

From a healthy calf to a performing cow: a case-control study



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SUMMARY

A dairy herd must be considered an integrated production unit. From newborn calves to milking cows, animal health status is pivotal to get satisfactory economic results. The neonatal phase of calves is a period of life that needs extra care due to their vulnerability. Diarrhea is considered the main pathology affecting newborn calves. Conversely, respiratory disease is the main cause of losses after sixty days of life. The present study aimed at assessing the impact of neonatal diarrhea on growth, milk productivity and health status in a selected population of dairy cattle. A case-control study involving 300 calves from 5 large dairy herds located in the Po Valley (Italy) was carried out. All animals received live-modified or inactivated, monovalent or combined vaccines for immunization to *Bovine Herpesvirus 1* (BoHV-1), *Bovine Viral Diarrhea Virus* (BVDV) and *Bovine Respiratory Syncytial Virus* (BRSV). Particularly, most calves were administered with IBR marker and BRSV vaccines by intranasal route as priming immunization treatment. The enrolled animals were divided in two groups, each consisting of 150 calves. In the group A (cases) were included the animals experiencing severe neonatal diarrhea. Conversely, the group B (controls) included calves showing no clinical signs of neonatal enteritis. The animals were monitored in order to measure the body weight at birth, 6 and 15 months of age and milk production. Moreover, mortality rate and incidence of respiratory disease episodes during life were recorded. Animals of Group A showed a lower body weight at 6 and 15 months of age and a significant loss of milk production compared to those of the Group B. Moreover, incidence of respiratory disease and relapses were significantly higher in Group A. Results support the thesis that neonatal enteritis has a negative impact on weight gain during the grow period, milk production and is related to severe respiratory disease onset.

KEY WORDS

Neonatal enteritis; respiratory disease; productive performances.

INTRODUCTION

Like any industrial enterprise, the main target of bovine dairy industry is the economic sustainability as well. This implies the production of a sufficient amount of milk to guarantee an acceptable income for the farmer. A dairy herd must be considered an integrated production unit. From newborn calves to milking cows, animal health status is pivotal to get satisfactory economic results. The neonatal phase of calves is a period of life that needs extra care due to their vulnerability⁶. This period, defined as the time interval from birth to 28 days of age, is especially important from a health point of view, as ap-

proximately 75% of losses in young calves occur at this stage, and the first week of life is considered the most critical period, with 50% of losses³. Diarrhea is considered the main pathology affecting newborn calves. Conversely, respiratory disease is the main cause of losses after sixty days of life. In many cases, respiratory disease episodes occur in animals previously showing neonatal diarrhea⁸. Microbial and extramicrobial factors combine to trigger neonatal diarrhea. In particular, the Failure of Passive Transfer (FPT) status is considered the main extramicrobial factor predisposing to the occurrence of neonatal diarrhea but also to infectious diseases in the latter stages of life⁷. The problem is widespread in dairy cattle industry. Regarding the domestic situation, a survey carried out in newborn calves belonging to 85 Italian Friesian herds with high milk production (≥ 11000 kg/cow/lactation) showed a FPT mean prevalence of 35%. In addition, 17% of colostrum samples suffered from a deficit of IgG. No significant difference was demon-

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strated for colostrum immunoglobulin content in relation to cow parity². The present study aimed at assessing the impact of neonatal diarrhea on growth, milk productivity and health status in a selected population of dairy cattle.

MATERIALS AND METHODS

A case-control study was performed on a total of 300 newborn calves enrolled from 5 large dairy herds, located in the Po Valley (Italy). All the animals resulted negative to IDEXX SNAP BVDV Antigen test devoted to detection of *Bovine Viral Diarrhea Virus* persistently infected (PI) animals. Calves were located in single pens or hutches for the first sixty days of life. No calves received any colostrum replacer. Fifty-five out of 300 calves were treated orally against *Cryptosporidium parvum* at birth. Depending on the cases, the animals were submitted to different immunization regimens. All animals received live-modified or inactivated, monovalent or combined vaccines for immunization to *Bovine Herpesvirus 1* (BoHV-1), *Bovine Viral Diarrhea Virus* (BVDV) and *Bovine Respiratory Syncytial Virus* (BRSV). Particularly, most calves were administered with IBR marker and BRSV vaccines by intranasal route as priming immunization treatment.

Based on the health status in the neonatal period, calves were enrolled and assigned to one of two groups (A or B), each consisting of 150 calves. Group A (cases) included animals experiencing severe (needing antibiotic therapy) neonatal diarrhea.

Conversely, group B (controls) included calves that did not showed clinical signs of neonatal enteritis. All animals were observed in order to record body weight at birth, at 6 and at 15 months of age. Additionally, they were monitored throughout their productive life to measure the average milk yield per lactation. Furthermore, mortality rate and prevalence of respiratory disease episodes, involving single animals and requiring anti-inflammatory and antibiotic treatments, were recorded. Two or more severe (needing anti-inflammatory and antibiotic therapy) respiratory disease episodes occurring in the same animal and in absence of a respiratory disease outbreak were evaluated as relapses due to reactivation of silent foci of pneumonia. Results were submitted to the analysis of variance by using the software IBM SPSS v28 (IBM Corp. Released 2020. IBM SPSS 240 Statistic for Windows, Version 28.0. Armonk, NY: IBM Corp). The Chi-square test was performed to compare mortality and morbidity data.

RESULTS

Data regarding body weight and milk yield in Group A and B are reported in Table 1. The animals of the Group A (cases) compared to those of the Group B had similar body weight at birth but differed for this parameter at 6 and 15 months of age on average by 8.77 and 5.15%, respectively. Regarding milk yield, overall group A suffered a mean loss of 760 Kg of milk/cow, corresponding to 350-450 euro/cow, in relationship to milk pro-

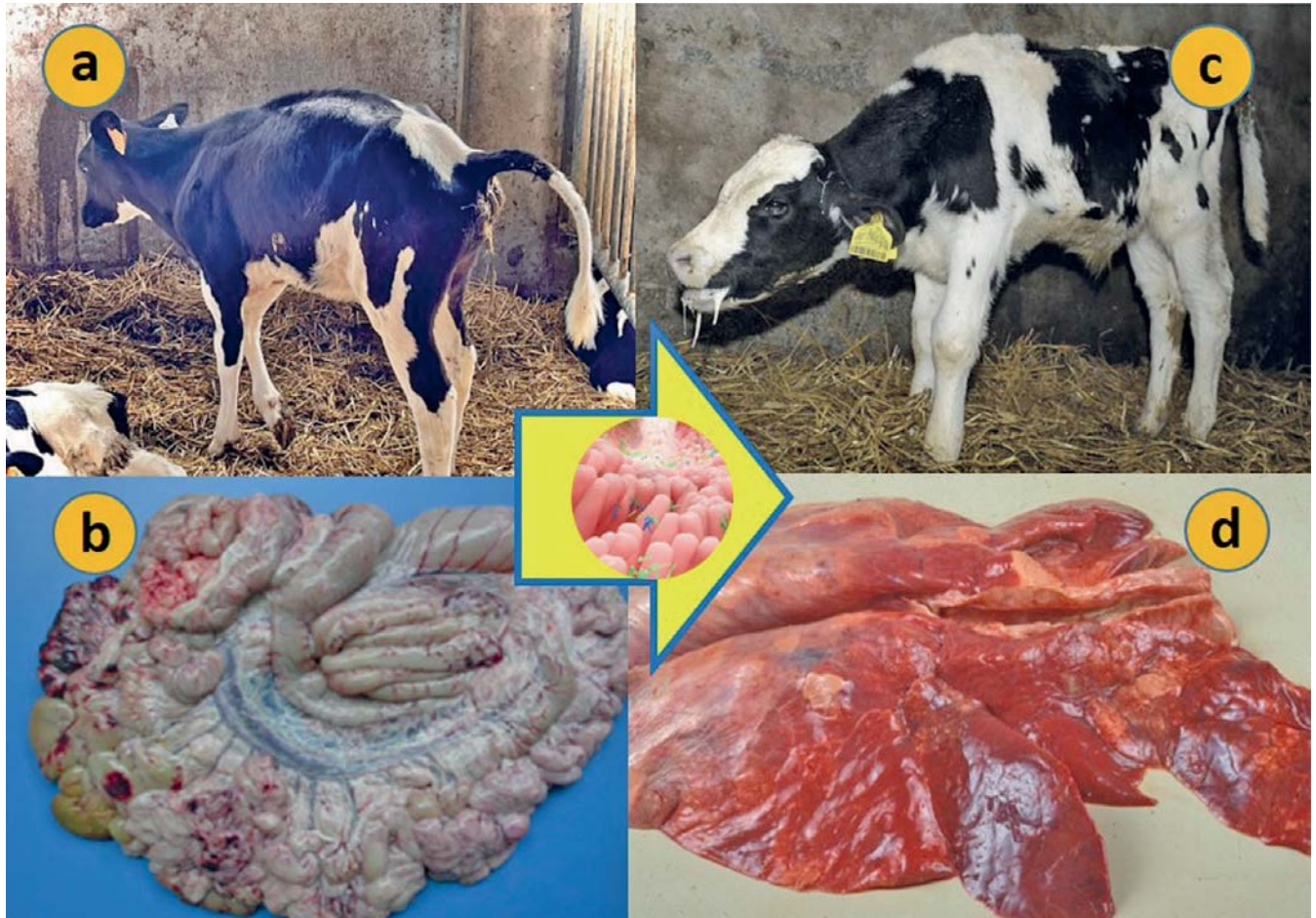


Figure 1 - Calf pneumonia (c, d) caused by microbial pathogens translocation from the gut with enteritis (a, b) to the lung through blood-stream route.

ductive destination. Calculation did not consider losses due to mortality and costs for therapy of respiratory disease episodes. Mortality rate and incidence of respiratory disease were respectively 8.67% and 30.67% in Group A vs 4.67% and 20.67% in Group B. Mortality rate was similar between groups, while respiratory disease incidence was significantly different ($P < 0.05$). Among respiratory disease episodes, 45% in Group A showed a relapsing character vs 21% in Group B ($P < 0.05$). In addition, data showed that overall 60% of respiratory disease episodes occurred during the first 6 months of age.

DISCUSSION

Results support the thesis that severe neonatal enteritis has a negative impact on weight gain during the growth period and on milk production. As previously demonstrated, preweaning diseases, namely enteritis and/or respiratory disease, elicits long-term negative effects on milk production¹. However, the impact on critical reproductive performance indicators and reproductive performances still remained uncertain¹. FPT plays an important role in the pathogenesis of neonatal enteritis, favouring viral, bacterial and parasitic infection and related pathogenic effect. Despite this parameter was not investigated in the present study, it's widely accepted that an IgG concentration < 800 mg/100 ml of blood serum in 3-10 day old calves is considered an index of a FPT status⁹. Regarding the origin of FPT, poor management of colostrum feeding has been widely accepted as the main cause of the problem. However, as reported above, a non-negligible number of dairy cows produce low-

Table 1 - Comparison of Body Weight and Milk Yield in animals belonging to Group A and Group B.

	Group A	Group B
Body Weight (Kg)		
at birth	47.6 ± 4.2	47.2 ± 3.8
at 6 months	182.5 ± 32.0	198.5 ± 23.0*
at 15 months	360.8 ± 32.4	379.4 ± 21.0*
Milk Yield (Kg)	11720 ± 425	12480 ± 346**

* $P < 0.05$, ** $P < 0.01$

quality colostrum (IgG < 50 mg/ml)⁴. To cope the problem, a useful tool could be the creation of a colostrum bank, collecting and freezing "good" quality colostrum aliquots. In this case, adoption of effective hygienic measures to avoid microbial contamination of stored colostrum must be considered pivotal. Animals affected by diarrhea showed a higher incidence of respiratory disease in later life periods. Impairment of enteric barrier triggers a microbial (mainly bacteria) translocation from gut to bloodstream and then to different organs, including lung (Fig. 1). Isolation of enteropathogenic bacteria, mainly *Escherichia coli* and *Salmonella* spp., from lung specimens of calves which experienced enteritis support this pathogenetic hypothesis. Furthermore, the anatomy of bovine lung (8 lobes, absence of interalveolar pores, presence of interlobular septa) hampers the microbial clearance, promoting persistence of silent foci of bacterial infection which can reactivate during the productive life causing the onset of relapsing respiratory episodes⁵ (Fig. 2).



Figure 2 - Respiratory relapse in an adult cow.

CONCLUSIONS

Since severe neonatal enteritis affects health, growth and production of dairy cattle, disease control is the first step to support dairy farm sustainability. Following the mantra “*prevention is better than cure*”, vaccination of dam during the dry period should be included in the protocols to cope neonatal enteric disorders. However, if a FPT status persists, even in presence of an effective maternal immunization, prevalence and seriousness of neonatal enteritis often persists as well. Consequently, the farmer’s feed-back could be: “*this vaccine doesn’t work*” or, even worst “*vaccination practice doesn’t work at all*”. To avoid that, it’s pivotal to detect the origin of FPT in the herd, setting up possible solutions to the problem. But, it’s not so easy to get.

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