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MONITORING OF VETERINARY DRUG RESIDUES IN ANIMAL-DERIVED FOODS

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Abstract

The presence of veterinary drug residues in food raises significant public health concerns. Exposure to these residues, especially at high levels, can lead to adverse health effects for consumers, including allergic reactions, antibiotic resistance and other toxicological risks. The indiscriminate use of drugs in animal husbandry to promote growth or prevent disease leads to the accumulation of residues in animal tissues and products of drug residues including antibiotics, hormones, and anti-inflammatory substances. A total of 1605 animal-derived samples were analysed, including 209 beef, 453 pig, 61 sheep and goat, 11 horse meat, 700 poultry, 68 milk, 82 egg, 1 rabbit, 2 wild game and 18 fish samples. The detected antibiotics were penicillins, tetracyclines, sulphonamides, aminoglycosides and cephalosporins, in the following proportions depending on the type of sample: beef (13%), pigs (28%), sheep/goats (4%), horses (1%), poultry (44%), milk (4%), eggs (5%) and fish (1 %). Tetracycline residues were the most prevalent in poultry meat, detected in 64% of the analysed samples.

Key words*: monitoring, residues, veterinary drugs, food.*

INTRODUCTION

The presence of veterinary drug residues in food has become a growing concern in recent years. While drugs are essential for maintaining animal health and welfare, their residues in food can pose risks to human health, animal welfare and environmental sustainability. Constant exposure to residues can produce adverse effects in human consumers including allergic reactions, antibiotic resistance and other toxicological and carcinogenic risks (Ciocîrlie et al., 2024; Goran et al., 2016). The extensive use of veterinary drugs in animal husbandry - antibiotics, antiparasitics, hormones, non-steroidal anti-inflammatories, etc. - with the aim of promoting growth or preventing diseases, will ultimately lead to the accumulation of residues in animal tissues and implicitly in the products and by-products derived from them (Dobre, 2019).

The beneficial effects of NSAIDs, antibiotics, and antiparasitics on digestive and respiratory conditions in farm animals are well documented, with obvious benefits in favour of combinations of substances (Anderson, 1988; Dobre et al., 2019).

From this perspective, ensuring the safety and quality of food products requires strong, well-established monitoring and enforcement mechanisms to detect and limit the presence of veterinary drug residues (Muaz K. et al., 2018). To avoid contamination incidents and to ensure compliance with maximum residue limits, proactive measures for better surveillance, risk communication and transparency are needed to maintain consumer confidence and market stability (Ciocîrlie et al., 2024).

In this context, this paper presents an analysis of antibiotic contamination in food of animal origin, detected in samples analysed by the Competent Authority in Romania, during 2022-2023.

MATERIALS AND METHODS

The residue analysis methods were liquid chromatography and gas chromatography suitable for the detection of trace levels of drug residues including antibiotics, hormones, anti-inflammatory substances, etc.

High-performance liquid chromatography is one of the most widely used methods for the analysis of chemicals, separating compounds based on their interaction with the mobile and stationary phases. Gas chromatography has been used to separate volatile and semi-volatile compounds,

with samples sometimes needing to be derivatized to increase their volatility.
The samples analysed in the I.I.S.P.V. laboratories were represented by muscle tissue from cattle, pigs, sheep/goats, horses, poultry, rabbits, farmed game; milk, egg and fish samples were also monitored.
Food samples were analysed for antibiotic residues, and the proportion of each antibiotic type present in the studied samples was recorded.
The period analysed in this study is between January 2022 and the end of December 2023.

RESULTS AND DISCUSSIONS

Food residue analysis is done to verify compliance with the regulatory efforts of the Competent Authority with the stated goal of protecting consumers from health risks - antibiotic resistance and allergic reactions.
At the same time, a comparative analysis was also desired compared to the situation in previous years in which the number of samples analysed positive for antibiotics remains at a constant level, quite high in pigs and poultry in 2022.
During 2023, a number of 1605 positive samples were identified in terms of antibiotic content, compared to 1817 samples in the previous year, a decrease of 12% as shown in Table 1.

Table 1. Number of positive samples of products of animal origin, analysed in 2023 compared to 2022

Year	2023	2022
Totally positive evidence	1605	1817
Beef	209	137
Pork	453	584
Seep/Goats	61	79
Horses	11	27
Poultry	700	661
Milk	68	138
Eggs	82	150
Rabits	1	3
Wild Game	2	22
Fish	18	16

In 2023, antibiotic residues were detected in poultry meat in 700 samples, which represents 44% of the food samples on which determinations were made (Figure 1). Among the antibiotics identified in these samples, tetracyclines, penicillins, aminoglycosides, sulphonamides/fluoroquinolones and cephalosporins were found. Compared to 2022, during which 661 samples containing antibiotics were recorded, it can be said that we are dealing with an increase in the incidence of antibiotic contamination from 36% (Figure 3) to 44% (Figure 2).

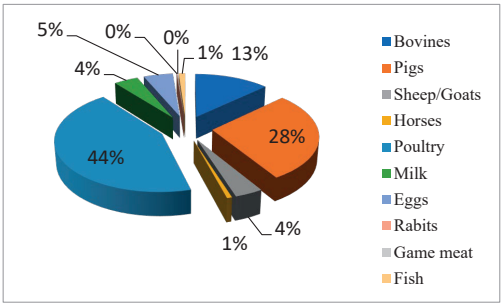

Figure 1. Proportion of samples containing antibiotics detected in animal products in 2023

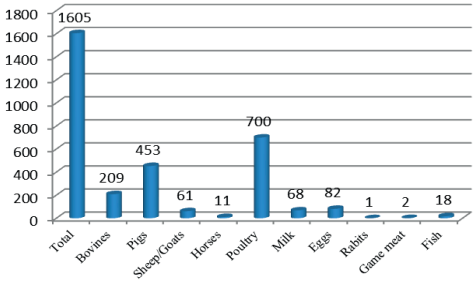

Figure 2. Number of samples containing antibiotics detected in animal products in 2023

This trend of increasing antibiotic residues in poultry meat can be attributed to the use of feed medicated with broad-spectrum antimicrobials and/or failure to comply with the withdrawal/ waiting time before slaughter.
A significant percentage of positive samples was also observed in pork: 28% in 2023 (453 samples), slightly down from 32% (584 samples) in 2022 (Figures 3 and 4).
The analysis of positive samples from poultry meat in 2023 showed the presence of several types of antibiotics in different proportions as follows: tetracyclines 64%, sulphonamides/quinolones 25%, lactamines 8%, aminoglycosides 3% as shown in Figure 6.

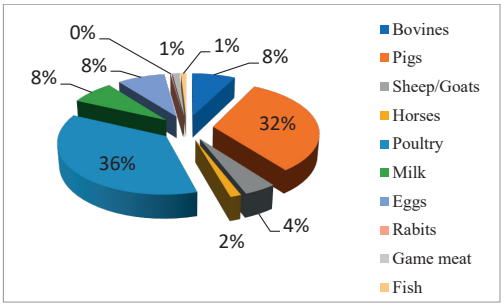

Figure 3. Proportion of samples containing antibiotics detected in animal products in 2022

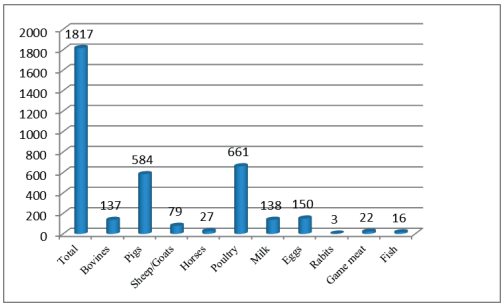

Figure 4. Number of samples containing antibiotics detected in animal products in 2022

In real numbers, out of a total of 700 positive samples, 448 showed traces of tetracycline, 175 sulphonamides/quinolones, 56 lactamine residues and in 21 aminoglycosides were present (Figure 5).

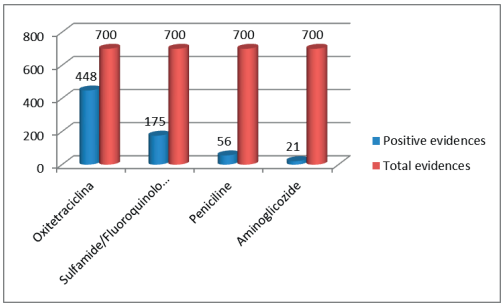

Figure 5. Number of samples containing antibiotics detected in poultry meat in 2023

Regarding the analysis of positive pork samples detected in 2023, the presence of several types of antibiotics in different proportions is observed. Ampicillin was the most frequently detected antibiotic, present in 240 of the 453 positive samples, which represents 53% of the total. Chemotherapeutics were identified in 118 samples. Tetracyclines were present in 95 samples, representing 26% of the total. Overall, 21% of the pork samples contained antibiotic residues and 26% of the total, that is 21% of the samples contain antibiotics (Figures 7 and 8).

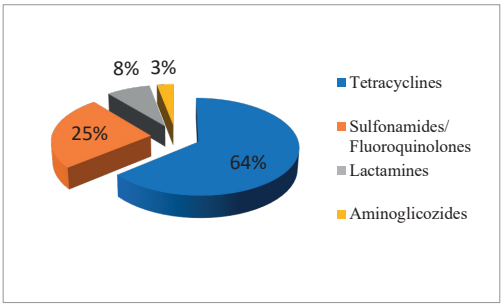

Figure 6. Proportion of different antibiotics present in poultry meat in 2023

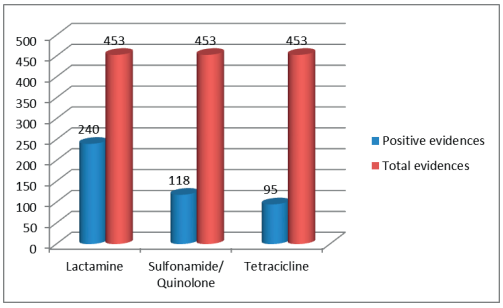

Figure 7. Number of samples containing antibiotics detected in pork meat in 2023

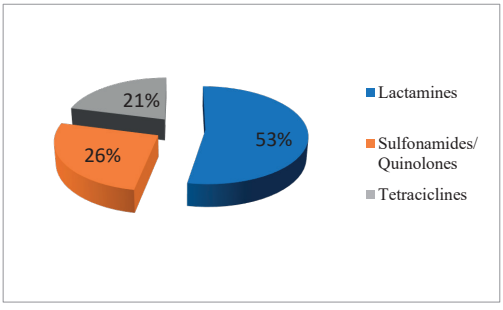

Figure 8. Proportion of different antibiotics present in pork meat in 2023

The food samples analysed in our study show the same trend of persistence of veterinary drug residues in final products intended for public consumption.

Whether they are used as growth stimulants, for prophylactic purposes or to treat diseases

(digestive, respiratory or parasitic) (Crivineanu et al. 2002) the various drugs are still found in the samples analysed by the competent authority as part of the monitoring process.

Whether determined globally or separately, antibiotics occupy the central position. In our case, in birds, tetracyclines were in the first position as in other studies (Yang Y. et al., 2020), along with sulphonamides and quinolones which were also very often identified (Er et al., 2013).

In pigs, the most common drug was ampicillin, probably due to its ease of administration and high degree of bioavailability via the digestive tract, as has also been observed in other studies (Paz-González et al., 2024).

CONCLUSIONS

Oxytetracycline was the most frequently detected antibiotic, present in 64% of the samples analysed.

Poultry samples had the highest proportion of antibiotic residues, with 44% testing positive in 2023, compared to 36% in the previous year, followed by pork samples, with a positivity rate of 28% in 2023, and a slight decrease from 32% in 2022.

Among the detected antibiotics, oxytetracycline was the most prevalent, found in 64% of the positive samples, followed by chemotherapeutics such as sulphonamides and quinolones, present in 25% of cases.

In pork, ampicillin was the most frequently identified antibiotic, detected in 53% of the positive samples.

A significant gap remains between the goal of eliminating drug residues from animal-derived food and the current reality.

Sustained efforts are needed to ensure the presence on the markets of foods free of veterinary drug residues.

Further efforts are required to enhance regulatory compliance, raise awareness among livestock producers, and implement more robust surveillance systems to reduce public health risks associated with veterinary drug residues.

ACKNOWLEDGEMENTS

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REFERENCES

Anderson, D (1988). Clinical use of flunixin *Br. Vet. J.* (Suppl.) 1, 7-8.

Ciocîrlie, N., Tudor, L., Boițeanu, C.N. (2024). *Veterinary Medicine and Public Health*, Ex Terra Aurum Publishing House, 165-252.

Crivineanu, M., Crivineanu, V., Goran, G.V. (2002). Enrofloxacin's efficacy in some birds bacterial diseases studies. *Revista Română de Medicină Veterinară*, *Vol. 12*, No. 1/2, 129-136, ref. 7.

Dobre, I.R. (2019). *Toxicologie veterinară*. București, Editura Printech, 159-171.

Dobre, I.R., Alexandru, D.M., Crivineanu, M. (2019). Study on changes in haematological parameters following administration of NSAIDs in dogs. *Scientific Works. Series C. Veterinary Medicine, vol. LXV*(1), pages 37-41.

Er, B., Onurdag F.K., Demirhan B., Ozgacar, Ö.S., Oktem, A.B., Abbasoglu, U. (2013). Screening of quinolone antibiotic residues in chicken meat and beef sold in the markets of Ankara, Turkey. *Poult Sci.*, *92*(8): 2212-5.

Goran, G.V., Crivineanu, V. (2016). *Toxicologie*. Editura Printech, 256-261.

Muaz K., Riaz M., Akhtar S., Park S., Ismail A. (2018). Antibiotic residues in chicken meat: global prevalence, threats, and decontamination strategies: a review. *Journal of food protection*, *Volume 81*, Issue 4, pages 619-627.

Paz-González, A., Martínez-Vázquez, A., Ortiz-Perez, E., Ramírez-Martínez, C., Lara-Ramírez, E., Juárez-Rendón, K., Bocanegra-Garcia, V., Vázquez, K., Rivera, G. (2024) Determination of antibiotic residues in pork meat from Northeast Mexico by UPLC-MS. *CyTA Journal of food., Vol. 22*(1)

Yang Y, Qiu W, Li Y, Liu L. (2020). Antibiotic residues in poultry food in Fujian Province of China. Food Addit Contam Part B Surveill. 2020 Sep, 13(3): 177-184.