Respiratory Diseases of Calves on Dairy Cow Farm

Jovan BOJKOVSKI¹, Dubravka MILANOV², Sara SAVIĆ², Ana VASIĆ¹, Nemanja ZDRAVKOVIĆ¹,
Dragan ROGOŽARSKI³, Nataša PROKIĆ¹, Sanja KORICA⁴

¹Faculty of Veterinary Medicine, University of Belgrade, Belgrade, Serbia

²Scientific Veterinary Institute »Novi Sad«, Novi Sad, Serbia

³Specilistic Veterinary Institute, Pozarevac, Dunavska 89, 12 Pozarevac, Serbia

⁴Union University "Nikola Tesla", Faculty for Ecology and Environmental Protection, Kosancicev venac 2, 11000 Belgrade, Serbia.

*corresponding author: bojkovskki@vet.bg.ac.rs

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Abstract. Intensive cattle breeding involves a whole series of technological processes, which should allow continued production and optimal use of production capacities. In those conditions new born calves must adapt to different environmental factors, including diet and housing conditions. Diseases of digestive and respiratory organs are the most common health problems in calves during the first months of their life. In this paper, we provide an overview of respiratory diseases of calves on a dairy farm. We monitored health status of calves on a dairy cow farm. Calves show clinical picture of respiratory diseases. In microbiological laboratory wide range of bacteria was isolated from calve lungs and nasal swabs. During one calendar year, the following bacteria were isolated from calve lungs: *Pasteurella multocida*, *Mannheimia haemolytica*, *Pasteurella* spp. *Histophilus somni*, *Haemophilus* spp, *Trueperella* (*Arcanobacterium*) *pyogenes*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Salmonella Enteritidis*, *Salmonella* Typhimurium. The total of 61 calves was diagnosed with respiratory diseases (34 male and 27 female calves). Number of dead male calves is 24 (16 male calves and 8 female calves). Calves with respiratory diseases were approximately 71.62 days old. Dead calves with pathomorphological changes on their lungs were approximately 77.25 days old. Diseases of calves on farms usually have multifactorial etiology, and the most important health disorders in calves on our farms were respiratory diseases. The occurrence of respiratory diseases is highly significant unfavorable result of microclimate conditions, hygienic accommodation and inadequate technological processes

Key words: calves, dairy farm, respiratory disease

INTRODUCTION

Respiratory system diseases in cattle belong to the groups of the economically important for cattle production. In addition to digestive tract diseases, they represent the leading causes of morbidity and mortality on high production dairy farms. On the high production dairy farms in the Republic of Serbia using tie-stall housing system, infectious diseases of the respiratory tract of the calves account for different percentage of the total mortality (Dobrić *et al.* 1999, Bugarski *et al.*, 2005; Bojkovski *et al.*, 2004, Bojkovski *et al.*, 2008). The mortality rate in the Republic of Serbia ranges between 14.3 and 50% (Šamanc *et al.*, 1990). Veterinary service has an important role in health monitoring, timely identification of the disease, establishment of etiology of infection and

application of the appropriate treatment. A disease known as enzootic pneumonia of calves and cattle is particularly important on high production dairy cow farms in the Republic of Serbia, its etiology is multifactorial and its onset is influenced by a combination of different stress factors and infectious agents (viruses, mycoplasmas and bacteria). The significance of non-infectious factors was evidenced in the experimental conditions, where respiratory syndrome was easy to induce by BHV and *Mannheimia haemolytica*, but not with other causative organisms (Rogan, 2010).

The ongoing paper presents results of a one-year monitoring of onset of the respiratory diseases of calves and cattle on cow farms, analysis of factors influencing their onset as well as type of the bacteria most commonly isolated from the

samples of nasal swabs of the diseases animals and parenchymatous organ tissues of the dead animals.

MATERIAL AND METHODS

The studies were performed on a high production dairy tie-stall housing farm. The farm had 1,000 milking cows, with average milk production of 8,000 L. Serological tests performed in adult animals as well as in calves and cattle of different ages, evidenced antibodies to viruses essential for development of enzootic pneumonia: bovine herpesvirus-1 (BHV1), parainfluenza virus type 3 (Pi3), bovine respiratory syncytial virus (BRSV) and bovine viral diarrhoea virus (BVDV). In February, June, July and August, the calves did not show any signs of any respiratory diseases. There was no mixing of different herds on the experimental farm. Great attention is paid to feeding of calves with colostrum as well as to quality of colostrum itself.

Symptoms of respiratory infections were evidenced in 61 calves (34 male and 27 female, while 24 calves died (16 male and 8 female). Average age of the disease and dead calves was 71.62 days and 77.25 days, respectively. For isolation of bacteria, nasal swabs were obtained from the sick calves and lung tissue samples from the dead calves.

Microbiological tests: Nasal swabs and parenchymatous tissue smears were microbiologically processed immediately after arrival to the laboratory. Isolation of bacteria was performed using the following: Columbia blood agar base (Oxoid, Basingstoke, UK, CM0331) with 5% defibrinated ovine blood and MacConkey agar (Oxoid, CM0007). For isolation of species from *Haemophilus* (except *H. somni*) and *Actinobacillus* genera, factors V and X were used (Oxoid, diagnostic disc). The plates were simultaneously incubated under aerobic and microaerophilic conditions (5-10 per cent CO₂) at 37°C for 2-3 days, and they were examined for bacterial growth every day.

Isolate identification was performed based on the colonial appearance, microscopic appearance (Gram-stained preparations), catalase and oxidase tests and biochemical properties as stated in Quin *et al.* (1998). Biochemical and serological verification of *Salmonella* isolates was performed according to SRPS EN ISO 6579:2008.

RESULTS AND DISCUSSION

Inappropriate passive immunity, exposure to adult animals, poor ventilation, overcrowded housing facilities, wide temperature variations, transportation and other stress factors may lead to development of respiratory infections. Group calf housing contributes to spreading of infections with inhalation being the major transmission pathway of respiratory infections. Clinical signs of pneumonia include nasal discharge, elevated body temperature, decreased appetite and breathing disorders. Administration of antibiotics is necessary however, the results are frequently disappointing. Complete recovery is rare in calves with chronic respiratory infections. Due to the significance of the respiratory system diseases for growth and future productivity of dairy cows, early identification of causes and treatment are of the utmost importance, with elimination of the risk factors being the imperative (Broom, 1991, Bugarski *et al.*, 2005, Radojičić *et al.*, 2014). The most frequent bacterial infections of the respiratory system in calves on the farms in the Republic of Serbia are caused by the following bacteria: *Pasteurella multocida*, *Mannheimia haemolytica*, *Trueperella* (*Arcanobacterium*) *pyogenes*. In very young calves, *Streptococcus*, *Pseudomonas aeruginosa* and *Haemophilus somni* are of the highest importance (Radojičić *et al.*, 2014). The following bacteria were isolated on the high production dairy farm included in the experiment: *Pasteurella multocida*, *Mannheimia haemolytica*, *Pasteurella* spp., *Histophilus somni*, *Haemophilus* spp., *Trueperella* (*Arcanobacterium*) *pyogenes*, Nocardioform microorganisms, *Pseudomonas aeruginosa*, *Salmonella* Enteritidis, *Salmonella* Typhimurium (Table 1 and Graph 1). Table 2 presents ratio of sick and dead calves during a calendar year, revealing that major health problem is encountered during the cold days. Graph 2 represents changes in the number of calves within a calendar year. We have studied the ratio of number of dead male and female calves within a calendar year (Table 3). Graph 3 represents changes in number of sick calves within a calendar year. Age of the sick and dead calves expressed in days within a calendar year is presented in Table 4. Graph 4 gives changes in number of dead calves within a calendar year.

Synergistic bacterial and viral actions are also important for onset of respiratory diseases in

Tab. 1. Results of bacteriological examination of nasal swab samples obtained from the sick calves and parenchymatous tissues of the dead calves

Type of isolate	Number of isolates
<i>Pasteurella multocida</i>	17
<i>Mannheimia haemolytica</i>	7
<i>Pasteurella</i> spp.	8
<i>Histophilus somni</i>	5
<i>Haemophilus</i> spp.	5
<i>Trueperella</i> (<i>Arcanobacterium</i>) <i>pyogenes</i>	13
<i>Escherichia coli</i>	12
<i>Klebsiella pneumoniae</i>	2
Nocardioform microorganisms	3
<i>Pseudomonas aeruginosa</i>	4
<i>Salmonella</i> Enteritidis	1
<i>Salmonella</i> Typhimurium	1
Total number of isolates	78

Fig. 1. *Klebsiella pneumoniae* mucoid colonies on MacConkey agar (left) and *Pasteurella multocida* on blood agar (right), isolates from the lung tissue of dead calves

Fig. 2. Results of bacteriological examination of nasal swabs obtained from sick calves and parenchymatous tissues obtained from dead calves originating from high production dairy tie-stall housing farm A

Tab. 2. Ratio of sick and dead calves originating from high production dairy tie-stall housing farm A according to months within a calendar year

Month	Number of calves	Number of sick calves	% of sick calves with respect to number of calves	Number of dead calves	% of dead calves with respect to number of sick calves	% of dead calves with respect to number of calves
January	413	7	1.69	1	14.28	0.24
February	0	0	0	0	0	0
March	412	6	1.45	2	33.33	0.48
April	396	2	0.50	1	50.0	0.25
May	399	5	1.25	2	40.0	0.50
June	0	0	0	0	0	0
July	0	0	0	0	0	0
August	0	0	0	0	0	0
September	462	7	1.51	6	85.71	1.29
October	421	14	3.32	6	42.85	1.42
November	400	9	2.25	2	22.22	0.50
December	389	11	2.82	4	36.36	1.02
Total	2896	61		16

Fig. 3. Changes in number of calves in the experiment within a calendar year.

Fig. 4. Changes in number of sick calves within a calendar year

Fig. 5. Changes in number of dead calves within a calendar year

Tab. 3. Sex ratio of sick and dead calves originating from high production dairy tie-stall housing farm A

Month	I	II	III	IV	V	VI	VII	VIII	IX	X
January	7	5	71.42	2	28.57	1	-	-	1	100.0
February	-	-	-	-	-	-	-	-	-	-
March	6	4	66.66	2	33.33	2	2	100	-	-
April	2	1	50.00	1	50.00	1	1	100	-	-
May	5	3	60.0	2	40.00	2	2	100	-	-
June	-	-	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-	-	-
September	7	3	42.85	4	57.15	6	3	50.0	3	50.0
October	14	7	50.0	7	50.0	6	5	83.3	1	16.66
November	9	14	44.44	5	55.55	2	-	-	2	100.0
December	11	7	63.63	4	36.36	4	3	75.0	1	25.0
Total	61	44		27		24	16		8	

I total number of sick calves II number of sick male calves; III % of sick male calves with respect to total number of the sick calves; IV total number of sick female calves; V % of sick female calves with respect to total number of sick calves; VI number of dead calves, VII Dead male calves VIII % of dead male calves with respect to total number of dead calves; IX dead female calves; X % of dead female calves with respect to total number of dead calves

Tab. 4. Age of sick calves originating from high production dairy tie-stall housing farm A

Month	Age of sick calves in days
January	81
February	0
March	80
April	71
May	62
June	0
July	0
August	0
September	71
October	63
November	64
December	81
Average age	71.62

Tab. 5. Age of dead calves originating from high production dairy tie-stall housing farm A in days

Month	Age of dead calves in days
January	85
February	0
March	103
April	79
May	51
June	0
July	0
August	0
September	77
October	58
November	78
December	87
Average age	77.25

calves, particularly in overcrowded facilities with poor microclimate conditions (low temperature and high humidity, high concentration of ammonia and draft) as well as in animals with impaired immunity. Infection of airways is a constant problem associated with seasonal flaring, particularly on the farms where zoohygienic measures are not properly performed. (Bugarski *et al.* 2005)

Wellbeing of calves related to housing conditions is most frequently compromised by inadequate ventilation, air flow and temperature as well as exposure to pathogenic microorganisms and parasites. In addition to information on housing conditions, in order to obtain full picture on wellbeing of the animals, feeding and certain management procedures must be also taken into account, such as method of watering or weaning of calves. Analysis of potential risks for wellbeing of farm animals points out to the possible cause of already present health-related and other problems in calves, as well as to the problems that may appear in the future (Relić and Bojkovski, 2010).

Viruses, bacteria and mycoplasmas (*Mycoplasma bovis*) are implied as the most common causes of diseases of the respiratory organs (Bugarski *et al.*, 2005). Pathogenic effects of viruses and mycoplasmas favor subsequent pathogenic effects of the bacteria.

Bojkovski *et al.* (2011) reported that the most common isolates from the nasal swabs obtained from calves affected with respiratory infections were the following: *Pasteurella multocida*, *Mannheimia haemolytica* (*Pasteurella haemolytica*), *Trueperella* (*Arcanobacterium*) *pyogenes*, *Haemophilus* spp., as well as *Klebsiella pneumoniae*. Investigations presented in the paper confirmed earlier conclusion that *Pasteurella multocida* was the most predominant cause of respiratory diseases in calves originating from high production tie-stall housing dairy farms.

Namely, it has been known that calves are prone to cardiorespiratory and metabolic disorders that may be diagnosed as early as during the first several weeks of life. The reason for the above lies in incompletely formed organisms of the newborn calves, and accommodation to the extrauterine way of life must be rather fast in conditions of the contemporary beef cattle production (Bugarski *et al.*, 2005, Radojičić *et al.*, 2014).

Calf vitality may be influenced by mistakes made in management of pregnancy, particularly

those related to feeding of cows during the last third of pregnancy (Radojičić *et al.*, 2014).

CONCLUSION

Etiology of calve diseases in intensive breeding is most commonly multifactorial, with respiratory diseases being the most important health-related problems on our farms.

On a tie-stall housing farm the following bacteria were isolated in calves within a calendar year: *Pasteurella multocida*, *Mannheimia haemolytica*, *Pasteurella* spp, *Histophilus somni*, *Haemophilus* spp, *Trueperella* (*Arcanobacterium*) *pyogenes*, *Escherichia coli*, *Klebsiella pneumoniae*, *nocardioform microorganisms*, *Pseudomonas aeruginosa*, *Salmonella* Enteritidis, *Salmonella* Typhimurium. Intensive breeding of calves requires continuous monitoring of their health status and appropriate application of veterinary-prophylactic, hygienic-sanitary and zootechnical measures.

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