PROCEEDINGS

26TH INTERNATIONAL CONGRESS OF THE MEDITERRANEAN FEDERATION FOR HEALTH AND PRODUCTION OF RUMINANTS

FeMeSPRum

Novi Sad (Serbia), 20th – 23rd June, 2024

ZBORNIK RADOVA

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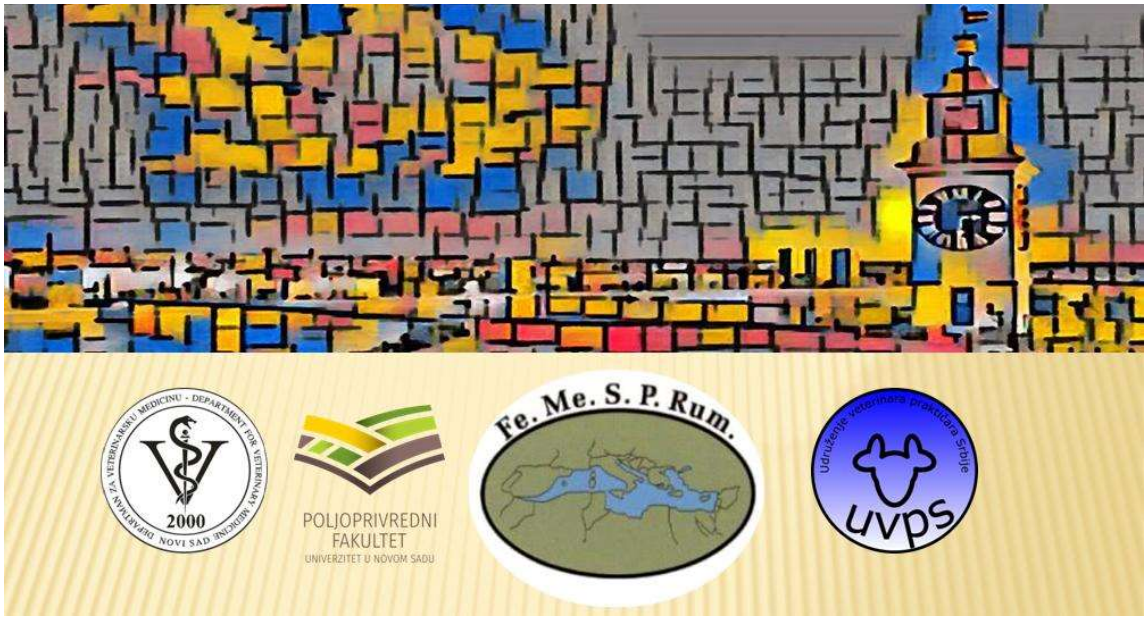

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Dear Participants of the FeMeSPRum Congress,

Welcome to the 26th Congress of the Mediterranean Federation for Health and Production of Ruminants (FeMeSPRum). It is an honor to gather with you esteemed veterinarians and animal scientists dedicated to advancing the health and productivity of ruminants in the Mediterranean region.

This year's Congress is in the beautiful city of Novi Sad, Serbia. Nestled on the banks of the Danube River, Novi Sad is renowned for its vibrant culture, rich history, and stunning architecture. Known as the "Serbian Athens," it is home to the majestic Petrovaradin Fortress, numerous museums, galleries, and the lively Danube Park. As the European Capital of Culture for 2022, Novi Sad offers a perfect blend of tradition and modernity, providing a picturesque and inspiring backdrop for our meeting.

This year's Congress will focus on critical topics that directly impact the health, production, and welfare of the animals we care for. Topics include Biosecurity and heat stress on ruminant farms, Parasite control in ruminants, and Clinical pathology and healthcare of ruminants. These scientific sessions will provide cutting-edge insights and innovative solutions, besides fostering collaboration and the exchange of expertise among leading professionals from the region.

The Mediterranean region has a unique climate, geography, and agricultural practices that present specific challenges and opportunities for ruminant health and production. Advancing the health of domestic ruminants in this region is crucial for ensuring sustainable agriculture, enhancing food security, and supporting the livelihoods of countless farmers and communities. Your work and dedication play a vital role in addressing these challenges and promoting the well-being of domestic ruminant populations.

The Mediterranean Federation for Health and Production of Ruminants (FeMeSPRum) is an organization with immense potential. Its core idea is to serve as a medium for fruitful collaboration among stakeholders in ruminant production. This platform is not only for exchanging information and good practices but also aims to provide a consortium that can cooperate in writing international project proposals and succeed in international project calls. By working together, we can be more innovative and have an impact in our field. With this in mind, I am sure this Congress will boost this idea and strengthen our Federation.

All this would not be possible without the dedicated organizing committee and especially Prof. Dr. Marko Cincović, president of the organizing committee, who have done their best to prepare everything for a smooth congress. Your hard work and dedication are deeply appreciated. Additionally, thank you to all our sponsors, whose generous support has made this event possible.

Your participation and contributions to the Congress are not only crucial to the success of this Congress but also to the existence of the Federation. Together, we will explore new strategies, share best practices, and pave the way for significant advancements in ruminant health and production.

Thank you for being here, and I look forward to a productive and inspiring congress in the charming city of Novi Sad.

With best wishes,

Prof. Dr. Jože Starič
President of the Mediterranean Federation for Health and Production of Ruminants (FeMeSPRum)

Drage koleginice i kolege,

Mediteranska federacija za zdravlje i proizvodnju preživara (FeMeSPRum) je međunarodno udruženje koje okuplja različite profesionalce iz akademske i istraživačke sfere (najčešće veterinare, ali i agronome, inženjere animalne proizvodnje i dr.) koji su posvećeni brizi o preživarama, proučavanju i prevenciji bolesti ovih životinja, kao i povećanju i poboljšaju njihove proizvodnje (meso, mleko, vuna, itd.), dobrobiti i svega onoga što će uticati na dobijanje kvalitetnog i zdravstveno bezbednog proizvoda za krajnjeg potrošača. FeMeSPRum promoviše organizovanje obuka, diskusija, seminara i konvencija, sa definisanom periodičnošću, i podržava sva dešavanja koja doprinose unapređenju ovog sektora i saradnji između zemalja članica, a njeni direktni korisnici su stručna lica iz oblasti veterinarske medicine ali i drugih srodnih oblasti. Kao što mu ime govori, sfera uticaja se proteže na nekoliko zemalja mediteranskog regiona, uključujući Italiju, Španiju, Grčku, Tursku, Sloveniju, Hrvatsku, Siriju, Egipat, Tunis, Maroko. Iako naziv federacije ukazuje na njenu geografsku pripadnost, u eri globalne razmene i unapređenog transfera znanja i pomeranja klimatskih pojaseva, FeMeSPRum je proširio svoje delovanje i na zemlje u okruženju, a posebno značajna zemlja za ovu organizaciju je Srbija. U Srbiji smo 2011.godine imali kongres u Beogradu, a ove 2024.godine kongres se održava u Novom Sadu koji, na naše zadovoljstvo, organizujemo zajedno sa dve partnerske respektabilne ustanove i to su Departman za veterinarsku medicinu Novi Sad i Udruženje veterinara praktičara Srbije.

Dobro došli!

Prof. dr Jože Starič
Predsednik Mediteranske federacije za zdravlje i produkciju preživara (FeMeSPRum)

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DETERMINATION OF NEW BIOSECURITY INDICATORS ON CATTLE AND PIG FARMS BASED ON PUBLISHED STUDIES

UTVRĐIVANJE NOVIH INDIKATORA BIOSIGURNOSNOSTI NA GOVEDARSKIM I SVINJARSKIM FARMAMA NA OSNOVU OBJAVLJENIH STUDIJA

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SUMMARY

In recent years, numerous papers have been published that consider indicators of cattle and pig farms biosecurity with the aim of improving it, and therefore their health and productivity. These indicators were presented in international projects published in indexed journals, as well as proceedings from international symposia. On-farm assessments usability of farm production biosecurity is generally well recognized. In the assessments of the farm biosecurity in different systems of rearing and accommodation, the need to determine new indicators in cattle and pig production was observed and discussed, based on a meta-analysis of previously published studies which include the most important papers in indexed journals and proceedings from international symposia that discussed the existing indicators. The analysis of the results of those studies will be used to determine the main characteristics of the existing new farm biosecurity indicators on cattle and pig farms with a focus on their applicability. The results, discussions and conclusions of those papers will be used to generate ideas to define biosecurity indicators on cattle and pig farms.

Key words: Biosecurity indicators, cattle farms, pig farms, literautre reivew

SAŽETAK

Poslednjih godina objavljeni su brojni radovi koji razmatraju indikatore biosigurnosti na farmi goveda i svinja u cilju njenog poboljšanja, a samim tim i njihovog zdravlja i produktivnosti. Ovi pokazatelji su predstavljeni u međunarodnim projektima objavljenim u indeksiranim časopisima, kao i u zbornicima radova sa međunarodnih simpozijuma. Procene farmske biosigurnosti u okviru proizvodnje je generalno dobro poznata. U procenama biosigurnosti farme u različitim sistemima uzgoja i smeštaja, uočena je i diskutovana potreba za određivanjem novih indikatora u govedarskoj i svinjarskoj proizvodnji, na osnovu ranije objavljenih studija koje obuhvataju najvažnije radove u indeksiranim časopisima i zbornicima radova sa međunarodnih simpozijuma koji su razmatrali postojeće indikatore. Analiza rezultata ovih studija biće korišćena za utvrđivanje glavnih karakteristika postojećih novih indikatora biobezbednosti farme na farmama goveda i svinja sa fokusom na njihovu primenljivost. Rezultati, diskusije i zaključci tih radova biće korišćeni za generisanje ideja za definisanje indikatora biosigurnosti na farmama goveda i svinja.

Ključne reči: indikatori biosigurnosti, farme krava, farme svinja, pregled literature

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INTRODUCTION

Farm-level biosecurity consists of numerous working practices used to prevent minimize or at least control the penetration and spread of pathogens into a farm population, and its shed from the unit that may have an detrimental effect on the economy, environment and human health (1,2), when talking about farm level biosecurity, it should be kept in mind biosecurity plans, Hazard Analysis at Critical Control Points (HACCP), and risk management. Previously mentioned biosecurity plans have to prevention certain negative events (3), by undertaking suggested biosecurity measures at specific points of production process in the right moment (4), but how effective? Measuring success in biosafety and biosecurity activities in laboratories, Dickerson (5) concluded that there is a lack reliable data on the scope of number and types of laboratories, personnel "at risk", activities conducted in labs, the effect of manipulations and technological innovations on biorisks, effectiveness of control measures, operational interventions on biosafety and biosecurity. In addition, there was a lack of standardized performance indicators and metrics, reliance on counting number of incidents to gauge "success", not to mention that there are no data on the impact of human behaviours on the effectiveness of any biorisk management systems, especially on pig and cattle farms. The aim of this paper is to suggest new, more appropriate and more useful biosecurity indicators in order to measure success of biosecurity measures during and after application of biosecurity plans.

DEFINITION OF TERM BIOSECURITY INDICATOR

Generally, an indicator is a focused, clear and specific characteristic which may determine or measure changes or progress of a program for achieving specific outcomes, at least one indicator for each outcome (6,7).

Any of the biosecurity indicators should be precise defined, in clear-cut terms that describe undoubtedly and accurately expected phenomenon, providing both qualitative and quantitative data and offer a simple and consistent approach to observe and evaluate achieved results (8). It is defined by Gudda (9) as CREAM: Clear, Relevant, Economic, Adequate and Monitorable, and also SMART: Specific, Measurable, Achievable, Relevant, and Time-bound (10).

In addition, according their traits, the indicators may be described in Table 1 (11):

Table 1. The biosecurity indicators by traits

Indicator type	Indicator description
Input indicators	Measuring the resources used, the amount of funding, time, or materials
Output indicators	Measuring the direct results of a program or project or set of measures undertaken
Outcome indicators	Measuring the changes or activity impacts results, improvements in health or income
Process indicators	Measuring level of a implemented set of measures, such as the provided services quality, the delivery rightness, or the level of stakeholder engagement
Impact indicators	Long-term, permanent effects of a programme or project can be measured, as specific type of performance indicator
Efficiency indicators	Measuring the cost-effectiveness of a program or project, such as the ratio of resources invested to results achieved
Effectiveness indicators	Measuring the amount to which the set of measures is achieving its objectives
Quality indicators	Measuring the quality of program or project outcome, such as the levels of beneficiaries
Sustainability indicators	Measuring the prospective for undertaken measures, program or project to continue after external maintain has finished

As it is given in table 1, the indicator has to be undoubtedly defined, quantifiable, and feasible within a realistic period, relevant to the objectives (11), so therefore valid (precise measure of a behaviour, practice or assignment that was undertaken), reliable (consistently measurable over time, but not subjective), precise (precisely defined), measurable (that can be proven by available methods), timely (measurable at relevant time intervals), programmatically important (achieving the programme objective), according to Gage and Dunn (12). All of the above says that biosecurity

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indicators survey needs to be performed periodically, in order to obtain more adequate, more reliable and more precise ones.

Basically, there two types of indicator that may be applied in biosecurity level or biorisck level assessment (10,13): quantitative indicators tell if the activities are taking place as it was planned, but do not provide any information on their effect or impact, and qualitative indicators are usually concerned with outcome, providing information on changes caused by the undertaken activities.

Previously stated indicate what is the good indicator of the level of biosecurity or biorisk on a livestock farm; when measuring or assessing achieved biosecurity level in certain moment of time on certain farm, there should be at least one indicator for one trait or outcome or result, which has to be focused, clear and specific, and precisely and unambiguously defined. When analyzing scientific papers and other type of publications, it is clear that farm biosecurity level assessment is based on defined biosecurity components: isolation, traffic control and sanitation (14), or pillars of biosecurity, that is physical protection, personnel management, material control and responsibility, transport and information security (15), more or less same way defined in detail (7).

SUGGESTED POTENTIAL FARM BIOSECURITY LEVEL INDICATORS

The inability to measure the biosecurity and hygiene level of farms precisely has been obstacle for a long time in the pursuit of improvements (7). If farm management should be encouraged to improve the biosecurity or hygiene status of their farm, it is essential for them to recognise and accept quantitative goals and benchmarks, which can be used to describe the farm with respect to its biosecurity level and hygiene status, so that the measures necessary for improvements can be identified and their impact subsequently measured, if possible quantitatively (16).

When analyzing available biosecurity documents and scientific papers, it is clear that an almost identical or very similar point of view of the problem and similar paths of measuring or assessment of biological risk or biosecurity level on livestock farms. Also, it has to be taken into account its complexity, that is whether it is easy to answer with yes or no or more or less; other consist of several parameters, each describing certain part of the issue (7).

In the paper published by Stanković et al. (7), several systems that have been created for inventories of biosecurity measures undertaken were mentioned, mostly developed as checklists or as manuals or as support material for vaccines, such as COMBAT system (Boehringer Ingelheim), helping to identify biosecurity hazards in PRRS infections in pig production. Many of these evaluating systems were developed with a view to controlling a specific disease, Wageningen University checklist developed for the risks factors and introduction and spread of Streptococcus suis in herds (16-18) and PADRAP system designed by the American Association of Swine Veterinarians (19) and Iowa State University (20), that assess the biosecurity protocols for rearing pig herds and identifying PRRSV infection potential risk factors.

The decision-making is a dynamic process, which helps to raise understanding biosecurity as applied concept by collecting and analyzing information, guiding their approach to biosecurity (21). Biosecurity awareness refers to a stakeholder's perception of specific information, government policy and safety principles; this aspect influences the on the whole anticipation and control of animal diseases (22). In the paper of Li at al. (23), stakeholders' understanding of biosecurity refers to their accepting of biosecurity policies, information, and values. As the most of biosecurity behaviours, the farmers' biosecurity consciousness level is the basis for adoption of biosecurity measures (24). Farmers' biosecurity awareness includes their understanding of methods for control of the farm biosecurity circumstances and their common sense responsibility for this. The improvement of farmers' awareness of biosecurity would guide the embodiment of biosecurity behaviours among farmers (25). Based on this, Li at al. (23) proposed the hypothesis that biosecurity awareness can encourage farmers to adopt biosecurity procedures, since knowledge of stakeholders, especially farmers, and their perception of biosecurity should be taken into account (26), analyzing not only biosecurity data, but the attitude of farmers towards biosecurity measures, and a detailed checklist of the biosecurity measures actually practiced on the farm as well. In general, farmers implemented measures to decrease contamination risks from humans and livestock other than pigs, but on the other hand, biosecurity measures related to replacement of animals were not

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applied often. They believe that the most important measures were the sanitary procedures appliance, a fence around the farm, the restriction of visits and vehicles, using bird-proof nets in windows, having changing facilities, applying quarantines, and the use of other measures related to replacement stock. Certain measure perception was significantly influenced by the procedures that are actually practiced on the farm; those who did not have a sanitary barriers insisted on the importance of vehicles disinfection, while those who had one did not. Finally, awareness of the relationships between perceptions and measures taken is important in creating useful pig farms biosecurity strategies. Nöremark et al. (27) investigated does relations exist between biosecurity routines and livestock species, geographic position and farm herd size were analysed. These authors discovered wide range in biosecurity routines application, both within and between groups, where certain farms had rather biosecurity high level. A higher level of biosecurity was related to farms with pigs only, compared to farms with cattle, sheep/goats or mixed species, and at larger farms vs. hobby farms. Noticed inconsistent biosecurity routines were interpreted due to a lack of knowledge of infections transmission; the farmers perceived the risk of introduction of disease as low, e.g. for the use of protective clothing by visiting professionals. More knowledge about the biosecurity routines and they variations among different farms may help to identify types of farms with higher risk for infectious disease introduction, as well as categories of high risk professionals who can spread infections between farms (28,29). Based on these data, there is opportunity to improve on-farm biosecurity, as well as to use of biosecurity routines application success on farms as important biosecurity indicator.

The sanitation and hygiene measures and biosecurity procedures in order to prevent and control infection to address antimicrobial resistance are primarily focused on human population protection, but they are also essential for public health, as they can decrease the emergence and spread of resistant bacteria. In this context, both hygiene and biosecurity procedures can be antimicrobial resistance-sensitive, e.g., improving use of clean water and sanitation facilities or supporting farmers to put into service biosecurity measures. These can be implemented at a system level through standard operative procedures (SOP), lessening risk factors embedded in social structures and address socioeconomic vulnerabilities. Correct use of antibiotics in therapy, antimicrobial resistance, the correctness, timeliness and increased use of sanitation preparations, or presence of persistent infections in farm populations might be used as quality indicator for successful sanitation procedures, especially if related SOP are not clear or followed (7).

According to Wayop et al. (18) antimicrobial resistance is described as a global threat to human and animal health, and therefore, one of the global objectives is antimicrobials use optimization in humans and animals (30). To achieve this, there is necessity to establish controlled approaches to optimize antimicrobial use in different animal production systems. In the Netherlands, for instance, the use of antimicrobials in animals was decreased significantly between 2009 and 2021 by 70.8% after the introduction of various regulations and measures (31), although a wide variation still exists among farmers and veterinarians in their level of antimicrobial use and prescription patterns (31, 32). For that reason, Royal Dutch Veterinary Association developed veterinary clinical practice guidelines. These guidelines are not obligatory, but they are part of a voluntary veterinary quality system, supporting veterinarians in their clinical decision-making, including antimicrobial prescribing practices (33), which offers a possibility for further antimicrobial use reduction, and, of course, it may be connected to the compromised farm biosecurity level.

Certain indicators might be unified for different purposes or types of questionnaires, like all types of farm contacts with contaminant sources, suggested by Brennan et al. (29), who report shortage of knowledge regarding the inter-farms types and frequencies of contact as pathogen transmission routes. These authors explored all types of contact and frequencies between cattle farms in a region, focusing on potential routes of pathogen transmission: sharing of equipment, humans and vehicles movement and contact over/through fences with neighbouring stock, wildlife and even wind (34,35). Information was obtained relating to contact types and frequencies, including those involving animal movements, equipment sharing between farms and any contractors or companies visiting the farms. These findings lead to better understanding of inter-farm contacts and may help to develop appropriate biosecurity and control practices, and to create mathematical modelling of infectious diseases.

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Similarly to the previous, the biomarkers of interest include animal-based measures, as indirect measurements of animal exposure to pathogens' presence and spread. The study of Scollo et al. (36) describes a novel biosecurity risk analysis tool - BEAT, along tailor-made biosecurity protocol and the survailance of biosecurity implementation to identify strong and weak points in pig farms production (37). The method incorporates both input and output parameters in order to assess the risks of introduction, exposure and spread of pathogen in intensive pig production. The output parameters are related to the biomarkers, such as animal-based indicators for continuous monitoring, and to give an early detection of breaches in biosecurity or biocontainment, such as:

Clinical Scores and Mortality, coughs and sneezing, and faeces on a 4-point scale (1 = firm and shaped; 2 = soft and shaped; 3 = loose; 4 = watery),

Slaughter Check, lesion scores on lungs, pleura, pericardium, and liver, as well as skin lesions on ear, tail, anterior and posterior of the carcass, with 3-point scale system (0 - up to one scratch or bite; 1 - from two to five scratches or bites, and score 2 - more than five scratches or bites, or any wound which penetrates the muscle), similar to the Welfare Quality® Protocol (38), and

Antimicrobial Use, method proposed by the EMA (39), in order to measure total antimicrobial use per year.

The final BEAT questionnaire include five sections related to external (entry risks in animal population) and internal (spread of pathogen between and in animal husbandry departments) biosecurity: the red zone (i.e., outside the farm perimeter, the public zone), the orange zone (the professional zone in-between the pigs' facilities), the green zone (the pigs' barns, the herd zone), and the two crossing points between external/professional zones (red/orange) and professional/internal zones (orange/green). Biosecurity and environmental sustainability were rated on a 4-point scale: a score of 0 was assigned to farms with completely inadequate biosecurity or sustainability practices, and a score of 3 was assigned to those with completely adequate biosecurity or sustainable practices (40). Therefore, biomarkers may bring important conclusions about level of farm biosecurity.

In addition, Chantziaras et al. (41) identified specific factors related to the environment, and discussed their relationship with health, welfare and reproductive performance in sows and piglets in different rearing systems, by: a) a questionnaire for farm management, interventions and housing, and b) farm production data related to the assorted performance parameters, such as litter index, replacement rate, repeat breeding, weaning to first mating interval and litter/piglet health performance: piglets born alive per litter, piglets born dead per litter, preweaning mortality rate and weaned piglets per litter. These factors are important for management and housing with significant effect on sow and piglet performances.

The Biocheck.UGent™ biosecurity risk-based scoring system for on-farm biosecurity quantification was developed at Ghent University for use in pig, poultry, beef and veal farms (42). It has general approach to biosecurity, focusing on paths of transmission of many types of transmissible diseases. Questionnaires for pig production include 109 (pig) mainly di- or trichotomous questions in several subcategories (2 to 19 questions each) for internal and external biosecurity, and weight factor for each subcategory and question, and the total score for internal and external biosecurity, ranged from 0 to 100 points (43-45).

Similar to mentioned Biocheck.UGent™, in 2011, the Ministry of Agriculture, Water Management and the Forestry of the Republic of Serbia financed the development of Guidances of Biosecurity Standards on cattle, pig and poultry farms (46-48), and the Questionary for farm biosecurity assessment within, related to numerous indicators, which was developed in Technological Research project 20110 "Welfare and Biosecurity Standards Development and Implementation in Improvement of Dairy and Pork Production" (2008-2011), and suported by Ministry of Science and Technology Development of Republic of Serbia (49). Each indicator with different numbers of parameters within, is rated from grade 0 to 5: Insufficient, without the potential to improve the biosecurity in the foreseeable future – 0; Insufficient, with the potential to improve the biosecurity in the foreseeable future – 1; Sufficient – 2; Good – 3; Very good – 4 and Excellent – 5, and summarized. In addition, a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) takes place to get detailed impression of the possibilities for reducing the negative and improving the positive aspects of biosecurity on farms and completing the final audit. All of the 15 indicators have to be analyzed in order to find threats to biosecurity on the farm and overcome the

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disadvantages, risks that may hinder or prevent the overcoming disadvantages. The farm is then graded according to a rating scale: Group V 0-1.99 insufficient, Group IV 2.00-2.49 sufficient, Group III 2.5-3.49 good, Group II 3.5 - 4.49 very good and group 4.5 - 5.00 excellent. The indicators which are used are: 1. planning and monitoring the implementation of biosecurity measures, 2. farm isolation, 3. quarantine, 4. health status of the farm population, 5. movement and traffic control, 6. attitude towards visitors, 7. nutrition and water supply control, 8. manure management, 9. removal of dead animals, 10. Presence of other species of animals on the farm, 11. rodent population control, 12. Insect population control, 13. Bird control, 14. Sanitation, and 15. Farm's attitude towards the environment.

Comparing to Biocheck Pigs questionnaire, part A. farm characteristics, in Hristov & Stanković questionnaire (49,50), the size of the farm and categories of pigs are taken into account through different indicators, but the employment structure and size, their experience in keeping pigs, and the age of the facilities were not taken into account (7). In Hristov & Stanković questionnaire (50) "stand down" period was investigated, comparing to "pig-free period (more than 12 hours)" in Biocheck Pigs; part E. vermin and bird control are similar to indicators 11. Rodents control, 12. Insects control, and 13. Birds control; indicator 2. Farm isolation of presented questionnaire is similar to the part F. location of the farm of the Biocheck Pigs; differences are related to the wild boars presence; The indicator 4. Heard health status of the farm population is similar to the part G. Disease management of Biocheck Pigs. On the other hand, Biocheck Pigs parts H. Farrowing and suckling period and I. nursery unit and J. Finishing unit give more detail information regarding to this issue than in the presented questionnaire, which is covered by mentioned indicator; part K. measures between compartments, working lines and use of equipment of Biocheck Pigs is covered by different indicators of presented questionnaire (51).

The possibility to isolate farm or production unit and prevent physical breakthrough of vectors as indicator is often limited on perimeter and gate under control and should be supplemented with additional parameters. Hristov & Stanković (50) suggested that location of the premise in respect to and required distance from risk sources is necessary, as well as separation of clean and dirty routes for movement and supply on the farm, knowledge of dominant winds directions, and protective 'green' belt of trees and shrubs which surrounds the premises. Torremorell (52) pointed out that term 'bioexclusion', is required to prevent pathogen movement across protection zones, in order to eliminate or diminish the number of disease-causing organisms within the animal's environment.

According to Gröndal et al. (53), different perspectives on biosecurity can prevent or reduce misunderstandings between pig farmers and veterinarians. The study identified differences between the veterinarians and farmers and their perception of the biosecurity in Swedish pig herds. Taking into account mentioned differences and similarities of the different perspectives can help to improve communication and cooperation regarding biosecurity issues.

When assessing farm biosecurity, besides well chosen and designed indicators, a systematically created questionnaire is no less important. The questions should be related and, if necessary, partially intersect, which gives a clear and detailed picture of the situation on the farm. It is very demanding to create modular and systematic questionnaire which would give precise description of biosecurity level of particular farm, but when achieved, mentioned traits enables adjustment and increased usability of such questionnaire (7).

CONCLUSION

Presented data of available scientific papers indicate traits of the good farm biosecurity indicator. It is very complex issue, with high similarities of point of view of the problem and therefore there are similarities in measuring or assessment of biological risk or biosecurity level on livestock farms.

Some of them are simple, easy to answer with yes or no or more or less; other ones are complex, with several parameters within.

Generally, when measuring or assessing achieved biosecurity level in certain moment of time on certain farm, there should be obtained at least one indicator for one trait or outcome or result, focused, clear and specific, and precisely and unambiguously defined.

Survey of biosecurity indicators is complex and has to be performed periodically, in order to obtain more adequate, more reliable and more precise ones.

When assessing farm biosecurity, well chosen and designed indicators are required and placed in

systematically created questionnaire. The questions should lean on each other and, if necessary partially overlap, and may give a clear and detailed picture of the situation on the farm. Modular and systematic questionnaire enables better adjustment and increased usability.

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