, U. (2010) Health Care Utilisation and Knowledge Concerning Prescribed Drugs among Older People. *European Journal of Clinical Pharmacology*, **66**, 1047-1054. https://doi.org/10.1007/s00228-010-0837-y

[11] Vieiria, S.Y., Ferreira, M, Boniface, O.L, Godoy, S.F. and Silva M.A. (2019) Characterisation of Antibiotic Resistance Genes in the Species of Rumen Microbiota. *Nature Communications*, **10**, Article No. 5252.

[12] Moore, B.S., Carter, G.T. and Bronshhrup, M. (2017) Are Natural Products the Solution to Antimicrobial Resistance? *Natural Product Reports*, **34**, 685-686. https://doi.org/10.1039/C7NP90026K

[13] Goncagul, G. and Ayaz, E. (2010) Antimicrobial Effect of Garlic (*Allium sativum*). *Recent Patents on Anti-infective Drug discovery*, **5**, 91-93. https://doi.org/10.2174/157489110790112536