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Key aspects of biosafety in modern animal husbandry

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Abstract. The relevance of this research is driven by the need to enhance biosecurity in animal husbandry to improve the health and productivity of livestock, as well as to safeguard human health. Biosecurity is a critical component that prevents the spread of infectious diseases, mitigates the risks of epidemics, reduces treatment costs, and increases productivity and economic efficiency within agricultural enterprises. In this regard, this study aimed to reveal the role of biosafety in preventive veterinary medicine. The leading approach to investigating this issue involved analysing existing practices and methods, which allows for a comprehensive examination of various aspects of biosecurity. The conducted analysis substantiated that preventive veterinary medicine is founded on the principle of disease prevention through risk reduction and the implementation of healthy practices. It has been established that this approach encompasses not only the treatment of sick animals but also the provision of advice to farmers on enhancing the health and productivity of their livestock. It has been established that biosecurity also helps prevent the emergence and spread of infectious diseases, reducing the need for antimicrobial drugs and lowering the risk of antimicrobial resistance. The research highlighted that in today's rapidly changing world, biosecurity is becoming even more important due to population growth, urbanisation, climate change, and human health threats such as antimicrobial resistance. The concept of "One Health" is encompassed, emphasising the close connection and interdependence among the health of humans, domestic and wild animals, plants, and the environment. The core

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principles of biosecurity included segregation, cleaning and disinfection, and considering the behaviour and attitudes of people working with animals. The material presented in this article is of practical value to veterinarians, farmers, and livestock farms, assisting them in developing and implementing effective biosecurity plans adapted to changing conditions, thereby contributing to reducing the risks of infectious diseases and improving livestock productivity

Keywords: preventive veterinary medicine; infectious diseases; antimicrobial resistance; cleaning and disinfection; human health protection; climate change

Introduction

Biosecurity, as highlighted by A. Diana *et al.* (2020), is a pivotal aspect of modern livestock farming, playing a crucial role in ensuring animal and human health, as well as enhancing the productivity of farms. In the context of growing populations, urbanisation, and climate change, the need for implementing effective biosecurity measures is becoming increasingly urgent. Biosecurity not only prevents the spread of infectious diseases among animals but also contributes to reducing the use of antimicrobial drugs, which in turn lowers the risk of developing antimicrobial resistance.

The relevance of this research is driven by the need to prevent the spread of infections that negatively impact animal and human health, as well as industry productivity. With the expansion of animal husbandry, the risk of epidemics also increases, necessitating the implementation of effective biosecurity measures. This is critically important for ensuring food security, economic stability, and reducing environmental impact, particularly through the fight against antibiotic resistance. V. Renault *et al.* (2022) argued that adhering to these principles helps to reduce the risks of infectious diseases and increase livestock productivity.

Biosecurity in modern animal husbandry is a subject of research for many scientists who have analysed various aspects of this field. V. Renault *et al.* (2022) investigated the importance of the biosecurity concept as a key element of the "One Health" approach. Using the concept of "One biosecurity", they emphasised the close link between public health components and the need to consider them as an integrated structure.

Adherence to biosecurity procedures is a key aspect of preventing the spread of infectious diseases among animals, as confirmed in the scientific research of E. Butucel *et al.* (2022). This can be achieved through an implemented strategy that involves preventing direct or indirect contact with pathogenic agents, vaccination, disinfection, rational water management, and appropriate disposal procedures, among others. Non-compliance with biosecurity protocols can lead to a loss of disease control on farms, resulting in animal mortality and significant economic losses for farmers.

As highlighted in the study by S. Sarrazin *et al.* (2019), the transmission routes of epidemiological diseases can be highly diverse, necessitating the implementation of comprehensive principles. The development of biosecurity plans and the analysis of the effectiveness of preventive measures can reduce risks and improve the control of disease spread. T. Zhang *et al.* (2024) have demonstrated that modern animal husbandry faces numerous challenges that require the implementation of effective biosecurity measures. One of the primary concerns is the risk of infectious disease spread among animals, which can lead to significant economic

losses and pose a threat to human health. The intensification of animal husbandry, globalisation of trade, and climate change create favourable conditions for the spread of pathogens, making biosecurity issues even more pressing.

One of the primary threats is antimicrobial resistance, which arises from the excessive and improper use of antimicrobial agents in animal husbandry. N.I. Azman *et al.* (2021) indicated that this leads to a decrease in the effectiveness of treating infectious diseases in both animals and humans, which can have serious consequences for public health. In particular, the rise of antimicrobial resistance threatens a return to an era when numerous infectious diseases became untreatable. Another issue is the inadequate understanding and implementation of biosecurity measures on farms. J.W. Aleri and M. Laurence (2020) noted that some farmers do not recognise the importance of biosecurity or lack sufficient knowledge for its effective implementation. The absence of appropriate education and training for farmers and livestock workers results in even the best biosecurity measures being ineffective due to human factors. For instance, as mentioned by E. Butucel *et al.* (2022), non-compliance with hygiene protocols, improper storage of feed and water, and insufficient isolation of new or sick animals can undermine all efforts to prevent the spread of diseases.

Furthermore, the globalisation of trade in animals and animal products creates additional biosecurity risks. The international movement of animals, feed, and equipment can provide a pathway for the introduction of new pathogens into different regions, making it more difficult to control infectious diseases. This is particularly important in the context of zoonotic diseases, which can be transmitted from animals to humans. According to the World Health Organization (WHO), approximately 60% of all human infectious diseases have a zoonotic origin, highlighting the importance of a comprehensive approach to biosecurity. This statistic is also supported by data from the Food and Agriculture Organization of the UN (FAO, n.d.), which indicates that 75% of new human infectious diseases also originate from animals. This data demonstrates the importance of coordinating efforts between the human and animal sectors to prevent the spread of diseases and improve biosecurity levels. (World Health Organization, 2020; World Health Organization, 2023).

Another aspect of the problem is the impact of climate change on animal health. Changes in temperature regimes, increased humidity, and other climatic factors can create favourable conditions for the development and spread of pathogens. For instance, rising temperatures can lead to increased populations of disease-carrying insects, posing additional risks to animal husbandry. Thus, as argued by D. Black *et al.* (2023), biosecurity measures must consider changing climatic conditions and the need to adapt to them.

Finally, the implementation of biosecurity measures often faces economic barriers. Some farms may lack sufficient financial resources to implement and maintain effective biosecurity measures. This includes the costs of constructing and maintaining isolation zones, purchasing disinfectants, ensuring proper hygiene, and training staff. Without financial support and incentives from governments or international organisations, farms cannot afford to implement the necessary biosecurity measures. Thus, to address biosecurity challenges in modern animal husbandry, a comprehensive approach is needed, including the development of educational programmes for farmers and farm workers, financial support, research, and international cooperation. Only then can sustainable and safe production of animal products be ensured, meeting the demands of the contemporary world.

This study aims to highlight the importance of biosecurity in animal husbandry and to provide recommendations for its improvement. The research employed methods of analysis, synthesis, and the summarisation of scientific and methodological literature on biosecurity in modern animal husbandry. The primary sources for analysis were scientific articles published by leading researchers abroad. These articles included reviews and original studies addressing various aspects of biosecurity, from risk management to the application of cutting-edge technologies in the field of animal husbandry. During the research, a substantial number of scientific sources were analysed, including articles published in peer-reviewed journals that explored diverse aspects of biosecurity in animal husbandry. Particular attention was given to research describing innovative approaches to ensuring biosecurity, as well as studies evaluating the effectiveness of various methods for protecting animals from infectious diseases. For example, some researchers proposed the use of biosensors for the early detection of diseases, which can reduce the risks of infection spread. Other scientists focused on developing new vaccines and antimicrobial agents that may be more effective and safer for animals.

Based on the analysis of the literature, the main trends and approaches to ensuring biosecurity in modern animal husbandry have been summarised. In particular, key aspects have been identified, such as risk management, sanitary measures, disease control, and the use of modern technologies for monitoring animal health and husbandry conditions. Risk management involves assessing and minimising potential threats that may arise during animal husbandry. Sanitary measures encompass a wide range of practices aimed at maintaining a high level of hygiene on farms, including regular cleaning and disinfection of animal housing.

Importance of biosecurity in modern animal husbandry: Key aspects

Biosecurity is a vital component of modern animal husbandry, helping to improve animal health and productivity while also protecting human health. This article explores the key aspects of biosecurity and its significance in preventive veterinary medicine. It aims to enhance the knowledge and skills of veterinarians in developing and implementing effective biosecurity plans in collaboration with farmers and farms.

J. Dewulf *et al*. (2018) demonstrated that preventive veterinary medicine is based on the principle of disease prevention through risk reduction and the implementation of healthy practices. This approach involves not only treating sick animals but also providing ongoing advice to farmers on improving the health and productivity of their animals. As A. Diana *et al.* (2020) found, biosecurity is a key component of this approach, as it helps prevent infectious diseases, reducing the need for the use of antimicrobials and lowering the risk of developing antimicrobial resistance.

In today's rapidly changing world, biosecurity is becoming even more important. Population growth, urbanisation, climate change, and threats to human health, such as antimicrobial resistance, demand effective solutions. According to the FAO, the world's population is projected to reach 9.15 billion people by 2050, placing significant pressure on food production systems (FAO, n.d.). Furthermore, as H.W.F. Waldeck *et al.* (2021) note, approximately 60% of all human infectious diseases have a zoonotic origin, highlighting the risks associated with close interactions between humans and animals.

Biosecurity is not limited to animal health; it also considers the health of humans, plants, and the environment. V. Renault *et al.* (2022) noted that the concept of "One Health" emphasises that the health of humans, domestic and wild animals, plants, and the environment

are closely linked and interdependent. This approach mobilises various sectors and disciplines to work together to ensure well-being and combat threats to health and ecosystems.

For example, brucellosis is a zoonotic disease that has serious consequences for livestock productivity and human health. This disease is spread through contact with aborted materials or birth fluids, as well as through the consumption of contaminated milk. In humans, brucellosis causes flu-like symptoms, but in some cases, chronic complications can develop, significantly impacting health and work capacity.

Control of brucellosis in animals involves vaccination and the implementation of biosecurity measures, such as maintaining hygiene during milking, as well as boiling and pasteurising milk. I. Garcia *et al.* (2023) highlight that veterinarians play a crucial role in educating farmers about effective preventive measures, thereby safeguarding both animal and human health.

In summary, veterinary professionals have a significant role in improving the resilience and efficiency of livestock farming. Implementing biosecurity measures as part of preventive veterinary medicine not only increases farm productivity but also contributes to protecting human health from zoonotic diseases and antimicrobial resistance. Preventive veterinary medicine helps ensure the stability and prosperity of both farmers and veterinarians, creating strong mutually beneficial relationships.

Basic principles of biosecurity in animal husbandry

Biosecurity is a key aspect of maintaining animal health and preventing the spread of infectious diseases. This article focuses on the fundamental principles of biosecurity, aiming to assist farms in developing effective measures to mitigate disease risks.

A. Diana *et al*. (2020) demonstrated that biosecurity is a strategic and integrated approach that encompasses policies and regulatory frameworks for analysing and managing risks in the domains of food safety, animal and plant health, as well as associated environmental risks. It covers a wide range of pathogens, including viruses, bacteria, fungi, endo- and ectoparasites, as well as protozoa. The foundation of effective biosecurity is a risk-based approach. In their study, M. Rahman *et al.* (2020) noted that it is impossible to completely eliminate the possibility of animals being infected by pathogens; however, it is possible to reduce this risk as much as practically possible. Prioritising high-risk factors allows for the optimal use of available resources.

Understanding the transmission pathways of pathogens is the first step towards effective biosecurity. The primary routes include aerosol, direct contact, oral, vector-borne, and fomite transmission. For instance, some diseases are transmitted through inhalation of respiratory droplets expelled by another animal, or through direct contact with infected bodily fluids. Effective biosecurity measures are typically categorised into three main components: segregation, cleaning, and disinfection. Segregation involves preventing contact between healthy and infected animals, as well as between potentially contaminated objects and healthy animals. Cleaning refers to the removal of all organic material from surfaces, significantly reducing the number of pathogens. J.S. Ferreira *et al.* (2024) emphasise that disinfection involves the use of chemicals to kill pathogens but its effectiveness depends on correct application.

Physical biosecurity measures, such as buildings and fencing, are important, but equally critical are the attitudes and behaviours of those working with animals. Even the best biosecurity protocols will be ineffective if people fail to recognise the risks and do not adhere to the guidelines.

Disease risks can fluctuate due to a variety of factors, including seasonality, weather conditions, and changes in farming practices. Therefore, biosecurity measures must be adapted to the current risk level. For instance, during an outbreak in a neighbouring area, a farm may temporarily change its feed sources to reduce potential exposure.

A combination of different biosecurity measures is often more effective than a single approach. Research by J. Denis-Robichaud *et al.* (2019) has shown that combining multiple layers of protection reduces the likelihood of a pathogen penetrating all barriers.

In conclusion, biosecurity is an indispensable component of successful livestock farming, serving to mitigate the risks of infectious diseases and enhance animal productivity. A risk-based approach, understanding pathogen transmission pathways, and implementing principles of segregation, cleaning, and disinfection are fundamental to effective biosecurity measures. Additionally, it is crucial to consider the behaviour and attitudes of individuals working with animals and to adapt measures to changing conditions.

An integrated approach to biosafety: Preventing pathogens from the environment

Biosecurity is a critical aspect of modern animal husbandry, playing a pivotal role in preventing the spread of infectious diseases among animals. This section of the article discusses biosecurity as outlined by K. Koutsoumanis *et al.* (2022), specifically about the movement of animals and vehicles visiting the farm.

One of the most crucial aspects of biosecurity is controlling the movement of animals. Introducing new animals to a farm can become a source of pathogens, making it essential to follow specific measures. Before purchasing new animals, a list of pathogens to avoid should be compiled. This will help assess the risks and implement the necessary measures to prevent them. Practices before purchasing animals include reducing the number of sources of new animals and conducting health assessments of the source herd through testing for undesirable pathogens. New animals should be isolated from the main herd for a period of three to four weeks, allowing for the detection of potential diseases and preventing their spread.

Vehicles visiting a farm can also act as a source of infection. These include vehicles for transporting animals, collecting milk, delivering feed, and others. As noted by F.J. Villaamil *et al.* (2020), to reduce this risk, the following measures should be adhered to: vehicles transporting animals should be thoroughly cleaned and disinfected after each journey. Where possible, access to areas where animals are housed should be restricted to vehicles. It is recommended to create separate parking areas outside the farm boundaries for certain types of vehicles. Loading and unloading points for animals should be located as far as possible from the main animal housing areas (Center for disease control ..., n.d.).

It is crucial to understand that all types of animal movements, not just the acquisition of new individuals, can introduce pathogens, so implementing appropriate biosecurity measures essential. Isolating new animals is a vital step to prevent the introduction of diseases onto the farm, with the quarantine period needing to be long enough to detect potential illnesses, while also conducting diagnostic tests. Vehicles in contact with animals present a high risk of spreading pathogens, making cleaning and disinfection mandatory measures. Recommendations for vehicle movement on farms include using separate vehicles for feed transport and the removal of manure or dead animals. It is also advisable to minimise the number of vehicles allowed access to animal

housing areas and to carefully plan their routes on the farm to prevent cross-contamination (Denis-Robichaud *et al.,* 2019).

Thus, implementing effective biosecurity measures when moving animals and vehicles on the farm is essential for maintaining animal health and improving farm productivity. Adhering to these principles will help reduce the risk of introducing and spreading infectious diseases, which is critical for the sustainable development of livestock farming. Visitors and farm workers can also be sources of pathogens, which may be carried on clothing, footwear, or equipment (National Association of State Public Health, 2023). Depending on the frequency of visits and contact with animals, the level of risk for pathogen introduction varies. High-risk groups include veterinarians, hoof trimmers, and workers employed on other farms or with their own animals. Medium-risk groups consist of product vendors, consultants, and milk truck drivers, while visitors who rarely visit farms, such as local school children, pose a low risk. To reduce the likelihood of pathogen introduction, hygiene zones with showers and toilets for visitors and workers should be established, separate clothing and footwear for each farm should be used, and regular hand washing and disinfectant use should be practised.

Farm equipment can also serve as a source of pathogen transmission between animals and farms. To mitigate this risk, it is recommended to use single-use needles and syringes for each animal, disinfect reusable equipment such as thermometers and ultrasound sensors, and clean and disinfect instruments after each use. Contact with animals from neighbouring farms can introduce pathogens, so it is essential to install robust fences to prevent contact between animals from different farms. These fences should be regularly maintained to prevent damage, and manure and other waste should be stored in airtight containers to prevent leaks.

Improper storage of feed and water can lead to contamination with pathogens. To ensure the safety of feed and water, they should be stored in closed and dry premises, protected from the weather and animals. The quality of water should be regularly checked and treated, such as by chlorination, and water should be stored in closed reservoirs to prevent access by animals and pests (Black *et al.,* 2020; Waldeck *et al.,* 2021).

Implementing effective measures for visitors, equipment, neighbouring farms, feed, and water is crucial for reducing the risks of introducing and spreading pathogens, thereby contributing to sustainable animal husbandry development.

Interaction with dogs, cats and pests as a component of biosecurity in animal husbandry

Dogs and cats can carry a variety of pathogens that are capable of infecting livestock and humans. Major biological threats include helminths such as *Taenia hydatigena*, which causes liver lesions in sheep, *Taenia ovis*, which affects the heart muscle of sheep, *Taenia multiceps*, which causes brain lesions in sheep, and *Echinococcus granulosus*, which causes the formation of hydatid cysts in the liver. Among protozoa, *Toxoplasma gondii* is particularly dangerous, as it can infect domestic animals and humans, with cats as the primary transmitters of this parasite, which can cause abortions in livestock. *Neospora caninum* can also cause abortions in cattle (Alocilla & Monti, 2022).

To prevent the spread of these pathogens, it is essential to restrict access of dogs and cats to feed storage areas, water sources, calving areas, and places of storage of animal corpses. This can be achieved by closing doors and gates to prevent access to feed storage areas, installing fences to restrict animal movement using physical barriers, and ensuring proper management

and training of dogs, which should have designated areas for resting, feeding, and drinking.

Pests such as rodents, insects, and birds can also carry pathogens that pose a threat to livestock. For instance, rodents can transmit leptospirosis, toxoplasmosis, and campylobacteriosis through their faeces. Birds are capable of spreading *Salmonella* and *Cryptosporidium*, contaminating feed and water with their faeces. Insects may carry various viruses, including the bluetongue virus and the nodular dermatitis virus. To manage pest populations, it is crucial to prevent conditions that favour their development, which includes ensuring proper storage of feed and water, adhering to hygiene practices to prevent the accumulation of waste and litter, and employing mechanical traps and insecticides for insect control. Additionally, rodenticides should be used to manage rodent populations, while physical barriers, such as nets, can help restrict bird access. As a biological control method, birds of prey can be used to deter other birds from the area (Ouchene *et al.,* 2023).

Products designed to control pests should be stored in designated areas, according to the storage conditions specified by the manufacturer. O. Alocilla & G. Monti (2022) pointed out that these areas should be accessible only to authorised personnel to avoid accidental ingestion or the inclusion of toxic products in animal feed.

In conclusion, adherence to biosecurity principles in interactions with dogs, cats, and pests is crucial for preventing the spread of pathogens on farms. Proper storage of feed and water, restricting animal access to storage areas, regular disinfection, and pest control will help to ensure animal health and increase the productivity of farms.

Security at livestock markets: Key aspects and measures

Although the popularity of buying and selling live animals at markets has significantly decreased over the past decade, according to S. Sarrazin *et al.* (2019), this practice still exists and therefore requires special attention and control from a biosecurity perspective. The movement of animals is one of the primary routes for the transmission of pathogens between herds. Research shows that livestock markets can play a central role in the spread of diseases. The mixing of animals of different age and sex groups and from farms with different epidemiological statuses plays a significant role in this process. As scientists have noted, this creates a high potential for the spread of pathogens both between farms and between regions.

Visiting livestock markets can introduce pathogens onto a farm through infected animals or fomites such as footwear or clothing that have been used at the market. For instance, if a farmer returns from a market without purchasing any animals, the risk is minimal. However, if a farmer brings new animals onto their farm, the risk increases significantly due to potential contact with other animals at the market. A medium-risk arises when a farmer returns with unsold animals, which may also have had contact with other animals.

To prevent the introduction of new pathogens onto a farm, farmers should adhere to specific biosecurity measures. Firstly, it is essential to conduct a visual inspection and avoid purchasing animals that appear ill. Before buying, it is necessary to consult with a veterinarian regarding the required vaccinations and treatments for new animals. All purchased or returned animals from the market should undergo a quarantine period. Additionally, it is necessary to plan in advance the number of animals to be purchased to avoid unforeseen situations, and to thoroughly clean and disinfect transport vehicles before and after transporting animals.

Livestock markets should also provide appropriate conditions to prevent the spread of

pathogens. This includes adequate infrastructure for animal housing, ventilation, lighting, and feeding, systems for waste removal and disposal, and facilities for maintaining hygiene for both workers and visitors. It is also important to have animal identification systems to easily track their movements and ensure the presence of official veterinary control to check the health status of animals before they are brought to the market. Particular attention should be paid to an isolation zone where animals requiring veterinary examination can be segregated (Avalos *et al.,* 2022).

In conclusion, livestock markets serve as significant hubs for the dissemination of pathogens; therefore, implementing effective biosecurity measures is crucial to preventing disease outbreaks. Adherence to appropriate biosecurity measures by both visitors and market operators will help reduce the risks of introducing and spreading pathogens, ensuring animal health and enhancing livestock productivity.

Biosafety assessment and development of a biosafety plan

Evaluating the level of biosecurity is a crucial step in identifying potential risks and developing effective measures to protect farms from threats while minimising their impact on animal health and productivity. A. Kucuk & Y. Yildirim (2024) argued that the first step in developing a realistic and effective biosecurity plan is to assess the existing biosecurity measures on the farm. According to W.R. Ashmawy *et al.* (2022), biosecurity assessment enables the identification of the strengths and weaknesses of current measures, allowing for recommendations for their improvement. This requires gathering accurate data on the biosecurity measures that have already been implemented. The assessment should be structured to collect all necessary information regarding the current biosecurity practices. The most common method for conducting the assessment is through surveys, which evaluate how risks are prevented or mitigated on the farm. It is essential to carry out the assessment directly on the farm rather than relying solely on interviews.

It is important to note that obtaining accurate responses from a farm can be challenging. Often, what is stated to be done differs significantly from what is actually being practised. This is why, as B. Benavides *et al.* (2021) pointed out, it is necessary to carefully plan the assessment structure to obtain a realistic picture of the biosecurity measures implemented. Conducting a biosecurity assessment requires a specific approach to ensure accuracy and effectiveness. It is important to listen attentively and not to perceive the assessment process as an audit but as an opportunity for improvement. To obtain complete information, it is advisable to use open-ended questions that allow farmers to explain in detail how biosecurity measures are implemented. The assessment procedure requires sufficient time to avoid hasty conclusions. Additionally, as M. Leite *et al.* (2023) noted, that visiting different parts of the farm is necessary to observe how biosecurity measures are implemented in practice on-site.

Following the completion of the biosecurity assessment, the next step is to develop a plan that should cover all possible routes of pathogen entry into the farm and their subsequent spread. When developing the plan, it is essential to carefully assess the areas that require improvement, based on the level of risk of pathogen transmission. This also includes implementing effective biosecurity measures that address the identified threats. It is important to consider the sociological and psychological factors that may influence the implementation of biosecurity measures. In addition, it is necessary to carefully discuss the advantages and disadvantages of the proposed measures. It is important to anticipate systematic monitoring,

regular review, and adaptation of the plan to ensure its long-term effectiveness. Furthermore, it is necessary to immediately identify the most important measures for improvement, taking into account the limited resources of the farms. The plan should be developed in partnership with the farms to ensure the acceptability, feasibility, and sustainability of the proposed changes.

Implementing the changes outlined in the biosecurity plan is a critical step. It is important to periodically assess and monitor the implemented measures to improve them. Farms and their workers must understand and be convinced of the necessity and benefits of these measures. As V. Sri Lestari *et al.* (2022) noted, the implementation of biosecurity measures can face various barriers, such as a lack of infrastructure or socio-economic factors. It is important to focus on measures that are feasible and sustainable over time.

Veterinary professionals play a key role in promoting biosecurity plans on farms. The use of good communication skills is essential to influence the behaviour of farm workers regarding biosecurity. In conclusion, it should be noted that developing an effective biosecurity plan requires a detailed assessment of existing practices, taking into account the specific risks for each farm, and cooperation with them. The continuous implementation and maintenance of biosecurity measures are key to protecting animal health and improving farm productivity.

Conclusions

Biosecurity is an integral part of modern animal husbandry, contributing to the preservation of animal, human, and environmental health. Implementing biosecurity principles prevents the spread of infectious diseases, reduces the use of antimicrobial drugs, and helps to reduce the risk of developing antimicrobial resistance. This article examines the key aspects of biosecurity, its importance, and the main principles that can be applied on farms to improve animal health and productivity. Biosecurity is a vital tool in modern animal husbandry, ensuring not only animal health but also the protection of human health. This is achieved through the implementation of preventive measures that reduce the risk of pathogen spread. Preventive veterinary medicine is based on the principle of disease prevention by reducing risks and implementing healthy practices. This includes not only treating sick animals but also providing advice to farms on improving the health and productivity of their animals. The growing population, urbanisation, and climate change create additional challenges for biosecurity. Effective measures that are implemented must take into account these changes and adapt to new conditions. The “One Health” concept emphasises the interconnectedness of human, animal, and environmental health. It mobilises diverse sectors and disciplines to work together to ensure well-being and combat threats to health and ecosystems. The main principles of biosecurity include segregation, cleaning, and disinfection. It is also important to consider the behaviour and attitudes of people working with animals. A combination of different biosecurity methods increases the effectiveness of measures. Developing an effective biosecurity plan requires a detailed assessment of existing practices and the specific risks for each farm. Cooperation with farmers is key to ensuring the acceptability and sustainability of proposed changes. The regular development of educational programs and training for farmers and farm workers is critical to ensure understanding and effective implementation of biosecurity measures. Investments in infrastructure, such as isolation zones, cleaning, and disinfection systems, will help reduce the risks of pathogen spread. Continuous monitoring and adaptation

of biosecurity measures to changing conditions will help maintain their effectiveness. Providing financial support to farms for implementing biosecurity measures is a crucial step in ensuring their sustainability and efficiency. Overall, implementing effective biosecurity measures is an integral part of sustainable livestock production. Considering global challenges such as climate change and population growth requires a comprehensive approach to biosecurity. Cooperation between farms, veterinarians, and scientists, as well as financial support and educational programs, will help ensure animal health and increase the productivity of livestock farms, creating strong mutually beneficial relationships between all stakeholders.

Future research will focus on developing effective biosecurity plans as preventative measures against the emergence of infectious diseases, to increase livestock productivity.

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Conflict of Interest

The authors of this article declare that there are no commercial or financial conflicts of interest that could influence the objectivity of the research or the interpretation of its findings. All data used in this article were obtained from open sources, and the analysis was based solely on scientific principles, without any influence from external organisations.

None of the authors has any financial interest in companies, products, or services that could benefit from the content of this article. All ethical standards of research conduct have been adhered to, and the authors are committed to disclosing any potential changes that may result in a conflict of interest.

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Ключові аспекти біобезпеки у сучасному тваринництві

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Анотація. Актуальність дослідження зумовлена необхідністю покращення біобезпеки у тваринництві для покращення здоров'я та продуктивності худоби, а також захисту здоров'я людей. Біобезпека є ключовим елементом, що запобігає поширенню інфекційних захворювань, сприяє зниженню ризиків епідемій, зменшенню витрат на лікування й підвищенню продуктивності і економічної ефективності сільськогосподарських підприємств, сприяючи покращенню якості продукції та зміцненню продовольчої безпеки, що підвищує конкурентоспроможність господарств на ринку. У зв'язку з цим, мета цього дослідження спрямована на розкриття ролі біобезпеки у превентивній ветеринарній медицині. Провідним підходом до дослідження цієї проблеми є аналіз існуючих практик та методів, що дозволяє комплексно розглянути різні аспекти біобезпеки. В результаті проведеного аналізу обґрунтовано, що превентивна ветеринарна медицина базується на принципі попередження хвороб через зниження ризиків та впровадження здорових практик. З'ясовано, що цей підхід включає не лише лікування хворих тварин, але й надання консультацій фермерам щодо покращення здоров'я та продуктивності їхніх тварин. Встановлено, що біобезпека також допомагає запобігати виникненню і поширенню інфекційних захворювань, зменшуючи необхідність у використанні антимікробних препаратів та знижуючи ризик розвитку антимікробної резистентності. Дослідженням підкреслено, що в сучасному світі, що швидко змінюється, біобезпека стає ще більш важливою через зростання населення, урбанізацію, зміни клімату та загрози для здоров'я людини, такі як антимікробна резистентність. Охоплено концепцію «Єдиного здоров'я», яка підкреслила тісний зв'язок і взаємозалежність здоров'я людей, свійських та диких тварин, рослин і довкілля. Основні принципи біобезпеки включають сегрегацію, очищення та дезінфекцію, а також врахування поведінки та ставлення людей, що працюють із тваринами. Матеріали статті становлять практичну цінність для ветеринарних лікарів, фермерів та тваринницьких господарств, допомагаючи їм розробляти та впроваджувати ефективні біобезпекові плани, адаптовані до змінних умов, що сприяє зменшенню ризиків інфекційних захворювань та підвищенню продуктивності тваринництва

Ключові слова: превентивна ветеринарна медицина; інфекційні захворювання; антимікробна резистентність; очищення та дезінфекція; захист здоров'я людей; зміни клімату