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BETTER

*Biosecurity Enhanced Through Training
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Preface

The COST action CA20103 titled “Biosecurity Enhanced Through Training Evaluation and Raising Awareness” (<https://better-biosecurity.eu/>) aims to reduce the risk of infectious disease introduction and spread by improving the implementation of biosecurity measures in animal production systems.

The 2024 First General Meeting of the COST action BETTER was held in Padua, Italy, on the 6th and 7th of February.). Hereby, we present you the book of abstracts of the research that was presented in this event. We would like to thank Prof. Alessandra Piccirillo and her team that made sure we had a great two days with many activities, presentations and networking opportunities with members of the another EU-funded project (NetPoulSafe).

On behalf of the COST BETTER action,

Alberto Allepuz & Ilias Chantziaras



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INNOVATIVE APPROACHES TO BIOSECURITY ENHANCEMENT IN RESOURCE-LIMITED EXTENSIVE SYSTEMS: A ROADMAP FOR SUSTAINABLE ANIMAL PRODUCTION

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The study delves into the intricate challenges surrounding biosecurity in animal production, with a specific focus on resource-limited extensive systems. Recognizing the pivotal role of biosecurity in averting pathogen introduction and promoting the overall health of farmed animals, this independent study aims to provide innovative solutions to address pressing issues impeding effective biosecurity practices. The study begins by conducting a meticulous evaluation of current biosecurity practices within extensive systems, acknowledging the scarcity of resources and knowledge gaps. Utilizing participative methodologies, the research seeks to unearth motivators and barriers hindering the optimal implementation of biosecurity measures in these settings. The generated insights act as a foundational baseline, informing the development of tailored communication strategies and training modules customized for resource-limited environments. Furthermore, this study performs a comprehensive comparison of existing biosecurity evaluation methods, exploring their applicability and effectiveness in extensive systems. By leveraging these diverse tools, the study endeavors to foster the creation of context-specific biosecurity options, considering risk assessments, feasibility, and economic benefits unique to each farm. The study identifies and addresses gaps in current training materials. It goes a step further by designing and proposing new courses that cater to the specific needs of extensive systems, thereby contributing to the augmentation of trained professionals in these settings. The outcomes of this study, promise to offer pragmatic and sustainable solutions for enhancing biosecurity in resource-limited extensive systems. By prioritizing the unique challenges faced by these environments, the study lays the groundwork for future biosecurity improvements, fostering the well-being of farmed animals, sustainability of production systems, and reduced antimicrobial use.

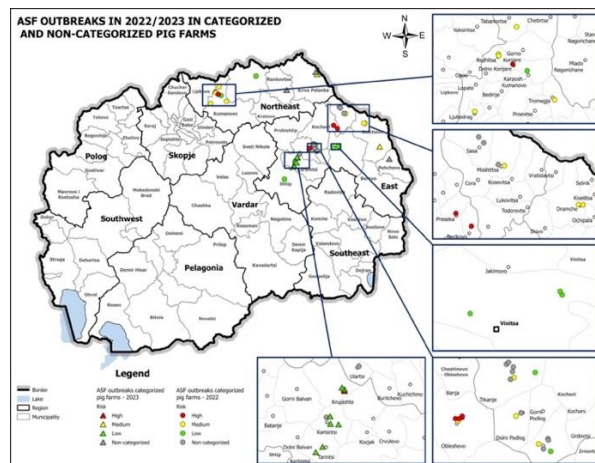
Keywords: Extensive Systems, Resource-Limited, Biosecurity Enhancement

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REVIEW OF AFRICAN SWINE FEVER OUTBREAKS IN 2022 AND 2023 IN RISK CATEGORIZED AND NON-CATEGORIZED PIG FARMS ACCORDING IMPLEMENTATION OF BIOSECURITY MEASURES

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Introduction: In period from June 2020 to December 2022, 5608 pig farms were categorized by private veterinary practitioners (PVPs) using FVA national score index system for biosecurity assessment. According to obtained scores, farms were classified into a low (up to 35 points), medium (36 to 55) and high (over 55) risk category. The first ASF case in domestic pigs was confirmed on 7th January 2022 in two backyard farms. In total, 45 outbreaks were occurred until the end of 2022. FVA confirmed ASF in 13 pig farms in 2023. According FVA national score index system 708 pig farms were classified as farms with low biosecurity risk, 4219 with medium and 681 were categorized as farms with high biosecurity risk. **Materials and Methods:** During the active and passive surveillance as well and in post outbreaks surveillance in 2022 and 2023, a total of 7914 domestic pig were tested for ASF. Samples were taken from dead and suspicions animals. Also, sampling was carried out at the slaughterhouse for active surveillance as well for post outbreak surveillance. Data were analyzed from Veterinary information system of FVA in relation to the carried out categorization and epidemiological investigation of ASF outbreaks. **Results and Discussion:** The disease was detected in 18 pig farms, no previously registered and categorized, while 2 cases were confirmed as illegal disposal of dead domestic pigs. In categorized pig farms, ASF were confirmed in 7 pig farms with high risk and in 16 pig farms with medium risk. However, unexpected ASF outbreaks were reported in 16 pig farms categorized with low biosecurity risk. **Conclusion:** The results of this study indicate that there is a need for essential improvements in the methodology and frequency for risk categorization of pig farms. Biosecurity assessment should be based on higher and more rigorous criteria during farm evaluation and categorization.



Keywords: ASF, biosecurity measure, pig farms, risk categorization

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BIOSECURITY CHALLENGES IN EXTENSIVE DOMESTIC PIG FARMING IN TWO COUNTRIES: SERBIA AND SLOVENIA

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Biosecurity measures are considered the most important instrument for preventing the introduction of African swine fever (ASF) into pig production systems. Especially in extensive pig production, biosecurity measures must be practical to implement, and understandable for farmers. In 2023, the bilateral Serbia-Slovenia country project has started with the aim of mapping and evaluating biosecurity measures in different pig production systems and establishing a link between herd biosecurity and the potential risk of ASF introduction. On the one hand, the project will address this through a recent epidemiological study in ASF-infected pig units (small farms, backyards) in Serbia. On the other hand, Slovenia, as an ASF-free country, is currently in the highest preparedness phase in view of the cases detected in the neighbouring countries. In 2019, ASF was detected in Serbia in extensive pig production. The rearing of pigs in backyards is a traditional practise in villages, but under certain conditions this type of unit can also be operated commercially. In contrast, extensive backyard pig production exists in Slovenia, but with varying degrees of regulation. In addition to backyard pig farming, there is an outdoor pig production oriented to the well-recognised pig breeds with labelled meat products (Krskopoljska pig). In 2023, the research groups from two countries visited Serbia and Slovenia to record and evaluate the specific factors in the structure of the country's pig production system. In Serbia, the field visits were carried out in the regions affected by ASF. In Slovenia, the extensive pig production units with outdoor pig production were visited and the country's measures to combat ASF were presented. The global dimension of ASF, including long-distance translocations, shows that all countries are at risk: Human-mediated spread to domestic pigs can occur at any time and in any country, regardless of the distance to ongoing infections.

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Keywords: biosecurity, extensive pig production, African swine fever

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DESCRIPTIVE OUTLOOK OF THE BIOSECURITY REGULATIONS IN THE MACEDONIAN INTENSIVE POULTRY SECTOR

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As part of the Working Group 1 task to map biosecurity measures in intensive poultry farm systems, we filled out the questionnaire designed specially for this purpose addressing measures required by law and other than law. In general, there are no biosecurity-regulated measures on the regional or area level. Furthermore, the Macedonian poultry industry has no biosecurity measure prescribed other than law. However, the Law on Food Safety encourages the preparation and dissemination and the use of guidance relating to good practices for the protection and welfare of animals. We found that stipulated biosecurity measures are dispersed into six legal acts (LA), of which, are the Law on Feed Safety (LA-A), the Rulebook for Technical-technological Requirements and Procedures for Quarantine Approval (LA-B), the Rulebook for Protection and Animal Welfare of Farm Animals (LA-C), National Control Plan for Reducing the Presence of Salmonellosis in Laying Hens, Parent Flocks, Broilers, Hatcheries (*Gallus gallus*) in the Republic of Macedonia (LA-D), Record for the Official Control of Poultry Holdings (LA-E), and Annual Animal Health Protection Act (LA-F). Interestingly, the act that covered the most questions is the LA-D with 16 “yes” or “partly” answers, followed by LA-E with nine answers, LA-B with six answers, LA-A with four answers, LA-C with two answers, and LA-F with only one answer. The results revealed that 24 biosecurity measures are not covered at all and the most significant lack of measures are in sections Entrance of People into the Farm, Dead-bird Disposal, and Litter and Manure Management. Only, the section Pest Control has all “yes” answers for all the categories except for the minor species. Even more, the measures in this section are mandatory. The majority of the prescribed measures address specific poultry categories while only 12 measures address (eight “yes” and four “partly” answers) all poultry categories. The measures stipulated in the LA’s are recommended except for the two mandatory in the Pest Control section, one for the cleaning and disinfection of the house for layers and broilers and one for the provision of a parking area. To sum up, there is not a single act in Macedonia that encompasses all addressed measures in this questionnaire rather they are dispersed in several LA’s which do not have a legal correlation between them. Unexpectedly, the LA-D which aims to reduce the presence of salmonellosis is regulating the most measures in this questionnaire. A high percentage (43%) of the measures are not regulated, and out of the regulated questions, only 21% are mandatory while the rest are recommended. Finally, there is a clear need to draft a single comprehensive biosecurity act for the poultry sector that would target all biosecurity measures thus alleviating the negative effects of the production and infectious diseases.

Keywords: WG1 questionnaire, poultry,

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METHODS USED FOR BIOSECURITY ASSESSMENT IN LIVESTOCK FARMS IN AFRICA: A SCOPING REVIEW

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Farm biosecurity has gained increasing attention worldwide during the last decades because of its role in reducing the occurrence of diseases and improving animal performance. Recently, recommendations to reinforce the concept of farm biosecurity in lower- and middle-income countries have been advised. Therefore, this review aimed to provide a comprehensive description of the methods used to assess biosecurity compliance in livestock farms in Africa and formulate recommendations. The present review was conducted according to the Cochrane handbook and following PRISMA-ScR guidelines. Peer-reviewed studies reporting biosecurity assessment in poultry, cattle, pig, goat, or sheep farms in Africa were included. Several databases were searched with no date restrictions. A total of 41 studies across 17 countries were finally selected. Selected studies were all published after 2008, and an increasing trend in the number of papers published per year was noticed. In total, 41 different methods for biosecurity assessment were found to be used in Africa countries, meaning that even within the same country, the same animal species, and the same farming system, different methods were utilized. In many papers, the methods used for biosecurity assessment were poorly described. In addition, during the biosecurity assessment, measures related to the purchase of laying hens, egg transport and management, calves, calving and dairy management and nursery units were almost not considered. These measures should be contemplated in future studies since they are related to important risk factors for the introduction and dissemination of infectious diseases. Interestingly, some measures not considered in European biosecurity tools were identified in the selected studies. The observed high disparity of the methods used may be due to the lack of regulations on biosecurity in African countries, therefore, authors recommend the development and implementation of a harmonized and contextualized method for the assessment of biosecurity in livestock farms in Africa.

Keywords: Biosecurity, farm, Africa, poultry, pig, cattle

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BIOSECURITY MEASURES ON THE SERBIAN BACKYARD POULTRY FARMS

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Extensive poultry farming is one of the most important sources of food for households in rural areas of Serbia. The disadvantages of this type of farming are related to the increased risk of the introduction and easy spread of pathogenic microorganisms between the birds within the same yard, the increased risk to the health of the people who take care of them, and the people who consume their products. As biosecurity (BS) is the first line of defense against pathogenic microorganisms in any animal production, in this study, an assessment of biosecurity measures was performed by Biocheck.UGent online survey on 15 backyard farms in different parts of Serbia. Farms are rearing crossbreed chicken species, in the mixed confinement rearing systems. According to the results, the total BS score ranged from 44 to 71 %, with an average score of 54.46 ± 6.44 %. The subtotal external biosecurity scores on backyard farms ranged from 54 % to 73 %, with an average score of 62.13 ± 6.53 %, and subtotal internal biosecurity scores ranged from 5 % to 62 %, with an average score of 23.8 ± 12.10 %. Within external parameters for biosecurity, the lowest score was obtained for the purchasing of one-day-old chicks (51.42%) or laying hens (30%) as they are buying it from different suppliers. Farmers pick up the one-day-old chicks/laying hens by themselves with a personal transport vehicle that is usually only cleaned, not disinfected. Low scores were obtained for manure and carcass removal ($45.93 \pm 17.95\%$). The manure is usually removed after several production rounds and it is finished as a fertilizer (without composting) for surrounding crop fields. The carcasses and leftovers (intestine, feathers, etc.) are thrown away in the environment or it is buried/burned in an open pit. Among other external parameters, noteworthy results were obtained for the depopulation and transport of poultry and poultry products ($96.73 \pm 5.77\%$), as farmers rear the poultry because of food production (meat or eggs) for their consumption and not for sale. Also, good scores were obtained for the location of the farms (75.93%). Concerning internal biosecurity, very low scores were obtained for disease management (20.33%) and cleaning and disinfection (26.4%) as well. A veterinarian visits the farms less than once a year. The birds are very rarely vaccinated against common diseases and the sick birds are usually in physical contact with the healthy animals. Compared to the world scores obtained from Biocheck.UGent online surveys database, the results of the external scores were higher in Serbia, but the results of internal scores were lower for most of the farms. In the case of extensive farming, it is first of all necessary to understand the existing knowledge and habits of farmers and then to point out the measures that they can take in their households to prevent the occurrence of various diseases. To be sustainable, these measures must be flexible and adaptable.

Keywords: backyard poultry, biosecurity, assessment

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METHODS FOR IMPROVING EFFICIENCY ON COW FARMS THROUGH INNOVATION IN BOSNIA AND HERZEGOVINA

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Our article discusses ways to increase efficiency through the application of innovations in farms specializing in animal husbandry. Agriculture represents a very important economic field in Bosnia and Herzegovina. Livestock is one of the leading sectors of agriculture in Bosnia and Herzegovina. Meat, dairy and egg products of the population provide the industry with leather, wool and other raw materials. In today's market economy, one of the most important tasks is to provide the population of Bosnia and Herzegovina with high quality, environmentally friendly and affordable livestock products. There are many branches of the livestock industry in Bosnia and Herzegovina, such as cattle breeding, sheep breeding, poultry farming, horse breeding, fishing, beekeeping. Nowadays, the European dairy cow sector faces major economic, social and environmental challenges that must be properly addressed to secure its survival. The findings of this study provide insights concerning the efficient financial management of dairy farms that can support the development of strategies and policy recommendations that will enhance the resilience and sustainability of the sector in Bosnia and Herzegovina. Therefore, the main tasks of the development farms in Bosnia and Herzegovina. achievements such as efficient use, cost-saving new equipment, introduction of innovative efficient technologies, mechanization of production processes, increasing the level of automation, widespread introduction of modern advanced technologies in practice and specialization of farms in formed production and other factors.

Keywords: dairy cow farming; innovation economic analysis; structural adjustment; sector transition

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ASSESSING THE IMPACT OF ON-FARM BIOSECURITY COACHING ON FARMER PERCEPTION AND FARM BIOSECURITY STATUS IN BELGIAN POULTRY PRODUCTION

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Farmers' readiness to accept changes is pivotal to biosecurity application and therefore improving biosecurity requires changes in the attitudes and behaviour of farmers. Veterinary coaching was tested to assess its efficacy in stimulating compliance. The ADKAR® (Awareness, Desire, Knowledge, Ability and Reinforcement) profiling technique was used to identify the key elements that enhance or block change (biosecurity compliance in this case). The Biocheck.Ugent™ (www.Biocheck.Ugent.be) a weighted risk-based online scoring tool was used to measure biosecurity, where farm scores generated range from zero (absence of any biosecurity measures) to 100 (ideal biosecurity situation), and benchmarking allows to identify risks and provide tailored advice. Poultry farmers (n=13) in Belgium; broiler (n=4); enclosed layer (n=2); free-range layer (n=1); turkey (n=2) and breeder (n=4), were profiled with ADKAR, coached and evaluated prior to and 6-months after coaching. A list of measures were proposed to improve on the farm during coaching. Biosecurity adoption following coaching, were indicated by a significant change in biosecurity levels (from $\bar{x} = 67.1$, $SD = 5.7$ to $\bar{x} = 70.3$, $SD = 5.7$; $p = 0.002$) measured using the Biocheck.Ugent™. From a total of 56 proposed biosecurity measures, 26 external and 14 internal measures were adopted. The ADKAR® model indicated that 5/13 participating farmers had relatively low scores (≤ 3) for one or more elements and none received ≤ 3 for all four elements. Farmers' perceptions (mainly on awareness (n=1) and knowledge (n=1) of biosecurity changed as a result of receiving individualized coaching, as evidenced by an increase in ADKA scores from low (≤ 3) to high (> 3). This study highlights the importance of recognizing the barriers to farm biosecurity practice adoption. The authors have found success in enhancing farm biosecurity procedures using the two complementary scoring tools ADKAR® and Biocheck.Ugent™.

Keywords: Keywords: biosecurity, coaching, intervention study, poultry, risks

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BIOSECURITY MEASURES IN A LARGE COMMERCIAL BEEF CATTLE FARM IN SLOVENIA

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Biosecurity is a cornerstone of successful intensive livestock production. In 2022, there were 28,482 registered cattle farms (family farms) and 12 cattle-breeding companies in Slovenia. The total number of cattle was 464,908, of which 240,004 were beef cattle; 122,616 cattle were slaughtered in 2022.¹ The studied commercial beef cattle farm in Slovenia fattened around 1,400 cattle per year. Ten percent of the calves are of Slovenian origin; all others are imported from the Czech Republic, Slovakia, Poland, Latvia, Hungary, or France, where the company has verified permanent suppliers. The animals are reared at 2 locations in 8 large barns on fully slatted concrete floors. They are kept in a loose housing system in groups of 7-17 animals. The animals are fed a total mixed ration adapted to the animal category, consisting of home-grown corn silage, grass silage, corn meal, straw and purchased mineral protein concentrate. As a biosecurity measure, the company has erected a 1.9 m high fence around both locations, access to the barns is restricted and the parking spaces are located outside the fenced area. All barns have protective nets against insects and birds, fully lockable doors, their own drinking water valve, barn tools and a hospital bay. New arrivals are housed in clean and disinfected boxes. They are vaccinated and dewormed in the first week after their arrival. Deratisation is carried out regularly. The employees are provided with work clothes and personal protective equipment. There are several washing facilities with hot and cold water, cleaning products and disinfectants at the locations. The size of the company, with its 25 employees and 2 locations, is both a strength and a weakness from a biosecurity perspective. Although the biosecurity measures are implemented, there is still room for error and additional biosecurity training, or annual refresher courses would be useful. Reference: 1 SURS. (2022). Number of cattle, cohesion regions, Slovenia, annually. Acquired: 19. January 2024 from: <https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/1517401S.px>

Keywords: livestock farming, disease prevention, fattening bovines

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RISK FACTORS FOR SPREADING OF AFRICAN SWINE FEVER IN BACKYARD PIG HOLDINGS IN AN OUTBREAK IN SERBIA

B. Kureljušić*, B. Savić, B. Milovanović, N. Jezdimirović, J. Maletić, M. Ninković, J. Prodanov Radulović

Risk factors for spreading of African swine fever in backyard pig holdings in an outbreak in Serbia Branislav Kureljušić, Božidar Savić, Bojan Milovanović, Nemanja Jezdimirović, Jelena Maletić, Milan Ninković, Jasna Prodanov Radulović In this investigation we assessed the main epidemiological risk factors for ASF maintenance and spreading for more than four months during 2023. in the epidemiological unit of the city Belgrade. During outbreak, in total 89 backyard pig holdings were visited and epidemiological investigations were carried out using prepared questionnaires. The average number of pigs per holding was 3,07 pigs. The most of the holdings had fatteners only (59,55%) and usually were used for own consumption. The 61,8% of holding were inside of hunting area or closed to 1000 meters from hunting ground whereas hunting activities by owners was noticed only in 5,62% holdings. Closed proximity to other holding with pigs at the distance of 100 meters was detected 60,67% of holdings. Other species at holding as dogs, sheep, cats etc. were present in 76,4% of holdings. Moving of pigs was noticed in only 11,24%, whereas moving of people in 53,93% of holdings. The home slaughtering was practiced in 87,64% of holdings, usually for own consumption. The complete fence was present in 57,3% of holdings. Regarding feeding, usually the pigs were fed extensively with swill in 57,3% cases, with crops from local grounds in 91,01% and with fresh mowed grass in 64,04%. During the epidemiological investigations different answers from the owners about possible source of infection were obtained. The home slaughtering, swill and mowed grass feeding were recognized as high risky activities. On the other hand as a source of infection other animals can play possible role in mechanic transmission (stray dogs and cats, rodents, birds, insects). In the most cases the sources of infection remain unknown. Different types of traditional extensive pig farms with no or very low biosecurity in combination with human activity and possible other factors play pivotal role in ASF spreading in Belgrade. Key words: ASF, backyard pigs, epidemiological investigations, Serbia

Keywords: ASF, backyard pigs, epidemiological investigations, Serbia

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REVIEW OF AFRICAN SWINE FEVER OUTBREAKS IN 2022 AND 2023 IN RISK CATEGORIZED AND NON-CATEGORIZED PIG FARMS ACCORDING IMPLEMENTATION OF BIOSECURITY MEASURES

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Introduction: The first African swine fever (ASF) case in domestic pigs was confirmed on 7th January 2022 in two backyard farms, while the last one occurred on 25.12.2023 at medium commercial farm. The goal of this paper is to give an overview on outbreaks in pig farms that occurred during 2022 and 2023 regarding implemented biosecurity measures. **Materials and Methods:** In period from June 2020 to December 2022, 5608 pig farms were categorized by using Food veterinary agency national score index system for biosecurity assessment. According to obtained scores, farms were classified into a low (up to 35 points), medium (36 to 55) and high (over 55) risk category. During 2022 and 2023, 7914 domestic pig were tested for ASF. Samples were taken from dead and suspicions animals. Sampling was carried out also at the slaughterhouse for active surveillance and post outbreak surveillance. Data were analyzed by Veterinary information system of FVA in relation to the farm categorization and epidemiological investigation of ASF outbreaks. **Results and Discussion:** In 2022 ASF was confirmed in 45 pig farms, while in 2023 the disease was detected in 17 pig farms. The ASF was introduced in 20 pig farms no previously registered and categorized, while two positive cases were related with Illegal disposal of dead domestic pigs. In categorized pig farms, ASF were confirmed in 8 pig farms with high risk and in 16 pig farms with medium risk. However, unexpected ASF cases were reported in 16 farms categorized with low biosecurity risk. **Conclusion:** The results of this study indicate that there is a need for essential improvements in the methodology and frequency for risk categorization of pig farms. Biosecurity assessment should be based on higher and more rigorous criteria during farm evaluation and categorization to reduce the risk for ASF incursion.

Keywords: African swine fever, biosecurity, pig farms, risk categorization

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PODCAST ON BIOSECURITY

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Background Biosecurity is pivotal in the management of animal health and disease control. To support the implementation of biosecurity in the field, and to inform people of the latest insights in biosecurity, a podcast was created within the European BIOSECURE research project. Objective With the BIOSECURE podcast, we aim to launch quarterly episodes created to communicate and disseminate biosecurity knowledge within the BIOSECURE project but also biosecurity in general outside the scope of the project. The podcast series focuses on biosecurity in animal production around the globe as a tool to safeguard animal and human health. It aims to empower listeners with practical knowledge of biosecurity measures and discuss challenges within the veterinary field. Guests/ Expert Interviews In each episode, experts from within or outside the BIOSECURE consortium are invited to talk about their expertise and certain biosecurity aspects. The experts shed light on the issues and insights related to ongoing diseases, preventive measures as well as success stories of "biosecurity champions", a segment within these podcasts to keep it entertaining and light for listeners. Interaction and Communication Listeners can interact via comments after each episode and ask any questions. The episodes are published on the BIOSECURE website, social media (Facebook, Twitter) as well as the official Spotify channel of the project. More information on the BIOSECURE project can be found on www.biosecure.eu.

Keywords: Biosecurity, podcast, communication, dissemination

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Highly Pathogenic Avian Influenza (HPAI) was detected in Finland for the first time in 2016 in wild birds. In 2021, the first and only case of HPAI in poultry occurred on a single pheasant farm. In 2023 over 70 fur farms were found to be infected with HPAI H5N1. Some of those were located near turkey production. Although biosecurity was believed to be well managed in commercial poultry farms, it was important to find out its actual level using a measurable method. In addition, it was necessary to give personal advice to farmers, because not everybody can be reached by training in form of written instructions or lectures. The Finnish Ministry of Agriculture and Forestry and European Agricultural Fund for Rural Development (EAFRD) financed two projects, in which the biosecurity on turkey farms was evaluated with the Biocheck.UGent method. All 32 commercial turkey farms and six parent stock farms (three rearing and three laying units) were visited. Additional, more specific questions relating rodent control, protection of feed etc. were asked. The results showed that the biosecurity was at a proficient level in the turkey production. However, some measures should be developed almost at every farm. The most common improvement proposals concerned structure of the hygiene barrier as well as cleaning and disinfection during the vacancy period as well as cleanliness of the production environment including pest control. Mostly, the variation in results between farms was not large. This can partially be explained by the strict contract production, where the same rules apply to every farm. In international comparison, Finnish farms scored in most areas as well as or better than the international average. However, comparison with international results can be problematic because of the wide variation in farm size and management practices, and the number of assessors.

Keywords: biosecurity, turkey

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THE SUSTAINABILITY OF BIOSECURITY IN THE SWINE LIVESTOCK: A BIBLIOMETRIC AND NETWORK ANALYSIS

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Infectious animal and zoonotic diseases represent a threat for farm productivity, product quality, and human health. Biosecurity measures adoption helps to prevent introduction and spread of diseases in farms but increases management and investment costs, potentially reducing profits. This study is part of a multi-year PhD research project and is part of the ongoing European HE Project BIOSECURE. The aim of this poster is to show the results of a bibliometric and network analysis focusing on the economic aspects of biosecurity in swine farms. Bibliometric analysis delineates and assess published research, the network analysis consists of a keyword co-occurrence analysis, that show graphically the link between each keyword. The extraction of documents was run on 22 November 2023, and carried out from Scopus, Pub Med and ISI Web of Knowledge. The extraction focused on studies published between 1995 and 2023. Three groups of keywords were used related to: the swine animal species, the economic research field and the biosecurity research field. 586 documents were selected for the analysis. Bibliometric analyses were performed through the R software, while network analysis through the VOSviewer software. Studies investigating the economic aspect of improving animal biosecurity are still quite rare. There is not a specific journal specialized on the economics aspects of animal biosecurity underlining that the topic is not yet fully explored and investigated, but it emerges an increasing interest for the topic. The network analysis highlight that the research focusses mainly on epidemiology, virology, diseases and swine health. An holistic approach in swine farms is required to consider also the biosecurity economic aspects. As part of a multi-year Project, therefore no conclusive results have been reported. The next step of this research includes the creation of a content analysis with the main studies focused only on monetary costs of biosecurity.

Keywords: economic biosecurity assessment; swine livestock; bibliometric analysis; network analysis

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SMALL RUMINANTS' BIOSECURITY MEASURES

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Biosecurity is a series of management practices designed to prevent the introduction and spread of disease pathogens that can harm or adversely affect livestock, crops, environments, and people. These practices may also help eliminate or control diseases already existing on the premises. The most important biosecurity principles (small ruminant introductions, visitors and staff, vehicles, neighbors, water and feed, control programs, management practices, managing outgoing products, working routines, training, plan and record), best-management practices and biosecurity measures based on literature data, national and international guides, instructions, code of recommendations and checklist are shown on the poster. In addition to the mentioned biosecurity principles, the importance of segregation, cleaning and disinfection is highlighted. Keeping infected animals and contaminated materials away from uninfected animals is the most important and effective part of biosecurity. Cleaning and disinfection of the animal housing facilities, vehicles, and equipment (including boots and clothing) are a very effective way to minimize disease transmission to or between the animals. It is very important to implement biosecurity measures as long-standing and successful practices on farms to keep sheep and goats healthy. These measures should be included in a comprehensive biosecurity plan. A biosecurity plan should address how farmers manage animals, vehicles and human access on the farm, animal health and operations. The most important biosecurity principles should be followed continuously, and in cooperation with veterinarians, farmers enable themselves to play a significant role in keeping the animals and the production as healthy as possible.

Keywords: sheep, goat, biosecurity, principles, measures

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DATABASES COLLECTING INFORMATION ON THE APPLICATION OF BIOSECURITY PRACTICES

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In numerous countries around the world data on the implementation of biosecurity measures on livestock farms, animal transport companies and feed mills are collected. Those data are gathered by various entities including national authorities, private companies and research institutions using a variety of tools and storing them either on paper or within online databases across different locations. Due to the decentralized nature of these data, the goal was to create an overview of large databases collecting information on the application of biosecurity practices on farms, transport companies and feed mills. As part of the European BIOSECURE research project, tools for assessing biosecurity were identified. Subsequently, the developers or owners of the tools were individually contacted to ascertain if their biosecurity application database met the inclusion criteria: 1) data stored in an online database, 2) evaluating biosecurity as the primary component of the assessment, 3) current utilization of the assessment, and 4) inclusion of data from at least 100 distinct farms. If these conditions were met, further detailed information was exchanged and finally the database was included on the 'Biosecurity Application Database' page of the BIOSECURE project website (Biosecurity Application Database). So far, six biosecurity compliance databases have been incorporated. Among these, four databases evaluate the biosecurity on pig farms in France (2), Spain (1) or worldwide (1). Another database contains information on movements of individuals and vehicles within and between poultry and pig farms. Furthermore, one database collects data on the implementation of biosecurity measures on pig, poultry, cattle and small ruminant farms worldwide. For more comprehensive insights into these databases, including background information, data collection methodologies, data analysis techniques and reporting procedures, detailed information can be accessed on the project webpage.

Keywords: Biosecurity assessment - Livestock farms - Transport - Feed mills - Databases

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MAPPING ON EXISTING BIOSECURITY WEBSITES

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Introduction: Different stakeholders may interpret a concept differently, which may lead to differences in subsequent actions. The involvement of stakeholders from different sectors with different skills allows for a collaborative and coordinated definition of concepts. However, there is no consensus on which methodology is best for defining terminology. The aim of this review was to identify methodologies used by researchers to reach a group consensus on the definition of specific terms through stakeholder engagement. **Material and Methods:** The databases used to search for articles were PubMed and CAB Abstracts. Inclusion criteria included the presence of the term 'consensus', the name of the consensus method used, and the process used to determine the most appropriate definition of a concept based on stakeholder opinion. A Microsoft Excel spreadsheet was used to record the extracted data from a number of specified fields independently by two authors. **Results:** A large proportion of the articles (67.6%) used some form of Delphi methodology. In relation to the total number of methods used (n=37), the Classic Delphi methodology was mostly employed (12/37; 32.4%; Figure 1). The articles were conducted involving panels of international stakeholders (70.3%). The majority (86.5%) of studies carried out preparatory information gathering (e.g. via literature reviews or surveys) prior to the eliciting stakeholder consensus and many (51.4%) used both online and face-to-face meetings and interviews. **Conclusion:** The fact that the Delphi methodology was the most commonly used method for defining specific terminologies in this review probably reflects the flexible nature of these approaches. The results of the current review are useful for researchers who wish to carry out similar research on the definition of specific terminologies, but may also highlight the potential for innovative methodological developments in this area.

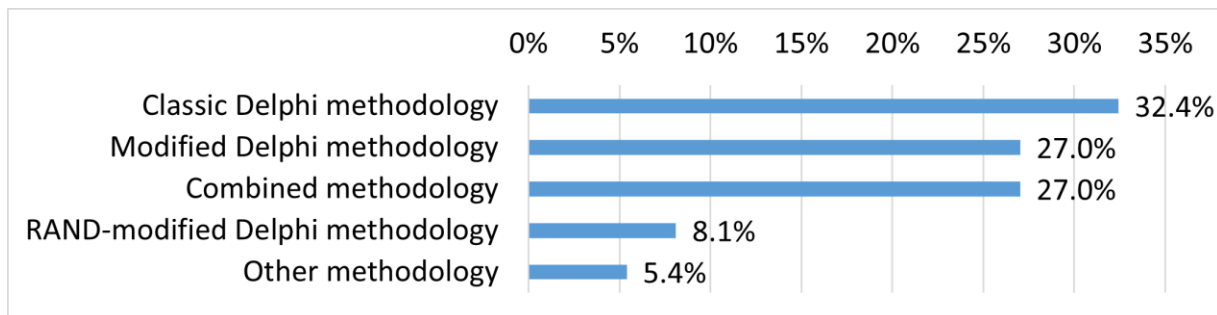
Keywords: biosecurity, websites

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A SCOPING REVIEW OF THE METHODS USED TO OBTAIN STAKEHOLDER CONSENSUS WHEN DEFINING TERMINOLOGY

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Introduction: Different stakeholders may interpret a concept differently, which may lead to differences in subsequent actions. The involvement of stakeholders from different sectors with different skills allows for a collaborative and coordinated definition of concepts. However, there is no consensus on which methodology is best for defining terminology. The aim of this review was to identify methodologies used by researchers to reach a group consensus on the definition of specific terms through stakeholder engagement. **Material and Methods:** The databases used to search for articles were PubMed and CAB Abstracts. Inclusion criteria included the presence of the term 'consensus', the name of the consensus method used, and the process used to determine the most appropriate definition of a concept based on stakeholder opinion. A Microsoft Excel spreadsheet was used to record the extracted data from a number of specified fields independently by two authors. **Results:** A large proportion of the articles (67.6%) used some form of Delphi methodology. In relation to the total number of methods used (n=37), the Classic Delphi methodology was mostly employed (12/37; 32.4%; Figure 1). The articles were conducted involving panels of international stakeholders (70.3%). The majority (86.5%) of studies carried out preparatory information gathering (e.g. via literature reviews or surveys) prior to the eliciting stakeholder consensus and many (51.4%) used both online and face-to-face meetings and interviews. **Conclusion:** The fact that the Delphi methodology was the most commonly used method for defining specific terminologies in this review probably reflects the flexible nature of these approaches. The results of the current review are useful for researchers who wish to carry out similar research on the definition of specific terminologies, but may also highlight the potential for innovative methodological developments in this area.



Keywords: consensus, Delphi, terminology, definition, concept, stakeholder, research methodology, involvement

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ASSESSMENT BIOSECURITY LEVEL IN ALBANIA DAIRY CATTLE USING BIOCHECK.UGENT SCORE SYSTEM

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Farm biosecurity is described as the implementation of a set of procedures to prevent disease introduction into the farm and transmission among individuals on the farm if an outbreak occurs. The 'One Health, One Welfare' strategy emphasizes disease prevention for herd and flock animals, arguing that prevention is superior to therapy. Despite the importance of biosecurity, there are few consistent methods for conducting quantitative assessments of farm biosecurity levels. The Biocheck.UGent score system offers a standardized framework for assessing farm biosecurity programs. In Albania, several major infectious endemic disease outbreaks and transboundary animal diseases have been observed in the last decade. The main issue identified was a lack of farm biosecurity programs and their appropriate implementation. In this study, we used the Biocheck.UGent score system to determine biosecurity levels on 30 dairy farms. The data were recorded in hardcopy and uploaded to online software, and reports were generated automatically following each submission. The demographic parameters were analyzed and both external and internal biosecurity indicators were statistically analyzed. The statistics demonstrate that there is a significant disparity in farm size and biosecurity scores between farms. The average external biosecurity score was 46.6, internal biosecurity was 26.8, and overall dairy farm biosecurity was 36.9. Biosecurity scores were compared to the global average. Both internal and external biosecurity indicators were assessed for their applicability in the Albanian dairy cattle context.

Keywords: Dairy Farm Biosecurity, Biocheck.UGent Disease Control, internal biosecurity, external biosecurity

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MAPPING ON BIOSECURITY PROJECTS AND TRAININGS

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COST action BETTER Task 4.3 goal was to gather comprehensive data on existing biosecurity training programs and ongoing research projects through an online survey. Criteria for categorization of the biosecurity training were created during WG4 meeting in Ghent. Herd health management related questions were added in cooperation with the Federation of Veterinarians of Europe. The survey was translated into 6 languages. A survey link was sent to COST action BETTER members and shared through social media platforms. Survey was open from 11/7–02/09/2023. Data acquisition was conducted via a structured search on Google, utilizing predefined selection criteria. For Biosecurity Trainings, all responses categorized as 'Biosecurity Trainings' or 'Trainings including biosecurity sections'. Trainings were divided into those exclusively focusing on biosecurity and those including biosecurity as a part of a broader curriculum. From the analyses of the results, 165 answers were derived and 111 among them presented useful information. Totally, 15 trainings were found and 11 among them, focused exclusively on biosecurity. A MSc program was included, however no info was available. Nine of the trainings were offered on – line, while the rest were either hybrid (n=2) or face to face (n=3). Lectures (n=6), videos (n=4), virtual classrooms (n=1) or workshops (n=4) were offered as educative tools. Trainings were open to anyone interested in (n=8), official members of Organizations (n=3), farmers (n=3), or professionals (n=1). Trainings focus on poultry (n=4), swine (n=2), food safety (n=2), ruminants (n=1), dairy cattle (n=1) or in many species (n=5). Results obtained here show that a wide range of biosecurity training programs is available and most of them are conducted on-line. Level of complexity and depth among them varies. Dedicated biosecurity training options for veterinarians and professionals are relatively scarce. These insights are valuable for the development of future biosecurity training courses

Keywords: Biosecurity, Trainings

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ASSESSMENT OF HYGIENE AND BIOSECURITY IN MILKING PARLOURS OF DAIRY SHEEP FARMS IN GREECE

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The Milking parlour is the most important component of a dairy sheep farm and plays a dominant role in productivity, health and welfare of ewes. The objective here was to assess hygiene and biosecurity status of milking parlours in dairy sheep farms in Greece. A questionnaire was developed to assess and record common practices on each farm. The questionnaire consisted of 269 questions and covered the main elements of a farm such as livestock, nutrition, reproduction, housing, management and veterinary practices, as well as financial data. Between October and December 2023, 28 farms were visited. In each farm, initially the housing facilities were assessed. Then, the farmer was interviewed by the same researcher using the designated questionnaire. The average duration of interviews was 86 minutes. In most farms, the rapid-exit milking parlour was installed; about 75% of the farms used it. The milking parlour and the milking area were cleaned after each milking in 100% and 32,1% of farms, respectively. In 60,8% of farms cleanliness of the milking parlour was rated as good. Only 32,1% of milkers wore gloves when milking. Isolation units were found in 39,3% of farms. About 82,1% of farms applied treatments in the milking parlour. However, 64,3% of farms did not keep any records of treatments. Overall, the hygiene status of milking parlours was satisfactory. However, the majority of milkers do not use gloves, and a third of them apply hand stripping of milk in daily milking routines. In most farms treating sick animals in the parlour, was the norm. The latter, combined with inadequate record-keeping raise concerns about overall disease management and antibiotic usage in dairy sheep farms.

Keywords: dairy sheep, biosecurity, milking parlour

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CHARACTERIZATION OF METHODS USED TO ASSESS BIOSECURITY ON ANIMAL PRODUCTION FARMS IN DIFFERENT COUNTRIES

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Biosecurity is crucial for safeguarding farmed animal health, welfare, and sustainability by preventing pathogen introduction and spread. However, existing biosecurity evaluation methods vary widely across different farmed animal species, lacking thorough comparison. The aim of this study was to identify the methods employed for evaluating biosecurity and/or the risk of disease introduction. A structured questionnaire was developed to gather data on the animal species targeted, objectives, enforcement, and measurement methods of biosecurity. Distributed through the EU survey platform to country representatives via the BETTER Cost Action (CA20103) network, responses were collected over eight months. An "evaluation method" was defined as a standardized process for assessing biosecurity or disease risk. Ninety-three valid responses were received from 21 European countries, 4 in America, 2 in Asia and 1 in northern Africa. Most of the 84 identified methods were used in a single country and only 3 of them were used in more than one country. Fifty-two percent of methods were for pig production, 42% for poultry, and 35% for ruminants. The main objective varied by species, with "improving farm biosecurity" being most common, followed by "focusing on a specific disease". Checklists, with or without descriptive evaluations, were commonly used for ruminants and poultry, while scoring methods weighted by biosecurity measures were prevalent in pig production. This study provides a comprehensive overview of biosecurity evaluation methods across farmed animal species in Europe. The findings highlight both commonalities and disparities among these methods, offering insights for improving assessment methodologies and initiating or reevaluating national biosecurity strategies.

Keywords: Biosecurity; Evaluation methods; farmed animals; sustainability; Survey

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THE INFLUENCE OF APPLIED BIOSECURITY MEASURES ON THE OCCURRENCE OF COCCIDIOSIS IN BROILER FARMS

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Eimeria are intracellular parasites present in broiler farms worldwide. They can cause subclinical and clinical type of coccidiosis and are caused by seven different pathogenic species of Eimeria. The appearance of a subclinical form of coccidiosis is very common on broiler farms. This study aimed to establish whether the level of applied biosecurity measures on broiler farms has an impact on the occurrence of coccidiosis. The study was conducted over two and a half years on 100 broiler farms (28 small capacity farms; 34 medium capacity farms; 38 large capacity farms). The analysis of biosecurity measures was done using a survey with 13 questions about biosecurity on each farm. One pooled sample of feces from 3- to 6-week-old chickens was also taken from each farm. Feces were analyzed using a modified McMaster method to determine the presence of coccidia oocysts. The obtained results show that 59% of the farms were positive for oocysts, while 41% were negative. The results of the biosecurity questionnaire show that the regular implementation of disinfection, disinsection, and deratization measures, as well as all the mentioned biosecurity measures together, can significantly reduce the occurrence of coccidiosis. These results may help to develop better strategies for the control and prevention of coccidiosis in broiler farms.

Keywords: broiler chickens, survey, coccidiosis, Eimeria, biosecurity measures

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METHODS USED FOR BIOSECURITY ASSESSMENT IN LIVESTOCK FARMS IN AFRICA: A SCOPING REVIEW

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Farm biosecurity has gained increasing attention worldwide during the last decades because of its role in reducing the occurrence of diseases and improving animal performance. Recently, recommendations to reinforce the concept of farm biosecurity in lower- and middle-income countries have been advised. Therefore, this review aimed to provide a comprehensive description of the methods used to assess biosecurity compliance in livestock farms in Africa and formulate recommendations. The present review was conducted according to the Cochrane handbook and following PRISMA-ScR guidelines. Peer-reviewed studies reporting biosecurity assessment in poultry, cattle, pig, goat, or sheep farms in Africa were included. Several databases were searched with no date restrictions. A total of 41 studies across 17 countries were finally selected. Selected studies were all published after 2008, and an increasing trend in the number of papers published per year was noticed. In total, 41 different methods for biosecurity assessment were found to be used in Africa countries, meaning that even within the same country, the same animal species, and the same farming system, different methods were utilized. In many papers, the methods used for biosecurity assessment were poorly described. In addition, during the biosecurity assessment, measures related to the purchase of laying hens, egg transport and management, calves, calving and dairy management and nursery units were almost not considered. These measures should be contemplated in future studies since they are related to important risk factors for the introduction and dissemination of infectious diseases. Interestingly, some measures not considered in European biosecurity tools were identified in the selected studies. The observed high disparity of the methods used may be due to the lack of regulations on biosecurity in African countries, therefore, authors recommend the development and implementation of a harmonized and contextualized method for the assessment of biosecurity in livestock farms in Africa.

Keywords: Biosecurity, farm, Africa, poultry, pig, cattle

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FROM R TO THE FARM: VISUALIZING RISK ANALYSIS TO IMPROVE FARM BIOSECURITY

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As part of the BIOSECURE project, we are developing a model to assess the probability of pathogen introduction and the impact of different biosecurity measures on specific farms. This model will provide tailored recommendations on biosecurity practices for farmers and veterinarians. We are currently testing the effectiveness of visualisations of the model results. To support the project, BETTER participants are invited to view an example application of the model and its outputs, and to complete a survey on the interpretation of the results. This feedback will help us to provide a more user-friendly tool for evaluating and improving on-farm biosecurity measures.

Keywords: Biosecurity Assessment, Data visualization, Risk Analysis

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BIOSECURITY CHALLENGES: INVESTIGATING THE NEXUS OF WILD ANIMALS, PESTS, AND PATHOGENS IN PIG FARMING

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Background: Wild animals and pests are important reservoirs and vectors of pathogenic agents that can affect domestic pigs. Rapid globalization, anthropogenic factors, and increasing trends toward outdoor pig production facilitate the contact between domestic pigs and wildlife. However, knowledge of the transmission pathways between domestic pigs and the aforementioned target groups is limited. **Objective** The present study aims to collect and analyze information on the roles of different wild animal species and pests in the spread of pathogens to domesticated pigs. **Materials and Methods:** Literature searches were performed between 2010-2022 using online databases (PubMed, Scopus, and Web of Science databases). 1250 peer-reviewed manuscripts published in English were screened through the PRISMA framework. All records were imported into the online tool Rayyan and compiled in a Microsoft® Excel 2019 sheet. A total of 84 studies reporting possible transmission routes of different pathogenic agents were included. **Results:** A majority of the studies (80%) focused on the role of wild boars in the transmission of pathogenic agents to pig farms. Approximately 65.5% of the included studies described possible risks/risk factors for pathogens' transmission based on quantitative data, whereas 31% of the articles only presented a hypothesis or qualitative analysis of possible transmission routes or risk factors and/or contact rates. Only 3.5% of studies presented evidence-based transmission routes from wildlife to domestic pigs. **Discussion and Conclusion:** Based on the results, wild boars are the main species transmitting pathogenic agents to domestic pigs in the European context. Other important vectors and reservoirs of infectious diseases include wild ungulates, rodents, wild carnivores, insects, wild birds, ticks, stray (or pet) cats, badgers, and hares. Outdoor farms or extensive systems and farms with low biosecurity are associated with a higher risk of pathogen introduction. **Perspectives** The future study will focus on tools for measures of biosecurity on farms. <https://www.mdpi.com/2076-2615/13/11/1830>

Keywords: African swine fever; biosecurity; pig farming; risk factors; wild boars; wildlife; pests

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AQUACULTURE BIOSECURITY ISSUES

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Over the last two decades, the fisheries and aquaculture sectors have been recognized for their essential contribution to global food security and nutrition. According to FAO statistics from 2022, aquaculture accounted for 56.2 percent of combined global fisheries and aquaculture production in 2020 (122.58 million tonnes produced with a value of USD 281.5 billion). While commercial fishing is stagnating due to various protection measures against overfishing, aquaculture has become the fastest growing food production sector. To meet the increased market demand, the aquaculture industry is faced with the need for rapid development of technological systems, as well as the introduction of new species into production. As a result of rapid development and the fact that more than 500 aquatic species are farmed today, diseases of farmed aquatic animals represent one of the biggest causes of economic losses for the industry, accounting for millions of euros in annual losses worldwide. There are many different challenges and issues facing the aquaculture biosecurity management sector. Some of those clearly identified are healthy seed, emergency preparedness and response, rapid diagnostics, production-level microbial management, disease and pathogen surveillance, aquatic species trade, policy and regulatory framework, welfare, research and technology development, antimicrobial resistance, non-conventional ways of pathogen transmission and Progressive Management Pathway. Because treatment options are limited for most aquaculture diseases, prevention remains the best line of defense for the aquaculture producers. For this reason, understanding how aquatic animal diseases are spread helps in identifying and developing the necessary biosecurity measures. Fish diseases can be transmitted between fish by direct contact, orally, water sources, fomites, and vectors. Not all pathogens can be transmitted by all routes, but some of them can be spread by multiple routes. While some fish pathogens present well-known problems, other diseases are emerging or spreading to previously unaffected areas. Outbreaks can occur quickly and spread rapidly, often resulting in high mortality. It is difficult to predict when a disease might appear, but the routine use of biosecurity measures can reduce the risk of introduction and the economic impact of these diseases. There are various challenges and issues of good biosecurity management with many complex factors that can expose farmed aquatic animals to an increased risk of infection with consequent losses. Many challenges are anthropogenic in origin and may result from poor choice of physical location, poor design of the production facility, as well as inappropriate decisions and practices by incompetent managers after the location is in operation. However, it is complicated and sometimes difficult for farmers to apply certain measures such as maximum population density and maximum biomass allowed, to carry out disease surveillance and regular health checks and

report diseases to the relevant authorities for advice. In addition to the need to improve the control and aquatic animal health legislation, farmer education and the development of biosecurity guidelines for different aquaculture systems (eg. pond, flow through/raceway, cage, recirculation aquaculture system-RAS, and combined systems) are emerging issues for the development and success of aquaculture sector.

Keywords: aquatic animals, guidelines, aquaculture production systems, farmers education, aquatic diseases

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EVALUATION OF THE BIOSECURITY COMPLIANCE IN MEAT TYPE POULTRY PRODUCTION IN POLAND

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Meat-type poultry production in Poland is high and requires the implementation high level of biosecurity, however, compliance can still be not optimal on many farms. Within the framework of the H2020 Netpoulsafe project, a qualitative assessment of biosecurity compliance in meat-type poultry farms in Poland was performed. Ten farmers and fifteen advisors from enclosed broilers and turkeys participated in interviews using a semi-closed questionnaire focused on 38 specific biosecurity measures, evaluating the frequency of implementation of each of them, and identifying reasons for non-compliance. Out of the 38 biosecurity measures, only 12 practices were reported as "always" implemented by 100% of farmers. Advisors, indicated only 4 practices as implemented by 100%. Notably, there were differences in opinions between farmers and advisors regarding certain measures. The "vehicle disinfection before entering the farm" was "always" performed in approximately 40% of farms according to advisors (60% as "sometimes"), when in 90% according to farmers. Similarly, the practice of "specific clothes before entering the house" was reported as "always" followed by 90% and 33% of farms according to farmers and advisors respectively. The "washing of hands before entering the house by personnel" in advisors' and farmers' opinion as "always" implemented was in 20% (67% as "sometimes"), and 70% of farms, respectively. Among the "least 'always' used measures" according to both farmers and advisors was "showering before entering the house" – 'by visitors' (20% and 0% respectively) and 'by personnel' (40% and 0% respectively). The main reasons cited for non-compliance included insufficient training, inadequate advice, time constraints, high costs, and a lack of awareness regarding risks and advantages. Implementing supportive measures such as biosecurity training, educational programs, and guidance from biosecurity advisors could potentially enhance farm compliance by increasing farmers' knowledge and skills.

Keywords: Biosecurity practices, compliance, meat type poultry production, Poland

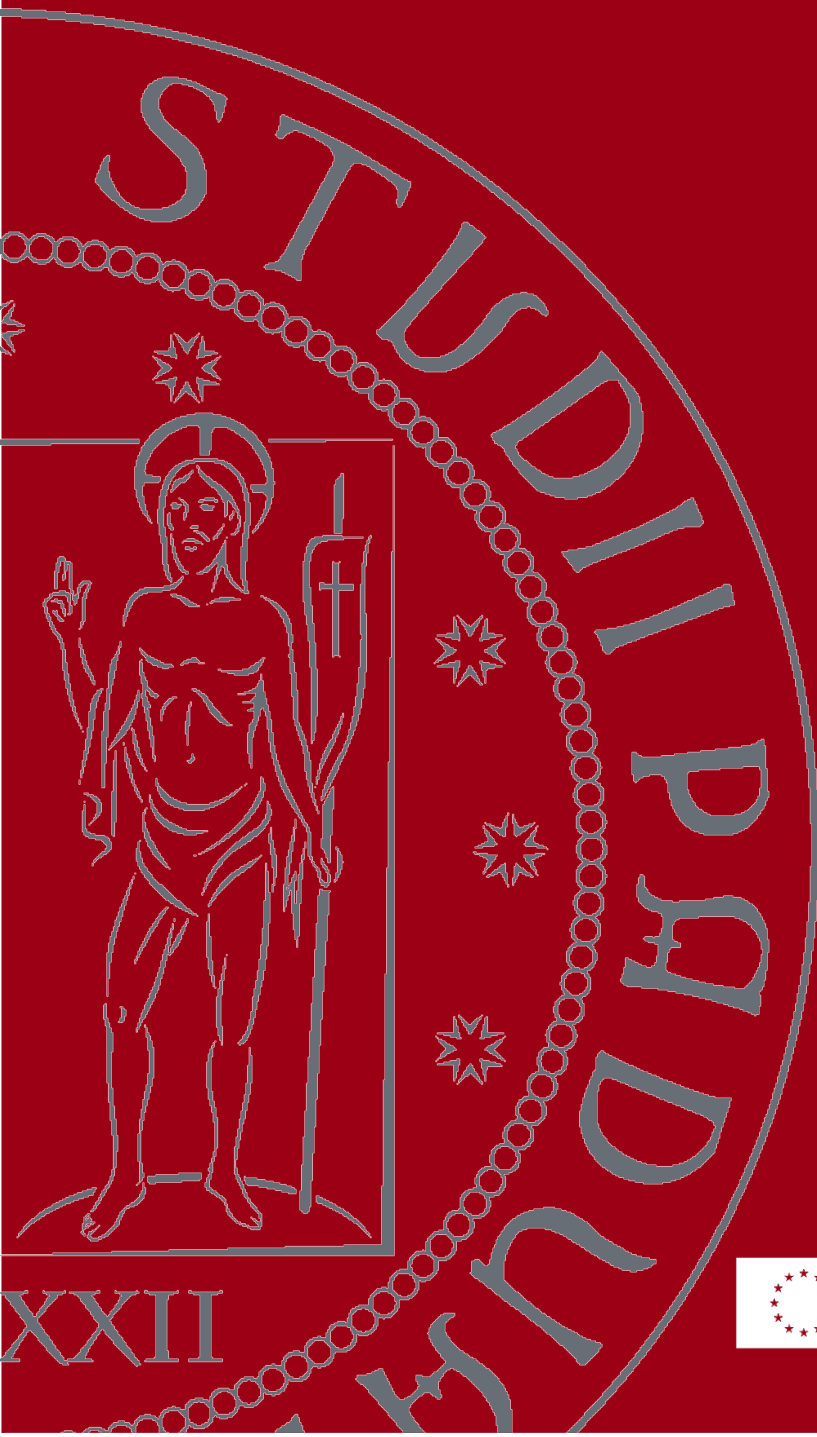
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