Proceedings of the 13th International Symposium
Modern Trends in Livestock Production
October 6 – 8, 2021, Belgrade, Serbia

ASSESSMENT OF BIOSECURITY AND WELFARE OF CALVES REARED IN INTENSIVE HOUSING SYSTEM

Ljiljana Samolovac[1], Slavča Hristov[2], Dušica Ostojić Andrić[1], Vlada Pantelić[1], Dragan Nikšić[1], Dragan Stanojević[2], Tamara Stamenić[2]

[1] Institute for animal husbandry, Belgrade, Serbia
[2] University of Belgrade, Faculty of agriculture, Belgrade-Zemun
Corresponding author: Ljiljana Samolovac, ljiljanasamolovac@gmail.com
Invited paper

Abstract: The quality of farm animal welfare largely depends on a number of measures and procedures carried out on farms, which are defined by one name as biosecurity. The application of certain management practices differs from farm to farm, and accordingly their impact on the quality of animal welfare differs. The quality of biosecurity, welfare and the presence of factors that threaten them depend on the technology of production on the farm, animal husbandry systems, microclimatic and hygienic conditions, management, procedures performed on animals and the way they are performed, the attitude of employees towards animals, their training and competence, etc.The aim of this study was to determine the impact of intensive calf rearing on differences in biosecurity and welfare quality assessment on two dairy farms. The technological process of production on both farms is similar, since both farms operate within the same production system. On both farms, there is a nursery in a separate facility, but without individual calving boxes. Calves are separated from their mothers immediately after birth. One of the significant differences between the farms was the way the calves were kept in the first 7 days of life. On one of the farms (A) the calves were kept tied in the nursery, while on the other farm (B) they were housed in individual boxes, also located within the nursery. At 8 days of age, calves were placed in group boxes, in a special facility, rearing stable.
The greatest weaknesses and threats to biosecurity and welfare on both farms were manifested at the earliest age of calves, and they relate to the accommodation and feeding of newborn calves with colostrum. Determined that newborn calves were kept tie-stall housing system or in dimly lit individual boxes of inadequate size and design, housed in the nursery together with the cows. This increased the calf's exposure to a number of pathogens. The risk to biosecurity and welfare is higher when inadequate colostrum consumption is taken into account in terms of quantity, manner and time of feeding. When it comes to calves of older categories, the situation was significantly more favourable in terms of nutrition and housing

conditions, as well as health surveillance and provided great opportunities in terms of further improvement.

Key words: biosecurity, welfare, risk factors, intensive production system

Introduction

The precondition for achieving high quality of farm animal welfare is the implementation of certain, precisely determined, measures that are defined as biosecurity. The most common biosecurity measures are a system of management practices used to protect animals from pathogenic agents and to prevent the spread of harmful agents from the farm to the environment. (*Linch, 2012; Damiaans et al., 2018*). Biosecurity can be divided into external and internal. External biosecurity refers to measures aimed at preventing the introduction of the disease into the herd (keeping the animal in quarantine, the principle of "all in – all out", control of the movement of visitors, disinfection barrier). Internal biosecurity is a set of measures taken to prevent the spread of disease within the herd (separation of different categories of animals, isolation of sick animals, control of the movements of the staff, control of the presence of birds, rodents and other animals on the farm, safe removal of corpses, etc.). The result of consistent implementation of the mentioned measures is a high quality of welfare of farm animals.

The definition of animal welfare most often refers to the general condition of individuals (*Huges et al., 1976; Broom et al., 1986*) observed in a particular environment. This means that animals (in this case calves) should be in an environment that will meet their basic needs in a satisfactory way: nutrition, housing, expression of physiological behaviors, interaction with individuals of the same species, absence of pain, injury and negative emotions, etc. (*Rollin et al., 1993*). The quality of welfare of calves in intensive agricultural production systems depends on a number of factors with different significance and intensity of impact, and one of the most important is biosecurity.

Given the pronounced interrelationship between biosecurity and welfare, it is clear that the presence of certain shortcomings, so-called risk factors, has negative impact on their quality. The quality of biosecurity, welfare and the presence of factors that endanger them depend on the technology of production on the farm, animal husbandry systems, microclimatic and hygienic conditions, management, procedures performed on animals and the way they are performed, the attitude of employees towards animals and their training and competence, etc. Different methods of production imply different degrees of biosecurity, and thus different

quality of welfare, because the specifics of each farm depend on risk factors that threaten biosecurity and welfare.
Numerous authors have addressed biosecurity issues from a variety of perspectives (*Beggs et al., 2015; Renaud et al., 2018; Emanuelson et al., 2018; Stanković et al., 2011 and 2014; Dammianis et al., 2019 and 2020; Robichaud et al., 2019; Boersema et al., 2013; Shortatall, 2017; Ježek et al., 2019; Winder et al., 2016; Richens et al., 2018; Stanković and Hristov, 2009; Ferit Can, 2018; Anderson, 1998; Nitovski et al., 2013; Pedersen et al., 2009; Bojkovski et al., 2012)* and welfare (*Hristov et al., 2011 and 2012; Samolovac et al., 2019 and 2020; Relić et al., 2014; Vasseur et al., 2009 and 2010; Weawer et al., 2000; Osaka et al. 2014; Hristov et al., 2015; Vasseur et al., 2010; Kieland et al., 2010; Gottardo et al., 2011; Wikman et al., 2013; Winder et al., 2016; Gottardo et al., 2011; Ostojić-Andrić et al., 2015; Relić and Bojkovski, 2010; Bojkovski et al., 2012; Stanković et al., 2011; de Vries et al., 2013; Lundvall and Saras- Johansson, 2011; Schütz et al., 2012; Burton et al., 2012; Elingsen et al., 2014; Winder et al., 2016;Robichaud et al., 2019).*
The basis for the study of the welfare of calves in the intensive housing system were two hypotheses: the first - biosecurity measures, welfare quality and risk factors on farms are interrelated and intertwined, and differ on individual farms, depending on the applied production technology and housing system, and the second - in different housing systems, there are different threats and weaknesses that affect the quality of biosecurity and welfare.
The aim of this study was to determine the impact of intensive calf rearing on differences in biosecurity and welfare quality assessment on two farms.

Material and Method

Assessment of biosecurity, risk factors and welfare of calves up to 30 days of age was performed on 2 dairy farms with intensive rearing. The technological process of production on both farms was similar, since both farms operated within the same production system. Both farms had a nursery in a separate facility, but without individual calving boxes. Calves were separated from their mothers immediately after birth. One of the significant differences between the farms was the way the calves were kept in the first 7 days of life. On one of the farms (A) the calves were kept tied in the nursery, while on the other farm (B) they were housed in individual boxes, also located within the nursery. At the age of 8 days, calves were placed in group boxes, in a special facility, rearing stable.
The assessment of biosecurity and risk factors was performed on the basis of data collected by the method of a structured questionnaire derived from the Project

"Development and implementation of welfare and biosecurity standards in order to improve the technology of cattle and pig production". Good and bad characteristics, threats and opportunities on farms, based on the data from the questionnaire were determined by SWOT analysis (analysis of strengths, weaknesses, opportunities and threats of the farm as a production unit) which included: biosecurity plan, isolation, health status, movement and traffic control, attitude towards other persons, control of nutrition and water supply, removal of dead calves, presence of other animal species on the farm, control of rodent populations, control of insect population, control of bird population, sanitation and farm attitude towards the environment (*Anon, 2011*).

The Welfare Quality® Assessment Protocol (*WQAP, 2009*), a scientific method for assessing the welfare of farm animals, was used to assess the welfare of the animals. The overall assessment of welfare protection on farms A and B was obtained on the basis of assessment of welfare criteria, which included a number of indicators: assessment of planning, organization and implementation of welfare protection, assessment of the staff regarding welfare protection, competencies of the staff regarding welfare protection, breeders' attitude towards animal needs, assessment of monitoring and inspection of animals and equipment, animal treatment; nutrition and watering of animals, housing conditions, microclimatic conditions, hygienic conditions in the facility, hygiene and care of the animal's body; reproduction, productivity, behaviour and health.

Risk factors for the welfare of calves on farms A and B were divided into 3 groups, namely: risk factors related to nutrition, housing conditions and management, i.e. production technology on the farm. According to the strength and character of the impact, they were classified from low to very strong (low, moderate, medium strong, strong and very strong impact). Exposure of calves to the impact was defined as: rare, very rare, moderate and very common. Based on the characterization and duration of action, and according to EFSA methodologies from 2006 and 2009, risk factors were classified into four categories: high, low, negligible and risk-free.

Results and Discussion

The obtained overall estimates for biosecurity on the observed farms are shown in the following table (Table 1).

Table 1. Assessment of biosecurity indicators on farms A and B

Indicators	Score	
	Farm A	Farm B
Biosafety plan	1.67	1.67
Insulation	2.67	2.67
Health status	3.40	3.60
Movement and traffic control	2.75	3.00
Relation to other persons	2.37	2.37
Nutrition and water supply control	3.50	3.50
Removal of dead calves	2.80	2.80
The presence of other species of animals on the farm	1.00	1.00
Rodent population control	2.80	2.80
Insect population control	2.00	2.00
Bird population control	1.33	1.33
Sanitation	2.92	2.92
The relation of the farm and environment	3.50	3.50
Average rating	**2.52**	**2.55**

The SWOT analysis shows that the most pronounced weaknesses on both farms are the lack of implementation of defined procedures related to biosecurity plans, control of visitor movements and control of the population of insects, rodents, birds and other animals. In contrast, the strongest points are the controlled quality of water (city water supply) and food (regular laboratory analyzes); health status on farms under the permanent supervision of the veterinary service and the socially responsible relation of the farm towards the environment. However, in these segments there is a need for further improvement. Great opportunities for improving the existing situation are provided in the field of isolation of the farm, increasing the control of the movement of visitors and workers, removal of corpses and sanitation, in order to prevent the occurrence and spread of infectious diseases. The total welfare assessment on farms A and B based on the indicator assessment is shown in the following table (Table 2).

Table 2. Assessment of welfare indicators on farms A and B

Inidicators	Score	
	Farm A	**Farm B**
Assessment of welfare plans, organization and implementation	1.00 - 1	1.00- 1
Assessment of staff regarding welfare	2.75 - 3	3.00- 3
Competences of staff regarding welfare protection	2.78 - 3	3.22 - 3
The relation of breeders towards needs of animals	2.67 - 3	3.00 - 3
Assessment of monitoring and inspection of animals and equipment	4.62 - 5	4.62 - 5
Treatment of animals	2.67 - 3	2.67 - 3
Nutrition and watering of animals	3.73 - 4	3.73 - 4
Housing conditions	2.70 - 3	3.00- 3
Microclimatic conditions	2.25 - 2	2.12 - 2
Hygienic conditions in the facility	2.67 - 3	2.55 - 3
Hygiene and body care of animals	3.00 - 3	3.00 - 3
Reproduction	3.00 - 3	3.00 - 3
Productivity	3.33 - 3	3.22 - 3
Behaviour	3.45 - 4	3.18 - 3
Health condition	3.33 - 3	3.33 - 3
Average rating	**2.93 - 3**	**2.98 - 3**

Given that the quality of welfare directly depends on the degree of implementation of defined biosecurity measures, it is not surprising that the obtained results of the assessment of welfare indicators on the observed farms are in accordance with the assessment of biosecurity measures. The most favourable situation was in terms of monitoring of animals and equipment thanks to the daily multi-hour presence of staff in the facilities, and in terms of food and water quality due to regular laboratory analyzes. The greatest weakness was manifested in the plans and implementation of welfare protection (lack of procedures, lack of clearly written instructions, lack of organized training of workers) and in terms of microclimatic conditions which were very often unfavourable (high temperature, high humidity). The analysis of the largest number of observed indicators related to the quality of welfare indicates the fact that there are great opportunities for their improvement.

Risk factors that negatively affected biosecurity and quality of welfare differed in part depending on the farm and category of calves, because they showed different intensity and duration of action, and are shown in the following table (Table 3).

Table 3. Assessment of risk factors on farms A and B (age categories are given in brackets)

Risk category	Farm A	Farm B
High	Calves tied to the bed (0-7) Colostrum amount (0-7) Insufficient water supply (0-7) Continuous arriving of animals to the facilities and departing (0-7) Allergens, hemoglobin, Fe not controlled (0-30)	Insufficient floor area (0-30) Insufficient light (0-7) Insufficient water supply (0-7) Continuous arriving of animals to the facilities and departing (0-30) Allergens, hemoglobin, Fe not controlled (0-30)
Low	Colostrum quality (0-7) Lack of maternal care (0-7) Insufficient light (0-30) Exposure to pathogenic agents (0-7)	Colostrum quality and consumption time (0-7) Lack of maternal care (0-7)
Negligible	Colostrum consumption time (0-7) Microclimatic conditions (0-7) Exposure to pathogens (8-30) Disinfection without analgesia (8-30)	Colostrum quantity (0-7) Microclimatic conditions (8-30) Light (8-30) Exposure to pathogens (8-30) Surface, floor quality and bedding hygiene (8-30)
Risk-free	Nutrition and water supply (8-30) Microclimatic conditions (8-30) Floor area and quality (8-30) Bedding hygiene (8-30) Mixing animals from different sources (0-30) Health monitoring (0-30)	Nutrition and water supply (8-30) Microclimatic conditions (8-30) Mixing animals from different sources (0-30) Health monitoring (0-30) No dehorning (0-30)

It is obvious that the greatest weaknesses and threats to biosecurity and welfare on both farms were manifested at the earliest age of calves. According to the SWOT analysis, the biggest weaknesses are the housing and feeding of newborn calves with colostrum. It is absolutely unacceptable to keep newborn calves tied to beds or in dimly lit individual boxes of inadequate size and design. Housing of calves in the nursery together with cows increases their exposure to numerous pathogenic agents. The risk to biosecurity and welfare is higher when inadequate colostrum consumption is taken into account in terms of quantity, manner and time of feeding. When it comes to calves of older categories, the situation is significantly more favourable in terms of nutrition and housing conditions, as well as health monitoring and provides great opportunities in terms of further improvement.

The improvement of biosecurity measures has been implemented continuously for many years, but there are still some dilemmas and doubts. There are still significant differences of opinion between veterinarians and animal breeders regarding the importance of implementing biosecurity measures and procedures, as stated by *Boersema et al. (2013), Shortatall (2017),* but breeders themselves attach

insufficient importance to certain measures that should be implemented in order to protect biosecurity on their own farms (*Ježek et al., 2019; Winder et al., 2016; Richens et al., 2018*). The overall assessment of the implemented biosecurity measures on the observed farms was similar for both farms and very close to the average. Low overall biosecurity scores on farms were recorded by *Dammians et al. (2020),* 48.6 out of 100 index points in the questionnaire, and *Stanković and Hristov (2009),* report the following results on two farms: 3.81 and 2.31. Different production systems imply different degrees of biosecurity on farms, and thus the quality of animal welfare, but it cannot be a priori claimed that one system is better than the other. This is indicated by a series of researches. According to *Beggs et al. (2015),* the size of the herd is to some extent a limiting factor in terms of biosecurity and welfare because it implies a higher population density, more difficult organization of storage and distribution of food, easier spread of the disease. However, larger farms hire workers with a higher level of education, conduct better veterinary supervision, have better records of activities, which is in line with the results obtained in our research. Also, *Renaud et al. (2018),* have determined that the farms with the lowest risk were those with veterinary supervision in the nursery every 3 hours. In Sweden, organic farms were compared with farms with conventional production methods. In the first system, antibiotics were less used, which is according to the standards and market demand when it comes to organic production. However, veterinarians are often to late for animal treatment, which had a bad impact on biosecurity and animal welfare *(Emanuelson et al., 2018*). *Stanković et al. (2014),* also state the more frequent occurrence of infectious diseases in the tie system. There was no established plan for the implementation of biosecurity measures on the observed farms and no training was provided to staff in that regard. The health condition of the herd was regularly monitored by the veterinary service, so that the treatment of the animals was performed regularly and on time, as soon as the occurence of a disease was noticed. The basic principles of farm construction and site selection were also respected. Namely, the facilities for housing animals were at the proper distance from the main road. The principle that was not respected was that the facilities inside the farm were insufficiently isolated from each other and insufficiently protected from the presence of other animals, birds, rodents and insects, although disinsection and deratization were carried out regularly. These characteristics are similar to the data provided by *Stanković et al. (2011)*. A large number of diseased animals, in addition to constant veterinary supervision, indicate a serious danger and biosecurity risk. The biosecurity risk was represented by the movement of staff on the farm between different facilities, the absence of clearly stated instructions that regulate the movement, etc. The visitors did not undergo a more detailed check related to their recent activities and contacts with the animals, although they

received protective clothing and footwear, and hand disinfection was mandatory. Also, there were disinfection barriers at the entrance to each facility, but they were not always operational. In the case of the dead calves, the corpses were usually, but not always, removed in a very short time, and after that the location was sanitized. The facilities were mechanically cleaned daily, and detailed washing and disinfection were performed after emptying the box or the entire facility. Similar problems in biosecurity protection were observed by *Dammianis et al. (2019)* and *Robichaud et al. (2019)*, and relate to poor isolation of sick animals, mixing of animals from different sources without quarantine, non-existent or non-functional disinfection barriers on the farm, cleaning and disinfection of facilities that are not performed after each production cycle, poor hygiene of facilities and animals, lack of protective wardrobe for employees, movement of visitors, etc. The observed farms did not respect the principle of "all in – all out", which often appears as a problem on farms (*Damiaans et al., 2019; Pedersen et al., 2009; Bojkovski et al., 2012).*

According to *Ferit Can (2018)*, the main difficulties in implementing a biosecurity plan on farms are: educational level, sociological and cultural characteristics (habits, tradition), costs and finances (profit should be greater than investment), farm size, geographical and climatic conditions, epidemiological situation and regulations. There are a number of suggestions for better biosecurity on farms. Some of them relate to the use of vaccines in order to prevent the occurrence of infectious diseases, as well as construction solutions that will contribute to better microclimatic conditions, the use of individual calving boxes, the use of individual "small houses" for calves (*Anderson, 1998*), keeping a closed herd, better veterinary supervision, adoption of a plan for the implementation of biosecurity measures (*Nitovski et al., 2013; Shortall et al., 2017*), control of the movement of staff and visitors, control of the population of rodents, birds and insects, prevention of contact with other animals *(Stanković et al., 2011.*). Considering the location and quality of facilities, there is a basis for improving all biosecurity measures on the observed farms such as: isolation of facilities on the farm, disinfection, disinsection and rodent and pest control, prevention of other animals and birds in facilities, control of movement of staff and visitors, improvement of microclimatic conditions, improvement of the hygiene of facilities and animals, strict respect for the principle of "all in-all out", education and training of staff on various bases (biosecurity measures, treatment of animals, technological procedures, etc.). The established practice of daily supervision of animals, equipment and production technology by highly professional and competent staff, chemical analysis of food and responsible behaviour towards the environment should be continued and improved over time. The application of these measures would greatly contribute to the general welfare of animals.

Like in the case of biosecurity, there was no established welfare protection plan on the observed farms nor were workers referred to any training in the area. They relied more on experience in day-to-day work or instructions from immediate supervisors. There was often a shortage of manpower, so workers were forced to move from one facility to another. Staff in charge of nutrition, treatment, implementation of technological procedures and organization of work on farms had adequate higher and higher education. Special training was attended by staff who had specific responsibilities such as hoof treatment, but not those who were in charge of feeding calves with colostrum. It was the colostrum diet that was the most sensitive part. The quality of colostrum is controlled only organoleptically, which is one of the most significant welfare problems in calves, as reported by *Hristov et al. (2011)* agree. Also, the level of iron and the presence of allergens in food have not been controlled. The amount of colostrum consumed, especially on farm A, and the method of administration (from a bucket) were not adequate for the age and consumption of calves, so colostrum intake was insufficient, and consequently the creation of passive immunity was highly debatable. The technology of feeding calves with colostrum of undetermined quality from buckets at will does not give good results in terms of acquiring passive immunity (*Samolovac et al., 2020; Relić et al., 2014; Vasseur et al., 2009 and 2010,). Weawer et al. (2000)* recommended an intake of 4 l of colostrum to reduce the risk of calf death, and *Osaka et al. (2014)* recommend 3.6 l. However, different results have been reported in practice. As stated by *Relić et al. (2014),* the intake of the first quantities of colostrum in calves on three farms with intensive rearing conditions was less than 1 l. One of the biggest threats to the quality of welfare was the limited movement of animals, i.e. calves tied to the bed or housing them in individual boxes of inadequate surface, which does not allow to fully realize some physiological behaviours such as explorative and maternal behaviour, less social contacts. (*Hristov et al., 2015*). There are rare cases in the world where calves are kept in individual "boxes" or tied (*Vasseur et al., 2010*).

According to a number of researchers *(Kieland et al., 2010; Gottardo et al., 2011; Wikman et al., 2013),* workers are generally aware that animals feel pain, fear, and express certain emotions. However, interventions such as dehorning or animal identification were performed without the use of local anesthetics, which is, unfortunately, a common practice on a large number of farms, as noticed by the results of research by *Winder et al. (2016), Gottardo et al. (2011).* Positive relation towards animals should be one of the goals of improving the quality of welfare in order to make sure that “animals have a life worth living” (*Hristov et al. 2012*). In the conducted research, the treatment of animals was very often rough, impatient, noisy, with the exception of milking. Microclimatic conditions on farms A and B were often unfavourable during the cold and warm periods of the year.

Temperatures exceeded 30^0 C in summer, while humidity was high in the buildings during the entire observation period. According to *Samolovac et al. (2019)*, unfavorable microclimatic conditions affect the increased morbidity and mortality of calves. The hygiene of animals and facilities can and must be much better, especially when it comes to nursery and calf breeding. Poor housing conditions represent one of the biggest threats to the quality of welfare (*Ostojić-Andrić et al., 2015*). During the examination, there was no protocol or plan related to the protection of the animal welfare on the farms, nor the training for staff in order to implement the protection of the quality of welfare. The overall welfare assessment of calves on the examined farms A and B was similar to the evaluations obtained in the research of *Vasseur et al. (2010), Relić and Bojkovski (2010), Hristov et al. (2011), Bojkovski et al. (2012), Stanković et al. (2011)*, and better than the estimates given by *de Vries et al. (2013)* on a larger number of herds. However, this situation provides only a solid basis for further improvement of the quality of welfare with existing production technology. First of all, the staff should be trained in terms of the importance of all aspects of animal welfare and biosecurity on farms, and certain written procedures and protocols should be adopted accordingly. The results of numerous researches show that the relations of breeders towards animals depend on their personal attitude, ethical principles, cultural and socio-demographic conditions, levels of education, etc. (*Ferit Can, 2018; Lundvall and Saras-Johansson, 2011; Schütz et al., 2012*). The way humans behave towards animals should be one of the goals of improving welfare as a whole, and not a characteristic of an individual or a small group of people, as stated by *Burton et al. (2012)* and *Elingsen et al. (2014)*. Raising the awareness of breeders about the importance of respecting the principle of welfare would also improve their treatment of animals, care for hygienic conditions in facilities and hygiene of animal. To improve housing and microclimatic conditions, it is necessary to change the technology of keeping and equipment in stables in terms of changing the way calves are kept (calves should be placed in boxes of appropriate size, with a quality surface and clean and dry bedding, outside the nursery), improving hygiene levels, by providing quality ventilation in facilities, providing outlets for the movement of calves and staying outside the stables, which would positively affect the overall health, behaviour of animals, or reduce the risks of compromising overall biosecurity and welfare in the herd, as stated by *Winder et al. (2016)* and *Robichaud et al. (2019).*

Based on the risk assessment on farms A and B, some recommendations can be made that would reduce the risk and improve the overall welfare of the calves. As already mentioned, it is necessary to adopt a clear and precise plan for the implementation of biosecurity measures and improvement of the quality of welfare on farms, the implementation of which would be familiar to all employees

(*Nitovski et al., 2013; Shortall et al., 2017*). Newborn calves should be placed in clean, disinfected individual boxes with adequate nutrition and water supply, especially in the part related to colostrum nutrition. In that sense, an alternative way of feeding, graduated bottles, buckets with artificial breast or esophageal probe can be introduced, and the quality of colostrum can be controlled by laboratory analyzes, at least occasionally by the method of random sampling. The same control principle can be introduced for the level of hemoglobin in the blood of calves, as well as the content of iron and allergens in food. Make microclimatic and hygienic conditions optimal or at least strive for it, and maintain good practice of constant control and supervision of the situation on farms by professional staff.

Conclusion

Based on the presented results on two farms with intensive production, it can be concluded that:

- Preservation of biosecurity on farms depends to a large extent on the applied production technology and rearing system
- Deficiencies in the implementation of all biosecurity procedures and measures jeopardize the quality of animal welfare, calves in this case, because biosecuritty and welfare are inextricably linked and interdependent
- Protocols on biosecurity and welfare protection were not adopted on the observed farms
- The greatest threat to biosecurity and welfare was found to be the conditions of feeding and housing calves in the first seven days of life
- Accordingly, the biggest changes in order to improve conditions relate to the introduction of procedures for the protection of biosecurity and welfare; introduction of individual housing for newborn calves outside the nursery; supply of high-quality colostrum from graduated bottles (for this purpose a colostrum bank should be formed, “milktaxi” should be put into use)
- Regularly train staff in the field of animal welfare and implementation of biosecurity measures
- Strengthen control over the movement of staff and visitors within the farm
- Regularly disinfect, disinsect and deratize farms

- Continuously work on improving accommodation, microclimatic and hygienic conditions in calf housing facilities
- Continue with daily zootechnical and veterinary supervision of animals and equipment

Procena biosigurnosti i dobrobiti teladi u intenzivnom sistemu držanja

Ljiljana Samolovac, Slavča Hristov, Dušica Ostojić-Andrić, Vlada Pantelić, Dragan Nikšić, Dragan Stanojević, Tamara Stanojević

Rezime

Kvalitet dobrobiti farmskih životinja u velikoj meri zavisi od niza mera i postupaka koji se sprovode na farmama a koje se jednim imenom definišu kao biosigurnost. Primena određenih upravljačkih praksi se razlikuje od farme do farme, pa shodno tome se razlikuje njihov uticaj na kvalitet dobrobiti životinja. Kvalitet biosigurnosti, dobrobiti i prisustvo faktora koji ih ugrožavaju zavise od tehnologije proizvodnje na farmi, sistema držanja životinja, mikroklimatskih i higijenskih uslova, menadžmenta, postupaka koji se sprovode na životinjama i načina na koji se sprovode, odnosa zaposlenih prema životinjama, njihovoj obučenosti i kompetentnosti itd. Cilj rada je bio da se utvrdi uticaj intenzivnog načina gajenja teladi na razlike u proceni biosigurnosti i kvaliteta dobrobiti na dve farme mlečnih krava sa intenzivnim načinom držanja. Tehnološki proces proizvodnje na obe farme je sličan, obzirom da su obe farme poslovale u okviru istog proizvodnog sistema. Na obe farme je porodilište u odvojenom objektu, ali bez individualnih bokseva za teljenje. Telad se odvajaju od majki odmah nakon rođenja. Jedna od značajnih razlika između farmi bio je način držanja teladi u prvih 7 dana života. Na jednoj od farmi (A) telad su držana vezana na ležištu u porodilištu, dok su na drugoj farmi (B) bila smeštena u individualne bokseve, takođe locirane u okviru porodilišta. Sa 8 dana starosti telad su smeštana u grupne bokseve, u posebnom objektu, odgajivalištu. Najveće slabosti i pretnje za biosigurnost i dobrobit na obe farme ispoljene su u najranijem uzrastu teladi, a odnose se na smeštaj i napajanje novorođene teladi kolostrumom. Utvrđeno je da se novorođena telad drže vezana na ležištima ili u slabo osvetljenim individualnim boksevima neadekvatne veličine i dizajna, smeštena u porodilištu zajedno sa kravama. Time se povećava izloženost

teladi brojnim patogenim agensima. Rizik po biosigurnost i dobrobit je veći kad se uzme u obzir i neadekvatno konzumiranje kolostruma u pogledu količine, načina i vremena napajanja. Kada su u pitanju telad starijih kategorija situacija je značajno povoljnija u pogledu uslova ishrane i držanja, kao i zdravstvenog nadzora i pruža velike mogućnosti u smislu daljeg unapređenja.

Ključne reči: biosigurnost, dobrobit, faktori rizika, intenzivni sistem proizvodnje

Acknowledgment

Research was funded by the Ministry of Education, Science and Technological Development, Republic of Serbia, Agreement on the realization and financing of scientific research work of SRO no. 451-03-9/2021-14/200022.

References

ANON. (2009): Welfare Quality: Assesment Protocol for Cattle.

ANON. (2011): Projekat "Razvoj i implementacija standarda dobrobiti i biosigurnosti u cilju unapređenja tehnologije proizvodnje goveda i svinja". Evidencioni broj projekta 20110. Rukovodilac projekta dr Slavča Hristov. Projekat je finansiran od strane Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije.

ANDERSON J.F. (1998): Biosecurity - A New Term for an Old Concept - How To Appl. The bovine practitioner. 32.2, 61-70.

BEGGS D. S., FISHER A. D., JONGMAN E. C., HEMSWORTH P. H. (2015): A survey of Australian dairy farmers to investigate animal welfare risks associated with increasing scale of production. J. Dairy Sci., 98, 5330–5338.

BOERSEMA J. S. C. , NOORDHUIZEN J. P. T. M., LIEVAART J. J. (2013): Hazard perception of Dutch farmers and veterinarians related to dairy young stock rearing. J. Dairy Sci., 96, 5027–5034.

BOJKOVSKI J., PAVLOVIĆ I., RELIĆ R., BUGARSKI D., SAVIĆ B., PANOUSIS N., GIADINIS N., STANKOVIĆ B., PETRUJKIĆ T. (2012): Zdravstveni problemi i dobrobit teladi u intenzivnoj proizvodnji. Radovi sa XXVI savetovanja agronoma, veterinara, tehnologa i agroekonomista, 18 (3-4), 85-91.

BURTON R.J.F., PEOPLES S., COOPER M.H. (2012): Building 'cowshed cultures': A cultural perspective on the promotion of stockmanship and animal welfare on dairy farms. Applied Animal Behaviour Science, 28, 174-187.

DAMIAANS B., RENAULT V., SARRAZIN S., BERGE A. C., PARDON B., RIBBENS S., SAEGERMAN C., DEWULF J. (2020): A risk-based scoring system to quantify biosecurity in cattle production. Preventive Veterinary Medicine**,** 179. https://doi.org/10.1016/j.prevetmed.2020.104992

DAMIAANS B., RENAULT V., SARRAZIN S., BERGE A. C., PARDON B., RIBBENS S., SAEGERMAN C., DEWULF J. (2019): Biosecurity practices in Belgian veal calf farming: Level of implementation, attitudes, strengths, weaknesses and constraints. Preventive Veterinary Medicine, 172. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7127683/

DENIS-ROBICHAUD J., KELTON D. F., BAUMAN C. A., BARKEMA H. W., KEEFE G. P., DUBUC J. (2019): Biosecurity and herd health management practices on Canadian dairy farms. J. Dairy Sci., 102, 9536–9547.

DE VRIES M., BOKKERS E.A.M., VAN SCHAIK G., BOTREAU R., ENGEL B., DIJKSTRA T, DE BOER I.J.M. (2013): Evaluating results of the Welfare Quality multi-criteria evaluation model for classification of dairy cattle welfare at the herd level. J. Dairy Sci., 96 (10), 6264-6273.

EMANUELSON U., SJÖSTRÖM K., FAL N. (2018): Biosecurity and animal disease management in organic and conventional Swedish dairy herds: a questionnaire study. Acta Vet Scand., 60:23.
https://actavetscand.biomedcentral.com/articles/10.1186/s13028-018-0376-6

ELLINGSEN K., COLEMAN G.J., LUND V., MEJDELL C.M. (2014): Using qualitative behaviour assessment to explore the link between stockperson behaviour and dairy calf behaviour. Applied Animal Behaviour Science, 153, 10-17.

FERIT CAN M. (2018): Farm Level Biosecurity: Challenges and Suggestions. Dairy and Vet Sci J., 1-3, 7(5): JDVS.MS.ID.555722

GOTTARDO F., NALON E., CONTIERO B., NORMANDO S., DALVIT P., COZZI G. (2011): The dehorning of dairy calves: Practices and opinions of 639 farmers. J. Dairy Science, 94 (11), 5724-5734.

HRISTOV S., STANKOVIĆ B, MAKSIMOVIĆ N. (2012): Welfare of dairy cattle – today and tomorrow. Third International Scientific Symposium "Agrosym Jahorina 2012", 55-62.

HRISTOV S., STANKOVIĆ B., TODOROVIĆ-JOKSIMOVIĆ M., MEKIĆ C., ZLATANOVIĆ Z., OSTOJIĆ-ANDRIĆ D., MAKSIMOVIĆ N. (2011): Welfare problems in dairy calves. Biotechnology in animal husbandry, 27 (4), 1417-1424.

HRISTOV S., STANKOVIĆ B. (2009): Welfare and biosecurity indicators evaluation in dairy production. Biotechnology in Animal Husbandry, 25 (5-6), 623-630.

JEŽEK J., GRABNAR P., BECI B., KLINKON M., NEMEC M., HODNIK J.J., STARIČ J. (2019): Management practices affecting calves welfare on farms in Slovenia. Acta universitatis agriculturae et silviculturae mendelianae brunensis, 67, 1147-1152.

KIELLAND C., SKJERVE E., ØSTREAS O., ZANELLA A.J. (2010): Dairy farmer attitudes and empathy toward animals are associated with animal welfare

indicators. J. Dairy Science, 93 (7), 2998-3006.
LUNDVALL J., SARAS – JOHANSSON M. (2011): Human-animal interactions in dairy production. Literature review, Swedish University of Agricultural Sciences, The Faculty of Veterinary Medicine and Animal Science, Department of Animal Nutrition and Management Uppsala.
NITOVSKI A., MILENKOVIĆ M., RADOVIĆ B., MILANOVIĆ V., GRČAK D., GRČAK M. (2013): Makeing a plan of biosecurity on a cattle farm. Macedonian Journal of Animal Science, 3 (1), 9–15.
OSTOJIĆ ANDRIĆ D., HRISTOV S., PETROVIĆ M. M., PANTELIĆ V., BOJKOVSKI J., NOVAKOVIĆ Ž., LAZAREVIĆ M., NIKŠIĆ D. (2015): Housing conditions and welfare of dairy cows in Serbia. Proceedings of the 4th International Congress New Perspectives and Challenges of Sustainable Livestock Production, 62-73, 2015.
OSAKA I., MATSU Y., TERADA F. (2014): Effect of the mass of immunoglobulin (Ig)G intake and age at first colostrum feeding on serum IgG concentration in Holstein calves. J. Dairy Science, 97 (10), 6608-6612.
PEDERSEN R.E., SØRENSEN J.T., SKJØTH F., HINDHEDE J., NIELSEN T.R. (2009): How milk-fed dairy calves perform in stable versus dynamic groups. Livestock Science 121, 215–218.
RELIĆ R., HRISTOV S., SAMOLOVAC LJ., BOJKOVSKI J., ROGOŽARSKI D. (2014): Colostrum management in calves' welfare risk assessment. Bulletin UASVM Veterinary Medicine, 71 (1), 187-192.
RELIĆ R., BOJKOVSKI J. (2010): Housing conditions in calves welfare risk assessment. Journal of Agricultural Sciences, 55(3), 283-292.
RENAUD D. L., KELTON D. F., LEBLANC S. J., HALEY D. B., DUFFIELD T. F. (2018): Calf management risk factors on dairy farms associated with male calf mortality on veal farms. J. Dairy Sci., 101, 1785–1794.
RICHENS I.F., HOUDMONT J., WAPENAAR W., SHORTALL O., KALER J., O'CONNOR H., BRENNAN M.L. (2018): Application of multiple behaviour change models to identify determinants of farmers' biosecurity attitudes and behaviours, Preventive Veterinary Medicine**,** 155, 61-74.
SAMOLOVAC LJ., MARINKOVIĆ M., PETRIČEVIĆ M., STAMENIĆ T., ĆOSIĆ I., BESKOROVAJNI R., STANKOVIĆ B. (2020): Effect of farm and birth season on calf body weight in the first week of life. Biotechnology in Animal Husbandry, 36 (3), 297-307.
SAMOLOVAC LJ., HRISTOV S., STANKOVIĆ B., MALETIĆ R., RELIĆ R., ZLATANOVIĆ Z. (2019): Influence of rearing conditions and birth season on calf welfare in the first month of life. Turkish Journal of Veterinary and Animal Sciences, 43: 102-109.
SCHÜTZ K.E., HAWKE M., WAAS J.R., MCLEAY L.M., BOKKERS E.A.M.,

VAN REENEN C.G., WEBSTER J.R., STEWART M. (2012): Effects of human handling during early rearing on the behaviour of dairy calves. Animal welfare, 21, 19-26.

STANKOVIĆ B., HRISTOV S., ZLATANOVIĆ Z., BOJKOVSKI J., MILOŠEVIĆ STANKOVIĆ I., MAKSIMOVIĆ N. (2015): Respiratory disorders and biosecurity on dairy farms. Proceedings of the 4th International Congress New Perspectives and Challenges of Sustainable Livestock Production, 415-427.

STANKOVIĆ B., HRISTOV S., OSTOJIĆ-ANDRIĆ D., ZLATANOVIĆ Z., SAMOLOVAC LJ., MAKSIMOVIĆ N. (2014): The most common health disorders and welfare of dairy cows and calves. Biotechnology in Animal Husbandry, 30 (4), 549-560.

STANKOVIĆ B., HRISTOV S., BOJKOVSKI J., ZLATANOVIĆ Z., MAKSIMOVIĆ N., TODOROVIĆ-JOKSIMOVIĆ M., DAVIDOVIĆ V. (2011): The possibility of dairy farms isolation assessment - biosecurity aspect. Biotechnology in Animal Husbandry, 27 (4), 1425-1431.

SHORTALL O., GREEN M., BRENNAN M., WAPENAAR W., KALER J. (2017): Exploring expert opinion on the practicality and effectiveness of biosecurity measures on dairy farms in the United Kingdom using choice modeling, J. Dairy Sci., 100:2225–2239.

VASSEUR E., RUSHEN J., DE PASSILLÉ A.M., LEFEBVRE D., PELLERIN D. (2010): An advisory tool to improve management practices affecting calf and heifer welfare on dairy farms. J. Dairy Sci., 92, 4414–4426.

VASSEUR E., RUSHEN J., DE PASSILLÉ A.M. (2009): Does a calf's motivation to ingest colostrum depend on time since birth, calf vigor, or provision of heat? J. Dairy Science 9 (8), 3915-3921.

WEAVER D.M., TYLER J.W., VANMETRE D.C., HOSTETLE, D.E., BARRINGTON G.M. (2000): Passive transfer of colostral immunoglobulins in calves. J. Vet. Intern. Med., 14:569– 577.

WIKMAN I., HOKKANEN A-H., PASTELL M., KAUPPINEN T., VALORS A., HÄNNINEN L. (2013): Dairy producer attitudes to pain in cattle in relation to disbudding calves. J. Dairy Science, 96 (11), 6894-6903.

B. WINDER C.B., LE BLANC S.J., HALEY D.B., LISSEMORE K.D., GODKIN M.A., DUFFIELD T.F. (2016): Practices for the disbudding and dehorning of dairy calves by veterinarians and dairy producers in Ontario – Canada. J. Dairy Sci., 99,10161–10173.