

THE IMPORTANCE OF PREVENTION, PROPHYLAXIS AND BIOSECURITY ON ANTIMICROBIALS CONSUMPTION AND THE SPREAD OF ANTIMICROBIAL RESISTANCE

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Antimicrobial resistance is now a major global health problem in human and animal population (Aidara-Kane et al., 2018; Robinson et al., 2016). AMR causes approximately 700,000 deaths annually worldwide. If this problem is not solved, the number of deaths could increase up to 10 million deaths per year by 2050. There has been a considerable pressure on reduction of overall usage of antibiotics on animals or to cease or minimize using of human critical antibiotics (WHO, 2017, 2018).

Animal diseases and infections should be primarily prevented by ensuring biosecurity, following good production and good management practices, and implementing integrated disease control programmes to minimise the occurrence of diseases and eradicate endemic disease (EC 2015/C 299/04).

The most important step in preventing of occurrence and development of antimicrobial resistance in livestock is to maintain good health of reared animals. At the same time, this doesn't only reduce the amount of antibiotics used, but also creates preconditions for achieving genetically given production and reproduction indicators of animals that will lead to the farmers' profitability.

Material and Methods

The aim of our work was to create a complex screening system for assessing influences of prevention, prophylaxis and biosecurity practices on reducing usage of antimicrobial substances and antimicrobial resistance developing. We resulted from a professional literature (PubMed, Web of Science) and especially from the practical

experience of the authors. The created system is composed of several interconnected database modules, which are analysed and comprehensively evaluated after entering the input data.

Results

Prevention, prophylaxis and biosecurity measures are critical points for creating a screening system that controls the level of resistance of microorganisms, as they have a major impact on reducing the consumption of antimicrobials.

An important tool of herd health management is well-kept zootechnical and veterinary records, which help to analyse problems, detect causes and health risks. They can provide the basis for making a decision about the next course of actions. The veterinarian in cooperation with the breeder should draw up a health and vaccination plans for the farm with a primary aim to ensure the prevention and prophylaxis, diagnosis and treatment of diseases. At the same time these plans should include an identification of deficiencies in management, nutrition, housing and other breeding infrastructure with proposals for effective measures to eliminate them.

The solution leading to changes in the health status of the herd should be divided into three consecutive, interconnected stages. **The first stage** is represented by changes in behaviour, feed and water intake, including changes in the health status of the animals detected by the subjective assessment of the stock keepers, a zootechnician and an owner. **The second stage** includes evaluation of the health status. It is based on a

clinical examination of changes in the animal's health status by the veterinarian, who decides about the way of treatment, including the evaluation of its effect. If there is no improvement in the health status of sick animals within a few days, the treatment can be considered ineffective, either because of resistance, or because of an inappropriate choice of antibiotic that is not effective against the pathogen in question, or it does not reach the site of infection. The veterinarian will then decide to use *the third stage*. That consists of collecting samples of (blood, urine, faeces, feed, water, etc., resp. raw materials and foodstuffs of animal origin - meat, milk, eggs) for a targeted examination of selected indicators, namely either by simple screening tests carried out directly on the farm, or by their analysis in accredited laboratories.

The decision on the therapeutic use of antimicrobial substances for the treatment of humans and animals must be based on the establishment of a correct diagnosis by a veterinarian, the identification of the causative agent and the proposal of therapy, including the selection of antimicrobials of first, second and third choice for the treatment of a given infection based on laboratory confirmation of the sensitivity of antimicrobial substances. Incorrect use of antimicrobial agents increases the risk of the spread of resistance in the population.

Vaccination in compliance with the vaccination schedule provides optimal protection of animals against selected disease agents. The vaccination program is prepared by the veterinarian in cooperation with the breeder on the basis of a thorough epizootological analysis of the health status of the herd. Its basis is the selection of vaccines suitable for use on a given farm. There is appropriate strict adherence to the vaccination scheme used for the given species and category of farmed animals, taking into accounts the actual epizootological situation of the region. It is necessary to vaccinate animals as a preventive measure. If the first clinical signs of the disease appear in the first animal in the herd, it is already too late to vaccinate the other animals. If the

breeder decides to vaccinate, he must vaccinate the whole herd, because each unvaccinated individual always becomes a potential source of infection for the entire herd.

Adherence to biosecurity principles significantly reduces the potential risk of infection agents entering and spreading on the farm. From the practical point of view, it is necessary to focus on establishing critical biosecurity control points, including mutual interactions between them, taking into account the possibilities of direct and indirect spread of infectious agents and their incorporation into the real conditions of each farm. As a part of external biosecurity, potential risk factors for the penetration of micro- and macro-organisms causing animal diseases on the farm or in stables by animals, people, feed and water, means of transport, wild animals are analysed including the definition of protective zones. On the other hand, when evaluating internal biosecurity, attention is focused on the possibilities of limiting the existing microflora inside the farm by managing the health status of the herd, optimizing technological systems, hygiene levels of primary production, quality control of raw materials and products, sanitation of the breeding environment and creation of barriers.

Prudent and responsible use of antimicrobial substances together with compliance with the principles of good husbandry practice with emphasis on prevention, prophylaxis and biosecurity is an important precondition for maintaining the good health of animals and people on the one hand, and at the same time maintaining the effectiveness of antimicrobial substances on the other hand.

Discussion

Despite the fact, that antimicrobials are essential in bacterial diseases treatments, the long-term antimicrobial usage in food-producing animals can become a potential source for development and spread of antimicrobial resistant bacteria through food, water or wastes in to the food chain (Ma et al., 2020). Overuse and misuse of antibiotics at

animals and humans contributes to the rising of antimicrobial resistance (WHO, 2017). The prerequisite for minimizing the risk of the creation and spread of antimicrobial and genetic resistance is mutual cooperation and coordination of all activities aimed at reducing the use of antimicrobial substances in all components of the food chain (OIE, 2019).

Good breeding practice principles play very important role in improving the health status of animals (Postma et al., 2016). The basis of these procedures are, first of all, to ensure an adequate level of immunity after birth, optimalization of the breeding environment, including minimization of animal stress, and following of the developed herd health plan.

The fundamentals of prophylaxis are based on adequate level of innate and acquired immunity and implementation of a vaccination plan. In the near future, vaccination will be one of the critical factors in reducing the amount of antimicrobial substances used to treat sick animals on the farms leading to development and spread of antimicrobial resistance. When using vaccines as a part of the fight against antimicrobial resistance, it is important to focus not only on the analysis of the possibility of expanding the potential of current vaccines, but also on the development of new vaccines against resistant strains of bacteria (Bloom et al., 2018).

Vaccination in compliance with the vaccination schedule provides optimal protection of animals against selected disease agents (Hoelzer et al., 2018). On one hand from the epizootological point of view, vaccination can be considered one of the key elements of preventing infectious diseases and maintaining the health of the herd by increasing the specific resistance to the infectious agent by applying vaccines without causing the individual's own illness.

Vaccines limit the pathogen's ability to establish in the host by protecting the organism from pathogen infection (Kennedy and Read, 2017).

Given that multiple factors contribute to antimicrobial resistance development, it is advisable to combine vaccination with other

approaches to the treatment of infection (increasing the level of hygiene and nutrition in breeding, rapid diagnosis of the causative agent by a veterinarian, including the responsible targeted use of antibiotics, etc.) (O'Neill, 2016).

Biosecurity is another effective tool to reduce the consumption of antimicrobials at livestock farming. The level of biosecurity of a herd was associated with the amount of antimicrobials used (Raasch et al., 2018). Adherence to the principles of biosecurity significantly reduces the potential risk of infection penetrating on the farm (animals, people, feed and water, means of transport, etc.) and its spread in the farm area (optimization of technological systems, creation of barriers, quality control of raw materials and products, etc.). Although the introduction and, above all, the consistent observance of biosecurity principles requires certain financial costs. In the long term it represents an investment for the breeder in the future, manifested not only in the improvement of the health of the herd, including an increase of the level of welfare, but at the same time it also leads to a reduction in morbidity and mortality rates, and so it reduces the amount of antimicrobials used on those farms, with the subsequent improvement of production and reproductive indicators. Finally, the economic profitability of breeders (Teagasc, 2018).

Under no circumstances should antimicrobials on livestock farms be used to compensate for low hygiene, shortcomings in the work of management, zootechnicians and animal caretakers.

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