

Colostrum Management in Calves' Welfare Risk Assessment

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Abstract

Successful milk production is based on proper calf rearing, especially the youngest categories. However, the intensive production can result in oversights that can have very negative effects on the survival of calves and their further growth. In order to reduce mortality and to improve rearing conditions for calves, different welfare assessment systems have been offered. The European Food Safety Authority (EFSA) has developed a risk analysis approach to analysis of calf welfare. In this paper, data on young calves' mortality, morbidity and elements regarding colostrum management risk assessment at three Serbian large dairy farms were considered. The study was carried out during one year and data were collected from the farm records and by survey of employees. According to the results, calves mortality in the first 7 days of life ranged from 1.57% to 3.79% at the year level, and the most frequent causes of death were enteritis and bronchopneumonia. Risk related to colostrum management in all three farms was present, and may affect the quantity and quality of colostrum that calves received were not adequate. As the major failures at most of the farms the follows can be highlighted: lack of monitoring of ingested colostrum quantity and assessment of colostrum quality with a colostrometer and lack of routine supply of adequate stocks of frozen colostrum. The results pointed on procedures of colostrum management in which changes should be made, in aim to improve health and welfare of calves and production results as well.

Key words

newborn calves, colostrum, welfare

INTRODUCTION

Successful milk production is based on proper calf rearing, especially the youngest categories. Rearing healthy dairy calves requires maximizing the calf's level of immunity against disease while minimizing its exposure to infectious agents. In the first days of life calves are very susceptible to pathogens, and failures in any of management procedures consequently influence their survival and further growth. Failures can be noted particularly in large dairy farms, considering calf rearing requires good organization of work and more care of animals. The highest risk of dying is

during the first week of calves' life (Svensson *et al.*, 2006). The majority of calf deaths occurred within the first 24 h postpartum with 75% of the total occurring days 0 through 7 (Patterson *et al.*, 1987). Mortality rate also tends to increase with increasing herd size (Gulliksen *et al.*, 2009). Calf mortality may be of considerable economic importance to dairy farmer, and occurrence of disease or mortality in calves is certainly a welfare issue. Knowledge of the causes of death and factors influencing mortality are of the vital importance in identifying opportunities to improve the health status of calves. According to Hall (1998) major

causes of young calf death or illness are: dystocia (calving difficulties), starvation due failures in colostrum management, hypothermia (exposure to coldness), metabolic disorders, infective diseases (scours i.e. enteritis and pneumonia), and trauma.

In order to reduce mortality and to improve rearing conditions of calves, different welfare assessment systems have been offered. The European Food Safety Authority has developed a risk analysis approach to animal welfare and has carried out a risk analysis of calf welfare in intensive farming systems (EFSA, 2006). This approach requires a characterization of the major hazards for calves welfare and an assessment of the likelihood of animals being exposed to each hazard. Considering survival of calves in the first days of their life largely depends on correct provision of high quality colostrum (Godden, 2008) inappropriate colostrum management is one of the most serious hazards for calf welfare. Wells *et al.* (1996) determined that up to 31% of dairy heifer mortality during the first 21 days of life could be prevented by changes in first colostrum feeding method, timing, and volume. According to EFSA (2006, 2012) hazards in colostrum management are connected with inadequate duration of colostrum intake as a major risk, and inadequate colostrum quantity and quality as minor risks. In all cases, an impact for the individual is characterized as very serious, and magnitude of risk characterization as very high. In the last years in Serbia a lot has been done in improving of farm animals' welfare and application of the welfare assessment methods. In this respect a particular attention is paid to the welfare of dairy cows and their calves (Relić *et al.*, 2010; Hristov *et al.*, 2011). According to the method by EFSA (2006), in the paper by Relić and Bojkovski (2010) the housing conditions for Holstein-Frisian calves at the farm with intensive rearing system were analyzed. In this paper, some elements regarding colostrum management risk assessment were discussed. Data shown in this paper are the preliminary results from detailed study on calves' welfare assessment in dairy farms in Serbia.

MATERIALS AND METHODS

The study was carried out in the period of one year at three tied system dairy farms, where average

number of calves born per year was 1132. All three farms have had the same type of calving facilities and similar housing conditions for calves that are kept individually in the first seven days of life. Data on mortality (0-7 days of life) and morbidity (0-30 days of life) from the farms records were collected. To identify risks in colostrum management the survey of employees was conducted (according to Vasseur *et al.*, 2010). For this purpose following data are considered: time of the first colostrum intake, method of feeding, quantity of colostrum in single meal, number of meal per day and duration of colostrum meals, colostrum origin, way of stocking colostrum, evaluation of colostrum quality, and evaluation of passive transfer. The answers to the questions were qualitative nominal (e.g., yes or no), qualitative ordinal (e.g., scale of answers from 1=never to 5=always), or continuous (e.g., number of liters of colostrum). Based on data obtained the potential welfare risks in colostrum management by EFSA methodology (EFSA, 2006; 2012) was discussed. For statistical analysis basic statistical parameters was determined and test of significance was applied.

RESULTS AND DISCUSSION

Mortality of newborn calves and the causes of death are showed in tables 1 and 2.

During the period of observation in all three farms losses in calves were similar. Inconsistency in mortalities throughout the year was indicated by the coefficients of variation greater than 30% (Tab.1). Non-parametric Kruskal-Wallis test confirmed the differences between farms were not significant ($p > 0.05$). The highest percentage of mortality was at the Farm B (3.79% at the year level and 8.70% as the maximal value at month level). In the paper by Uetake (2012), mortality rate at the farms was ranged from a few percent to over 20%. In the study by Patterson *et al.* (1987) calves lost from birth through day 3 post calving accounted 4.6%.

Diarrhea and respiratory diseases increase the risk of newborn calf death (Gulliksen *et al.*, 2009). Svensson *et al.* (2006) was found the main diagnoses in calves died between 1 and 30 days of life were enteritis and pneumonia, and the probability of dying due to enteritis peaked during the second week of life. Similar results were

Tab. 1 Mortality of calves in the first seven days of life

Farm	Mean number of death per month	Standard Error	Coefficient of variation	Mortality (%) 0-7 days of life	Min. (%)	Max. (%)	p-value*
A	2.00	0.41	61.24	1.57%	0.00	3.84	0.253 ^{NS}
B	3.78	0.80	63.17	3.79%	0.00	8.70	
C	3.00	1.30	47.10	2.30%	0.00	5.00	

*According to Kruskal-Wallis test; NS – not significant (p>0.05)

Tab. 2 Causes of death of calves in the first seven days after birth

Diagnosis	% of occurrence		
	Farm A	Farm B	Farm C
Enteritis	22.22	14.71	58.06
Bronchopneumonia	27.78	79.41	-
Mors subitanea	5.56	-	-
Aplasio recti et ani	5.56	-	3.23
Septicaemia	11.11	-	-
Non-vitality	27.78	-	35.48
Asphixio	-	2.94	-
Mors per apoplexio	-	2.94	-
Traumatisacio-contusio	-	-	3.23
TOTAL	100.00	100.00	100.00

Tab. 3 The most common diseases of calves in the first month of life

Diagnosis	% of occurrence		
	Farm A	Farm B	Farm C
Omphalophlebitis	3.65	0.05	0.3
Diarrhea	4.13	-	-
Non-vitality	2.06	0.75	0.67
Sepso	6.85	-	-
Hypovitaminosis	7.12	-	8.45
Cahexio	0.8	-	0.07
Bronchopneumonia	59.88	50.06	21.13
Deformatio extremitates	0.13	-	0.07
Meteorismus	0.07	-	0.15
Enteritis	15.17	49.08	69.16
Phlegmona	0.07	-	-
Mors per apoplexio	0.07	-	-
Conjunctivitis	-	0.06	-
TOTAL	100.00	100.00	100.00

obtained in this study: at the farm C dominated enteritis as a cause of death (58.06%), at the Farm B bronchopneumonia (79.41%), and at the Farm A bronchopneumonia and mortality due to poor viability of calves (both by 27.78%). A similar situation was in terms of calf morbidity in the first month of life. At the Farm C was still the highest number of calves suffering from enteritis (69.16%), and at the farms A and B of bronchopneumonia (59.88 and 50.06%, respectively).

Newborn calves are exposed to various stressors from the environment, which can act as a trigger for the occurrence of disease. Their health is

adversely affected by weather, nutrition, exposure to infectious agents and, most significantly, by the calf's passive immune status. The most important factor for decreasing morbidity and mortality was to ensure adequate passive transfer through colostrum (Berge *et al.*, 2005). However, although the importance of colostrum for calf health and survival is generally recognized, actual practices in calf rearing do not always favor adequate colostrum intake.

In Tables 4 and 5 details of the colostrum management at three observed farms are showed.

Tab. 4 Frequency of performance of certain procedures in colostrum management

Criteria	Farm A	Farm B	Farm C
First feeding within first 4 h of calf's life	5	5	5
Monitoring of quantity ingested at first feeding	1	1	1
Feeding of at least 4 L of first-milking colostrum within first 12 h of life	1	1	1
Use of a method by means of which a controlled quantity of colostrum can be given	1	1	5
Feeding of a smaller quantity (up to 2 L) only in case of difficulty and colostrum of excellent quality; otherwise, use of esophageal feeder	1	1	1
Routine assessment of colostrum quality with a colostrometer	1	5	1
Routine supply of adequate stocks of frozen colostrum	1	5	1
Routine verification of immunity transfer	1	1	1
Routine hygiene of equipment for the preparation of colostrum and feeding	5	5	5
TOTAL	17	25	21

1 - never; 2 - rarely (a few times a month), 3 - frequently (several times a week), 4 - almost always (daily, with rare exception); 5 - always

Tab. 5 Method of performing certain procedures in colostrum management

Parameter	Farm A	Farm B	Farm C
First colostrum meal timing	up to 2 hours	2-3 hours	up to 2 hours
First colostrum meal quantity	ad libitum (up to ½ L)	ad libitum (up to ½ L)	ad libitum (up to ½ L)
Total colostrum quantity (L)	approximately 6 L	approximately 6 L	approximately 6 L
Feeding method	bucket	bucket	bucket
Alternative feeding method	nursing bottle	workers dip finger into bucket with colostrum	nursing bottle
Evaluation of colostrum quality	organoleptic	colostrometer	organoleptic
Stocks of colostrum	no	yes	no
Check of passive transfer	no	no	no

Colostrum management implies consistent providing of sufficient volume of clean, high-quality colostrum within the first few hours of calves' life. Time after birth at which colostrum is first fed is critical to determining if the calf will acquire adequate passive immunity and its ability to defend against disease. Calves that don't nurse within 2 to 4 hours after birth often die of exposure or become weak and unable to nurse and starve. If they look cold, hunched up and droopy should be suspected of not getting enough milk. Calves that have not nursed should be assisted or tube fed colostrum with a special calf feeder (Hall, 1998). Tube feeding may be also a suitable alternative in the case where newborn calves have difficulties voluntarily drinking the recommended amount.

According to Tables 4 and 5, calves on three farms received the first meal in approximately 2 h after birth, which complies to the recommendations. The calves during the first 12 h of life gets less than 4 L of colostrum (about 3 L). Weaver *et al.* (2000) consider a minimum quantity of 4 L of colostrum to ensure a sufficient absorption of immunoglobulins and subsequently reduce the risk of mortality. However, according to data by Vasseur *et al.* (2010), the amounts of colostrum fed in the first 12 h were 0.5 to 8 L, depending on the farm.

At the farms in this study the exact amount was not measured but it was estimated subjectively i.e. based on workers' experience, except at the Farm C. Vasseur *et al.* (2009a) reported that 22% of Holstein calves of 2 to 6 h of age are unable to bottle-drink 2 L of colostrum in a first meal. In this respect, the amount of colostrum offered to calves at the first meal (1/2 L) is appropriate.

Inability to calves with difficulties with ingestion the first meal provide help by esophageal feeding at the start reduces the ability to survive. However, at the large farms such as in our study it is not always possible to provide enough experienced workers to perform this operation.

Colostrum should be regularly provided for a sufficient length of time, preferably for the first three days after birth. Using only fresh colostrum and having no frozen stocks is not recommended and shows a lack of awareness of the importance of timely colostrum feeding. In this respect Farm B was in advantage compared to other two, as the colostrum is kept frozen and used when there is sufficient quantity of fresh colostrum.

The method of colostrum feeding can have an effect on calf welfare. Hänninen *et al.* (2007) showed that sucking colostrum from a teat bucket compared with drinking from an open bucket improves calf rest and sleep. No access to natural teat or artificial teat also represents a hazard for calf welfare (EFSA, 2006). Route of colostrum administration that is practiced in the studied farms, i.e. from open bucket instead teat bucket, can be an obstacle for newborn calves whose natural way of eating is by sucking. Certainly, it affects some calves to take insufficient amount of colostrum since they need more time to learn to drink from a bucket. Dipping a finger in the bucket with colostrum, as an alternative method which enables the calves to take the first meal, may adversely affects the hygienic quality of colostrum.

Evaluation of colostrum quality by colostrometer was the practice only at the Farm B. Organoleptic evaluation (Farm A and C) may not provide estimation of concentration of antibodies in colostrum and ensure provision of high-quality colostrum.

Measuring immunoglobulin concentrations in the calf's blood is the only method for evaluating passive transfer of immunity; however, this practice was not carried out in the studied farms, as well as in the study of Vasseur *et al.* (2009a). According to these authors measuring passive transfer is more frequent in the United States, particularly at larger farms.

CONCLUSIONS

Although the mortality of calves in the first week of life was relatively low, results from this paper indicate that some risks related to colostrum management in all three farms existed. Data showed that some of recommended procedures in colostrum management are not included in the regular practice of the investigated farms, which may affect the quantity and quality of colostrum that calves received were not adequate. As the major failures at most of the farms the follows can be highlighted: lack of monitoring of ingested colostrum quantity and assessment of colostrum quality with a colostrometer, lack of routine supply of adequate stocks of frozen colostrum.

In this paper all aspects of colostrum management were not discussed. However, even these results pointed on procedures in which changes should be made (continuous and accurate monito-

ring of the quantity of colostrum ingested, the use of objective methods for colostrum quality control, constantly ensuring sufficient quantities of good quality colostrum), in aim to improve health and welfare of calves, as well as production results.

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