



RESEARCH ARTICLE

OPEN ACCESS

Factors affecting rearing practices and health of calves on family farms

Renata Relic¹, Nada Lakic², Ljiljana Jankovic³, Vesna Davidovic¹, Jozse Staric⁴ and Jozica Jezek⁴

¹ University of Belgrade, Faculty of Agriculture, Dept. of Animal Science, 11080 Belgrade, Serbia ² University of Belgrade, Faculty of Agriculture, Dept. of Agroecology, 11080 Belgrade, Serbia ³ University of Belgrade, Faculty of Veterinary Medicine, Dept. of Animal Hygiene, 11000 Belgrade, Serbia ⁴ University of Ljubljana, Veterinary Faculty, Clinic for Reproduction and Large Animals, 1000 Ljubljana, Slovenia

Abstract

Aim of study: Calf rearing practices vary in different countries and may be affected by many factors. Poor management is related to diseases outbreak and death in calves. This study aimed to analyze practices in calf rearing and the occurrence of common calf diseases on family farms in two European countries and to examine the characteristics of a farmer and his farm as factors that may affect the way of performing practices related to calves' health.

Area of study: Slovenia and Serbia.

Material and methods: For collecting data, the same questionnaire-based survey was distributed among cattle farm owners in Slovenia and Serbia.

Main results: The following factors showed a significant influence ($p < 0.05$) on certain rearing practices: farm size (on time for checking calves, milk reheating, and providing rehydration fluids to the calf with diarrhea in Slovenia), specialization of the production (on preventive antiparasitic treatments and restriction of drinking water for calves with diarrhea in Slovenia, and the time for checking calves in Serbia), breeder's age (on colostrum quality checking in Slovenia), and breeder's education (on time for checking calves and checking colostrum quality in Serbia). The results pointed out the rearing practices to be improved in both countries, Slovenia and Serbia, such as colostrum management and prevention strategies of calf diseases.

Research highlights: Characteristics of the farmer and his farm may affect many aspects of calves' rearing. Continuous education of farmers and appropriate production planning can contribute to better farm productivity and better health and welfare of calves.

Additional key words: calf; management; diarrhea; respiratory diseases; prevention; welfare

Authors' contributions: Conceived and designed the study: RR, JS and JJ. Performed the survey: RR, JJ, LJJ and VD. Analysed and interpreted data: NL, RR, and JJ. All authors drafted and approved the final manuscript.

Citation: Relić, R; Lakić, N; Janković, LJ; Davidović, V; Starić, J; Ježek, J (2021). Factors affecting rearing practices and health of calves on family farms. Spanish Journal of Agricultural Research, Volume 19, Issue 1, e0501. <https://doi.org/10.5424/sjar/2021191-17181>

Received: 12 Jul 2020. **Accepted:** 12 Feb 2021.

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Funding agencies/institutions	Project / Grant
COST	Action FA1308 DairyCare
Slovenian Research Agency Research	P4-0092

Competing interests: The authors have declared that no competing interests exist.

Correspondence should be addressed to Renata Relic: rrelic@agrif.bg.ac.rs

Introduction

Most of cattle holdings in the world are family-based farms (FAO, 2010; EFSA, 2015). The health of calves is essential for profitable production wherefore calf welfare should be of primary importance for a breeder. Poor management is one of the main factors leading to the outbreak of diseases and deaths of calves (Vasseur *et al.*, 2010). On family farms, the quality of calf rearing has been affected by many factors, including different social, political, economic and cultural conditions in which the farmers live (Marce *et al.*, 2010; Vasseur *et al.*, 2010; Davidova & Thomson,

2014; Hötzel *et al.*, 2014; Santman-Berends *et al.*, 2014; EFSA, 2015; Klein-Jöbst *et al.*, 2015; Velde *et al.*, 2018).

Slovenia and Serbia, two European countries, differ in geo-political, cultural, economic and other aspects. However, both countries have in common that family farms represent over 98% of all agricultural holdings with livestock. Dairy production is predominant (Eurostat, 2018; RZS, 2018; SURS, 2018) and based on indigenous, cross-bred and site-adapted cattle breeds suitable for different production goals (milk, meat, or for dual purpose). Slovenia has about 480,000 heads of cattle and Serbia 899,000 (RZS, 2018; SURS, 2018). According to data

from the last census, the average economic size of agricultural holdings in Serbia was 5,939 EUR and 13,944 EUR in Slovenia (Cvijanović *et al.*, 2014; data for 2012; SURS, 2018; data for 2013). This study aimed to analyze practices in calf rearing and the occurrence of common calf diseases on family farms in Slovenia and Serbia and to examine the characteristics of farmers and their farms as factors that may affect the way of performing practices related to calves' health.

Material and methods

Data collecting

A questionnaire-based survey was conducted among owners of family farms in Slovenia and central Serbia – an area of similar size to Slovenia, which is also rich in hill and mountain pastures. The questionnaire consisted of nine (IX) sets of multiple-choice and semi-closed questions, about the following: general information on the farm and the breeder (I), housing and care of pregnant cows and new-born calves (II, V, and VI), calves' feeding management (III and IV), the appliance of preventive measures and the occurrence of common calf diseases (VII), including diarrhea (VIII) and respiratory diseases (IX). Participation in the survey was voluntary, and totally 405 of the farmers responded. They provided data related to the previous twelve months, by giving a numerical or written answer or by choosing among options offered.

Statistical analysis

Given that among respondents in Serbia were no farm owners with over 100 cows, due to the comparability of

data, only farms with a maximum of 100 cows were considered, that is 92% of farms surveyed in Slovenia and 100% of farms in central Serbia (in further text: Serbia). For this study, the statistical analysis included selected answers to the relevant questions. The comparison between the countries concerned the general characteristics of farms and their owners, the occurrence of calf diseases, and some rearing practices by using a t-test, Mann-Whitney U-test, and chi-squared test. Data analyses were performed using SPSS v 20.0 (IBM Corp., 2011).

As potentially significant factors affecting calves' rearing practices and disease occurrence, the age and education of the breeder, and also size and specialization of a farm were considered. The predictors were analyzed using the following categories of the answers: *age of farmer* as 18-35, 36-55, 56-69, and 70 and more; *education level* as low (uncompleted elementary school or elementary school), medium (high school), and high (college, professional school, faculty, specialization, master or doctorate); *farm size in cattle heads* as up to 20, 21-60, and 61-100; and *specialization in cattle production* as milk, and other (meat, other). The relation between these four predictors and selected target (criterion) characteristics from the surveys were analyzed by binary logistic regression using SPSS v 20.0 (IBM Corp., 2011).

Results

The countries significantly differ in some aspects of cattle breeding and herd structure (Table 1). Besides cattle farming, breeders in Serbia deal with some type of plant production (21.67%), or they breed some other animal species (8.33%), while in Slovenia only 5.88% of family farms are engaged in other agricultural activities than cattle breeding. In Serbian farms, Simmental

Table 1. General data on the farms and the owners in Slovenia and Serbia

General data	Slovenia	Serbia	<i>p</i> -value ¹
Cattle breeding			
Main production	94.12%	70.00%	< 0.001
Common breeds ²	SM, BS, HF	SM and SMX	< 0.001
Dairy cattle mainly	48.53%	38.33%	0.152
Herd structure			
Total cattle	25	11	< 0.001
Dairy cows	11	5	< 0.001
Calves up to 6 mos.	6	5	0.614
The farmer			
Age (years)	48.35	49.25	0.578
Education		high school	0.190

¹*p*-values were bolded for statistically highly significant differences. ² SM, Simmental; SMX, Simmental Cross; BS, Brown Swiss; HF, Holstein Friesian.

and crossbreeds are predominant (83.33%). In Slovenia, Simmental (13.33%), Brown Swiss (19.33%) and Holstein-Friesian (10.41%) breed are the most frequent, and many farmers keep more than one cattle breed at the farm. Cattle herds are on average 2.2 times larger in Slovenia than in Serbia. The majority of farmers in Slovenia and Serbia do not differ in their average age and level of education (they finished a high school: 58.40% and 52.54%, respectively). Slovenia and Serbia differ (Table 2) in the representation of percentages of specific responses regarding the occurrence of diarrhea and respiratory diseases ($p<0.001$) and the incidence of ringworm *i.e.* trichophytia ($p=0.035$). According to farmers' responses, diarrhea and respiratory infections in calves significantly more frequently occur in Serbia (Table 2). Disease incidence greater than 20% was reported: diarrhea on 40.08% farms and respiratory diseases on 6.25% farms in Slovenia, and in Serbia on 77.55% and 52.63% farms, respectively. In Slovenia, diarrhea is most commonly reported to occur in older calves than in Serbia, but younger calves more commonly get some respiratory disease in comparison to Serbia. In Slovenia, symptoms of a respiratory disease mostly last shorter than in Serbia (Table 2).

Most breeders in Slovenia and Serbia dedicate the same time (up to 30 min per day) for checking calves' health and behavior (74.44% and 56.67%, respectively). According to the participation of other answers on the time spent in calf monitoring, Slovenia and Serbia differ significantly (Table 3). Similarity between countries exists regarding new-born calf's navel disinfection (do not perform or irregularly perform in 65.93% and 61.67% farms, respectively), the treatment of endo- and ectoparasites (do not perform or irregularly perform in 80.08% and

75.00% farms, respectively), the time interval in which a calf gets the first colostrum meal (within 2 hours, 46.30% and 46.67% farms, respectively), the amount of colostrum that a calf drinks for the first time (2 liters, 48.95% and 39.39% farms, respectively), and the absence of colostrum quality checks and the method of milk temperature assessment before giving to calves (Table 3).

Respondents in both countries considered to know the temperature of milk before they use it for feeding calves. The values which the majority declared are similar (Table 3). However, row data vary from 15 to 50 °C wherefore the difference in the structure of all answers is highly significant ($p<0.001$). Farmers in Slovenia check the milk temperature occasionally (39.42%), while Serbian farmers almost do not perform it at all (70.00%).

Practices in diarrhea and respiratory disease management vary between the countries, most importantly about the use of rehydration fluid and restriction of milk for calves with diarrhea, and then regarding control of body temperature and isolation of calves with respiratory disease. The percentage of responses on the regular isolation of calves affected by respiratory diseases is significantly different between the countries (Table 3).

Farmers specified various reasons why they decide to call a veterinarian for help, but reasons shown in Table 3 were opted by largest percentage of them: when diarrhea occurring it is "if no improvement in a few days" (36.65% of farmers in Slovenia and 30.28% in Serbia), and in case of respiratory diseases "when heavy-breathing is noticed" (19.30% and 22.55%, respectively). The representation of these categories of responses does not differ significantly among countries (Table 3). However, the structure of responses related to all given reasons for calling a

Table 2. Data on the most common calf diseases on the farms

Calf diseases	Slovenia	Serbia	<i>p</i> -value ¹
Mortality up to 6 months of age	7.09%	7.88%	0.575
Diarrhea			
Incidence ≤ 20%	59.92%	22.45%	< 0.001
Age when appears	3 wks	1wk	< 0.001
Common duration		3-5 d	0.502
Respiratory diseases			
Incidence ≤ 20%	93.75%	47.37%	< 0.001
Age when appears	1wk-1 mo	1-3mo	< 0.001
Common duration	3-5 d	5-8 d	< 0.001
Navel infection	18.89%	25.00%	0.372
Joint ill	23.42%	13.33%	0.123
Ringworm	13.08%	25.00%	0.035

¹*p*-values were bolded for statistically significant and highly significant differences

Table 3. Most common rearing practices related to calf health

Calf health	Slovenia	Serbia	<i>p</i> -value ¹
Time spent for calf monitoring	up to 30 min/day		0.010
Navel disinfection ²	34.07%	38.33%	0.066
Parasite control ²			
Only endoparasites	25.94%	46.67%	0.017
Ecto- and endoparasites	19.92%	25.00%	0.382
Colostrum management			
Time of the first consumption	up to 2 hrs		>0.999
Quantity at the first meal	2 litters		0.543
Use without quality control	54.55%	58.33%	0.599
Milk temperature			
Breeder claims s/he knows it	54.31%	23.33%	< 0.001
Breeder's opinion on the value	37° C	38° C	0.077
Frequency of the control	occasionally	never	< 0.001
Control by hand	70.81%	64.71%	0.601
Control by thermometer	20.50%	29.41%	0.394
Treatment of diarrhea			
Controlling calf's temperature ²	31.84%	19.64%	0.098
Providing a rehydration fluid ²	24.41%	55.56%	< 0.001
Stop feeding milk ²	17.78%	100.00%	< 0.001
Isolation of the sick calf ²	8.99%	14.81%	0.292
Cleaning pen after sick calf ²	83.27%	88.68%	0.436
A common reason to call a vet	no improvement in a few days		0.250
Treatment of respiratory diseases			
Controlling calf's temperature ²	57.56%	34.48%	0.031
Isolation of the sick calf ²	14.67%	36.67%	0.006
A common reason to call a vet	heavy-breathing is noticed		0.526

¹*p*-values were bolded for statistically significant and highly significant differences. ² The result is related to regular carrying out of the procedure

veterinarian in the case of diarrhea differs highly significantly ($p < 0.001$) between two countries, and significantly ($p = 0.044$) in the case of respiratory diseases.

Concerning the application of general biosecurity measures for prevention of disease introduction and spreading on the farm, breeders in Slovenia and Serbia differ only in the use of disinfectant footwear barriers, and also with respect to the absence of application any of the measures ($p < 0.001$; Fig. 1).

Considering breeders did not respond in sufficient number to all questions, the analysis of the mutual effect of the farmer and farm characteristics on certain rearing procedures important for the occurrence and course of diseases was carried out only for those parameters, which met the condition for the application of logistic regression

(Table 4). The time that breeder daily takes to observe the calves' health state and behavior is significantly influenced by the farm's size in Slovenia (Table 4); the chance that observation time will be longer than 30 minutes is 2.53 times lesser at farms with 21-60 cattle, and 2.9 times lesser at farms with 61-100 heads compared to farms with ≤ 20 heads. In Serbia, a significant influence on this parameter have specialization of production and level of breeder's education: the chance that farmer observes the calves more than 30 minutes per day is 4.08 times greater at a dairy farm than other farms, and if he has a medium or high education – compared to low education (10.01 and 4.47 times greater likelihood, respectively). Carrying out preventive treatments against parasites of calves in Slovenia is affected by specialization of production; on dairy

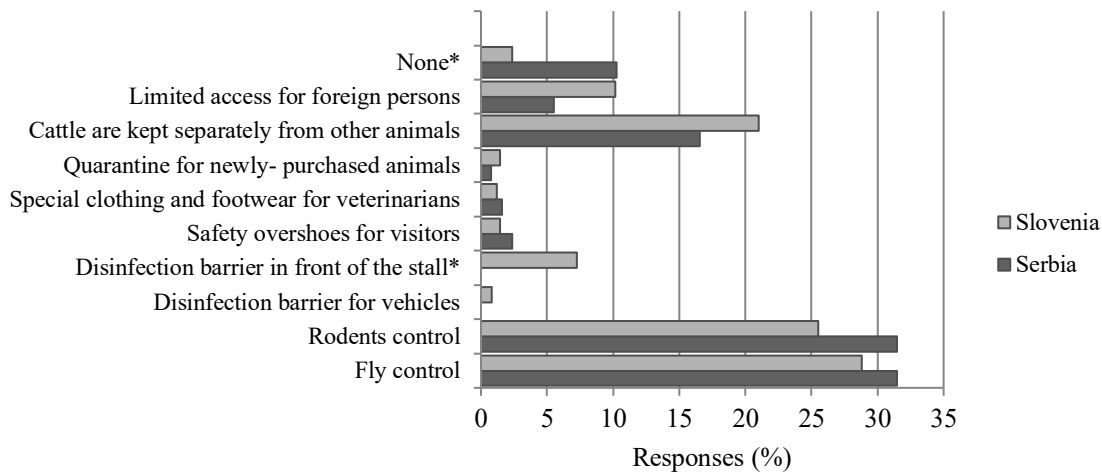


Figure 1. General biosecurity measures on the farms (* $p < 0.001$)

farms, antiparasitic treatment is 1.98 times less applied compared to other farms. In Serbia, the effect of the predictors on this parameter is not significant.

Checking colostrum quality prior to feeding the calf in Slovenia is significantly affected by age of the farmer: in comparison to farmers of 18 to 35, the oldest farmers (age 70 and more) check the quality of colostrum 1.63 times less; in contrast, farmers of 36 to 55 and 56 to 69 years more often perform the checking (1.31 and 3.50 times, respectively). In Serbia, this parameter is affected by the level of education: farmers with secondary school

and high education perform it less than farmers with the lowest education (5.26 and 2.75 times less, respectively).

Carrying out the milk reheating before feeding a calf in Slovenia is significantly influenced by the size of the farm. At largest farms, this operation is conveyed 3.27 times more often than at farms with up to 20 cattle. There are no significant impacts of the predictors on this parameter in Serbia.

Providing fluids to rehydrate the calf with diarrhea in Slovenia depends on the size of the farm. On larger farms (21 to 60, and 61 to 100 cattle) this practice is performed

Table 4. Characteristics of farmer and his farm that affect the carrying out of certain practices

Parameter (categories for answers classification)	Traits significantly affecting the parameter (p -value) ¹	
	Slovenia	Serbia
Time spent for calf monitoring (up to 30 min, over 30 min)	Size of the farm (up to 20 cattle, $p=0.009$) (21-60 cattle, $p=0.004$)	Specialization in production (milk, $p=0.046$) Level of breeder's education (low, $p=0.011$) (medium, $p=0.003$)
Carrying out preventive treatments against calf parasites (yes, no)	Specialization in production (milk, $p=0.013$)	No significant impacts
Checking colostrum quality before feeding a calf (yes, no)	Age of the breeder (18-35 years, $p=0.021$) (56-69 years, $p=0.013$)	Level of breeder's education (medium, $p=0.033$) (high, $p=0.040$)
Reheating milk before feeding a calf (yes, no)	Size of the farm (61-100 cattle, $p=0.037$)	No significant impacts
Providing rehydration fluids to a calf with diarrhea (yes, no)	Size of the farm (up to 20 cattle, $p=0.015$) (21-60 cattle, $p=0.011$) (61-100 cattle, $p=0.027$)	No significant impacts
Limiting access to the water for a calf with diarrhea (yes, no)	Specialization in production (milk, $p=0.023$)	No significant impacts

¹ p -values were bolded for statistically significant and highly significant differences

more often (2.40 and 3.90 times more, respectively) than at small farms (up to 20 heads). There are no significant impacts of the predictors on this parameter in Serbia.

The water restriction in Slovenia is significantly influenced by the specialization of production, and calves with diarrhea at a dairy farm have the unimpeded access to drinking water 1.89 times more often than at other farms. There are also no significant impacts of the predictors on this parameter in Serbia.

Discussion

Structure of farms and farmers

Official data show a similar ratio between total numbers of cattle and dairy cows per farm in Slovenia and Serbia (Cvijanović *et al.*, 2014; SURS, 2018) as in our study. In Slovenia, the average age of the owner of a family farm is 57 years (SURS, 2018), and in Serbia it is 65 years or more (RZS, 2018). That is not consistent with our results from Table 1 and points that mostly younger population took part in our survey. Medium level of education is common for farmers in both countries (Eurostat, 2017; RZS, 2018), which is in accordance with our results.

Calf diseases

Morbidity and mortality rates are useful in assessing poor welfare associated with disease and lack of care (Ortiz-Pelaez *et al.*, 2008; Colditz *et al.*, 2014), wherefore they should be as low as possible. The mortality rates in Slovenian and Serbian farms are in accordance with data by Gulliksen *et al.* (2009) and Santman-Berends *et al.* (2014).

Two major causes of calf mortality in the first 180 days of life are diarrhea and respiratory diseases (Gulliksen *et al.*, 2009; Lorenz *et al.*, 2011a). They are also the main diseases in pre-weaned dairy calves: diarrhea during the first three weeks of life, and viral or bacterial pneumonia in calves over four weeks old (Lorenz *et al.*, 2011a). Weaning is considered a predisposing factor of pneumonia in recently weaned suckler calves (Lorenz *et al.*, 2011c). Common time reported by all responders on diarrhea appearance is consistent with data by Lorenz *et al.* (2011a). Our results show that diarrhea more frequently occurs (or breeder detects it easier) than respiratory diseases. Lorenz *et al.* (2011c) also stated that the cases of calf pneumonia are more likely to be missed than misdiagnosed indicating that breeders pay less attention to the signs such as coughing, wheezing, and especially the appearance of discharge from the eyes and nose, which are early signs of respiratory disease. The last claim is

supported also by our findings that the most frequent reason for calling a veterinarian to help is only when the calf is breathing heavily.

Traditional cattle breeding in both countries implies tied housing in closed facilities with solid walls and using seasonal pasture from spring until late autumn. However, in some Serbian farms, cattle spend most of the time housed because everyday releasing, re-attaching and keeping animals on the pasture are not feasible operations for small families or elderly people if they are alone in the household and, in both cases, if there are no funds for extra workers. Spending time outdoors in the fresh air is beneficial in reducing the prevalence of respiratory diseases in pre-weaned calves, while poor air and hygienic conditions in a stall may facilitate the emergence and extend the duration of diseases (Lorenz *et al.*, 2011c). According to farmers' responses in the survey, an average length of both diseases in Slovenia and diarrhea in Serbia is in line with data by Donovan *et al.* (1998).

Navel infection and joint ill are also conditions related to young calf exposure to pathogenic bacteria from the environment. Preventive measures for umbilical infection include maternity pen hygiene, decreasing the time a newborn calf spends in the maternity pen, adequate passive immunity transfer, and antiseptic umbilical cord care (Mee, 2008). Regular implementation of navel disinfection in both countries is much lower than in the study by Vasseur *et al.* (2010) but similar to data by Renaud *et al.* (2017). Among farmers who never or irregularly use the navel-dip is likely to be those who allow the cow to dry off her newborn calf by licking. Calves with joint ill may have history and symptoms of other diseases, such as pneumonia, umbilical cord infection and diarrhea (Goodarzi *et al.*, 2015). The incidence of navel infections reported in our study is in accordance with data by Wieland *et al.* (2017) and the incidence of joint ill is lower than reported by Klein-Jöbstl *et al.* (2015). Trichophytia is a dermatomycosis (ringworm) common in calves housed together, in poor hygienic and hot and humid conditions. Poor nutrition, biosecurity, and livestock management, as well as lack of sanitation routines, facilitate the spreading of *T. verrucosum*, the causative agent of this disease. The prevalence rate in a herd can be higher than 70% (Papini *et al.*, 2009; Agnetti *et al.*, 2014), which was not the case in our study.

Rearing techniques

Monitoring calves for signs of disease is of special importance in the first weeks of life when they are most sensitive to pathogens. Farmers must continue to check all housed calves at least twice a day and calves kept outside at least once a day, irrespective of the milk feeding systems used in the first months of life (FAWC,

2015). In small farms, up to 30 minutes of observing per day may be enough but not on larger farms with more calves. On dairy farms, calves are kept separately from their mothers. Breeders usually check the calves during feeding time, which could explain the significant influence of farm specialization on the answer chosen for this parameter in Serbia. Furthermore, Serbian breeders with better education consider monitoring of calves important for successful rearing, but we did not examine what exactly this implies.

Our survey results show that farmers in Serbia more regularly use ecto- and endoparasitic treatments than Slovenian farmers. In farms where cattle graze they have more problems with parasites and are more likely to use the means to control parasites. In the study by Schnieder *et al.* (1999), farmers did not use strategic control regimes for the control of helminths but preferred to use treatments after clinical signs were observed in animals, which is similar to our results. Diarrhea and respiratory infections may be related to the presence of internal parasites (Göz *et al.*, 2006; Panciera & Confer, 2010); so irregular endoparasite control may contribute to a greater incidence of these diseases.

Details on appropriate colostrum management and its importance in the prevention of common calf diseases have been described by Vasseur *et al.* (2010), Lorenz *et al.* (2011a,b) and Hötzel *et al.* (2014). In our research, the time of first consumption and the quantity of consumed colostrum are in accordance with the recommendations. However, in both countries, it is common practice to use colostrum without any kind of quality control (visual, by colostrometer or by refractometer), which is a risk factor for failure of passive immunity transfer in calves. It is interesting that the youngest population of breeders in Slovenia and the lowest educated in Serbia said they were checking, possibly because young farmers have more knowledge and enthusiasm to apply recommended practices but less educated have enough experience in cattle breeding to know the importance of colostrum. Milk for feeding calves should have the temperature as close as possible to the calf's body temperature, and values obtained in this study can be considered as appropriate in that sense. However, it is debatable if responders really know the value, or they just know how it should be, considering most of them assess the temperature of the milk by hand. According to the results, many farmers pay too little attention to ensuring adequate milk temperature for feeding calves that could be related to the high frequency of diarrhoea in some farms. The appropriate temperature of milk fed to the calves is necessary for optimal digestion. A too low temperature of milk impairs digestion in the abomasum (Mornet & Espinasse, 1990) and may cause diarrhoea, additionally, it is also a risk factor for abomasal bloat (Marshall, 2009).

Practices in the case of diarrhea and respiratory diseases

Calves with diarrhea require prompt replacement of lost fluid and electrolytes to prevent severe dehydration and death. In calves suffering from diarrhea, ad libitum availability of water is strictly required (Wenge *et al.*, 2014). Still, there are many farms where diarrheic calves have limited access or no access to the water; the owners give them instead rehydration solution two or more times per day (Relić *et al.*, 2017). Besides lack of information on the importance of free water-access, the reasons for limitation can be related to calves' housing and feeding systems and the absence of automatic waterers in old stalls, and the specialization of production. Another traditional belief is that milk feeding should be stopped for calves with diarrhea, either for a defined period or for as long as diarrhea persists. However, starvation rapidly results in malnourishment and weight loss of the sick calf. Continued milk feeding provides the energy and nutrients that are necessary for the recovery of the intestinal mucosa (Lorenz *et al.*, 2011b). In our results, it is noticeable that all respondents in Serbia stated they stop giving milk to the calves with diarrhea, but most of them give fluid for rehydration. In a study by Klein-Jöbstl *et al.* (2015), on 86.3% of examined farms in Austria, milk was fed restricted. On the other hand, less than a fifth of breeders in Slovenia stop giving milk that is probably the reason why they said to use rehydration solutions in a smaller percentage than farmers in Serbia.

Deviation of body temperature from the normal range is a sign that something may be wrong with a calf. When other signs of illness are poorly expressed or unclear, noticing the elevated temperature can contribute to timely treatment. In favor of the previous, early signs of pneumonia, include increased respiratory rate and fever, followed by depression (Lorenz *et al.*, 2011c). Delayed diagnosis may result in a more severe disease that needs prolonged use of antibiotics, a high recurrence rate, and complications on the respiratory and other organs with worsening of the condition or even death of the calf. On the other hand, early detection and effective treatments minimize antibiotic use, disease recurrence, chronic respiratory disease cases, and endemic dairy calf pneumonia (McGuirk & Peek, 2014). In both countries, a greater number of breeders measure the calf temperature if a respiratory disease is suspected than in the case of diarrhea. However, no matter what the disease is, respondents from Serbia less often measure the body temperature of sick calves.

Pathogens causing diarrhea are usually transmitted via the fecal-oral route (McGuirk & Ruegg, 2019). Therefore, a high level of hygiene in the area where calves are housed has an important role in the prevention of diarrhea, as well as cleaning pens after sick calves. Isolation of a sick

calf is necessary to prevent spreading pathogens to other animals, which is more often done in Serbia than in Slovenia. However, it is not clear if respondents under “isolation” mean the keeping of an animal individually in a box or tied somewhere in the stall, which can be found on many family farms in Serbia. Individual pens for isolating sick animals must have solid walls (Marce *et al.*, 2010), but we did not specify that in the question in our survey.

Biosecurity measures

Results indicate that farmers in both countries are similarly implementing biosecurity measures. Rodents and fly control were considered as the most important by the farmers. A worryingly small percentage of farmers in both countries practice quarantine of newly purchased animals; it looks like they are not fully aware of the importance of quarantine and other biosecurity measures in preventing diseases. Farmers partially or completely omit implementation of biosecurity measures also in other countries, as described by Sarrazin *et al.* (2014) and Ritter *et al.* (2017).

According to Velde *et al.* (2018), poor adoption of recommendations to reduce disease transmission or enhance biosecurity practices and low participation in voluntary disease prevention are related to the personal traits of the farmer. Sometimes, small family farmers cannot bear the management costs; even more frequently, they may lack the information, knowledge, and skills needed for modern environmental management (Davidova & Thomson, 2014). Ritter *et al.* (2017) listed some key recommendations to enhance farmers’ skills, disease problem and benefits awareness, as well as a sense of responsibility. These universal recommendations can be applied to breeders’ education in any country.

It can be concluded that rearing practices in Slovenia and Serbia mostly match, in positive and also in negative aspects. Breeders greatly rely on tradition and experience, and farm size and type of specialization most often showed the influence on rearing procedures. The most neglected biosecurity measure in both countries is the isolation of newly purchased animals. A very common practice is to use colostrum without checking the quality. Farmers devote too little attention to controlling milk temperature for feeding calves and to water provision. Farmers often inadequately supply diarrheic calves. They call a veterinarian for help when diarrhea does not improve in a few days and when heavy-breathing is noticed in case of respiratory disease, which poses a risk to worsen the health status of the calf. All these data may help in breeders’ education and in another kind of support in the areas to be improved on-farm, *e.g.* colostrum management and prevention strategies for common calf diseases. The findings may help to improve the health and welfare of calves, reduce the use of antibiotics and, consequently,

facilitate more sustainable and effective cattle breeding on family farms.

Acknowledgments

The authors gratefully acknowledge all persons who participated in the survey.

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