MONITORING THE NEONATAL PERIOD IN CALVES

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Abstract
Recommended targets for the neonatal period are "S.M.A.R.T." (farm-specific, measurable, attainable, realistic and time-based) and these will need adjusting for individual herds over time. The indices to monitor neonatal calf health are focused primarily on colostrum management and survival rates in the first 24 hours of life. The two main disease implicated with morbidity and mortality in young stock are diarrhea and pneumonia. Mortality rates and disease incidence in young stock are extremely variable between farms, and this is an area in which the herd health advisor can have an influence on cow welfare and herd productivity. If the rate of perinatal calf mortality is above target, calving management should be reviewed and discussed with farm staff. Vaccination of cows in the last trimester of pregnancy can be useful in providing immunoglobulins in colostrum against certain diseases, but cannot replace excellent hygiene and husbandry in the neonatal period. The cost of disease are difficult to quantify but are linked to a reduced growth rate and increased mortality rate. Initial value of the calf is around 200-250 EUR, but total cost from birth to 12 weeks age is about 350-400 EUR. For this reason prevention and control of diarrhea and pneumonia needs to be a primary focus during the pre-weaned period as well as the provision of adequate nutrition.
Key words: *management, calf, colostrum, diarrhea and pneumonia*

Introduction

Youngstock are often observed less frequently than adult cows by both veterinary advisors and farm staff resulting in delayed disease detection and treatment. The indices to monitor neonatal calf health are focused primarily on colostrum management and survival rates in the first 24 hours of life. Mortality rates and disease incidence in young stock are extremely variable between farms, and this is an area in which the herd health advisor can have a major influence in cow welfare and herd profitability (Breen et al.,2012). The two main disease processes implicated with morbidity and mortality in youngstock are diarrhoea and pneumonia. The cost of youngstock disease are difficult to quantify but are linked to a reduced growth rate and increased mortality rate (Andrews et al., 2000). Losses associated with youngstock continue through the growth period and into the first lactation.

Materials and methods

Monitoring calves in the neonatal period was done in two farms (farm A with about 700 Holstein and Fleckvieh Simmental cows and farm B with 50 Fleckvieh Simmental cows) from the north east of Romania.

The indices were focused primarily on colostrum management, survival rates, incidence rate of navel ill, incidence rate of neonatal diarrhea, incidence rate of respiratory disease, growth rate, and approximate floor area, to monitor calf health in the neonatal period.

Results and discussions

The targets for the neonatal period are "S.M.A.R.T." (farm-specific, measurable, attainable, realistic and time-based) and these will need adjusting for individual herds over time (Breen et al.,2012).

The characteristics of the farms are: milk production, feed analyses performed irregularly, artificially insemination, cows moved to the maternity pen 2 weeks before calving, inconstant assisted calving, calves are not left with their dams, navel is usually sprayed with iodine solution, calves that appear to fail to begin respiration are rubbed with straw over the chest.

Recommended targets for monitoring the neonatal period are: stillbirth (born dead, lungs not inflated), perinatal calf mortality (losses in the first 24 h of calves born live), assessment of passive transfer (colostrum quality, refractometer, serum γ-glutamyl transferase, radial immunodiffusion assay and zinc sulfate turbidity test), diseases (navel ill, diarrhoea, respiratory disease), growth rate, housing (Table 1).

Table 1.

Targets for monitoring the neonatal period in calves

Herd monitor	**Farm A**	**Farm B**	**Target** (Breen et al.,2012)
Stillbirth (%)	4	2	<2
Perinatal calf mortality (%)	14% H 21% FS	8	<2
Colostrum quality	not measured	not measured	>1.05
Refractometer-plasma protein (g/L)	not measured	not measured	>65
Serum γGT (IU/L)	not measured	not measured	>75
Radial immunodiffusion assay (mg/dL)	not measured	not measured	>1000 (IgG); >80 (IgM) >22 (IgA) Values at >48 h old
Incidence rate of navel ill	15%	5%	<0.05 cases/calf during the rearing period
Incidence rate of neonatal diarrhea	30% H 40% FS	10%	<0.08 cases/calf during the rearing period
Incidence rate of respiratory disease	20% H 20% FS	10%	<0.05 cases/calf during the rearing period
Growth rate (g/day)	Approx. 600	Approx. 700	750
Approximate floor area (m^2)	Individual pen (on straw) outside	4 (grouped pens, on straw), inside	>3
Relative humidity (%)	not measured	not measured	50-80

H- Holstein; FS- Fleckvieh Simmental

Stillbirth represent the calves born dead with the lungs not inflated. Perinatal calf mortality is usefully expressed as a monthly incidence rate (number of cases per cow calving per month) and represent losses in first 24 h (calves born live to cows calved >260 days gestation). Farm A has the highest values regarding the stillbirth and perinatal mortality and the biggest losses (21 %) was at Fleckvieh Simmental calves.

The main risk factors for perinatal calf mortality (PCM) are: gender (PCM is greater in male compare with female); calving assistance (PCM decreases with greater assistance); PCM increases with twin compared with single calves; season (PCM is lower summer); a previous PCM event means that PCM is 4 times more likely in that cow; the sire predicted transmitting ability for PCM; parity interactions (PCM is higher in primiparous than multiparous cows, is greater in twins born to heifers than twins born to older cows, is increased with low age at calving in primiparous cows); duration of second stage labour (PCM is significantly greater if the duration of second stage labour exceed 120 min) (Gundelach et al., 2009, Mee, 2007).

In both farms potential causes of perinatal death are: excessive body condition of dams at time of calving; inadequate prepartum and intrapartum observation; dystocia followed by risky extractions; infectious diseases of dams; mineral deficiency. Excessive body condition can lead to

prolonged delivery time and subsequently to perinatal death. Also, limited labor resources combined with inadequate facilities are largely to blame. Dystocia may be caused by heavy birth weights, narrow pelvic diameter, insufficient dilatation of the cervix and abnormal fetal position. Dystocia is often followed by forced extraction which can lead to calf and dam trauma. Neither history nor clinical examinations of dams revealed evidence of infectious processes that can be implicated in the perinatal deaths. Further investigation about infectious causes can be performed to rule out bovine viral diarrhea virus, *Leptospira*, *Listeria* and *bovine herpes virus type 1*. Regarding mineral deficiencies, there are no farm data available at this time to support a mineral deficiency hypothesis. A study in UK reported an average perinatal calf mortality rate of 8% from 19 herds (Brickell et al., 2008). Other research has reported 9.3% perinatal calf mortality rate in Germany over one year from 46 herds (Hoedemaker et al., 2010). In a Danish study that conducted a genetic analysis of calf and heifer losses on more than 840000 calves and heifers born between 1998 and 2007 was found lower mortality rates of 3.2% (first month of life) and 2.7 % (months 1-6) (Fuerst-Waltl and Sorensen, 2010).

Colostrum quality should be measured at the first or second milking from all cows by using a hydrometer (colostrometer). A hydrometer can be used to assess the level of IgG in colostrum through measurement of specific gravity (figure 1). Only colostrum in which the density meter floats to the market green area (specific gravity 1.035-1.075) should be used to feed calves (Breen et al.,2012). Vaccination of cows in the last trimester of pregnancy can be useful in providing immunoglobulins in colostrum specifically against certain diseases (*Escherichia coli K99*, rotavirus, coronavirus, clostridial diseases and *Salmonella spp*.). Enhancing specific immunoglobulins in colostrum by this method is particularly useful for control of calf diarrhea (Breen et al.,2012).

Fig.1. Colostrometer, green area

Refractometer measures total plasma protein. The test may give false positive values if a calf is dehydrated. Serum γ-glutamyl transferase can be used indirectly to assess passive transfer because the level in colostrum is about 300 times that of dam s serum. This is absorbed in the small intestine of the calf in the first 24-30 h of life (Breen et al.,2012). Radial immunodiffusion assay is considered the best test for measurement of serum levels of Ig. Serum IgG levels provide a prediction of the probability of survival when used on a group. Optimal measurement accuracy is acquire if the test is performed within the first week of life (ideally between 24 and 48 h of age), because after 8 days of age, calves can synthesize significant amounts of Ig (Breen et al.,2012). The most common test is zinc sulfate turbidity. It is a good correlation between zinc sulfate turbidity test and total serum Ig. The specificity and sensitivity alter with the concentration of the test solution.

None of the two farms uses the assessment of passive transfer (colostrometer, refractometer, serum γ-glutamyl transferase, radial immunodiffusion assay and zinc sulfate turbidity test).

The health and well being of calve is very important. It is common for national organizations to produce laws or recommendations for cows welfare that include youngstock. Exemples in Romania include Ord. ANSVSA No. 72/2005, Ord. ANSVSA No. 75/2005, HG No. 984/2005, Regulation (EC) No. 767/2009 of the European Parliament and of the Council. It is essential that codes relevant to an individual farm are adherent to. For dairy calves the most common health issues arise from enteric and respiratory disease in neonatal period.

The calf should be separated immediately from her mother and transported to a clean and dry hutch to minimize transfer of infectious agents. This is important to prevent diarrhea caused by bacteria (*E.coli, Salmonella, Clostridium*), viruses (Rota, Corona, BVD-MD) and Protozoa (*Eimeria* and *Cryptosporidiae*) (Anton and Solcan, 2017). Neonatal calves infected with virulent enterotoxigenic *E.coli* during the first 24 hours after birth are very susceptible to develop diarrhea and possibly septicemia.

On both farms the disease rates (diarrhea and respiratory disease) are over the target despite the fact that the calves are separated immediately from their dams. A 3 year study of 135 dairy herds in Norway reported low incidence rates for diarrhea and respiratory disease in the first 180 days of life (3.8 and 2.9%, respectively; Gulliksen et al., 2009). Calves from farm A have higher incidence rate of respiratory disease than farm B. Studies showed that a diagnosis of pneumonia in the first 6 months results in reduced growth rates, decreased future milk production, fertility and increased probability of mortality (Virtala et al., 1996; Warnick et al., 1997; Donovan et al., 1998). The most critical period for respiratory disease in calves is between the second and tenth month of life. The most common infectious agents are: *Bovine Respiratory Syncitial Virus, Para Influenza-3 Virus, Bovine Herpes Virus , BVD-MD, Mycoplasma spp., Pasteurella spp., Salmonella spp., Haemophilus spp*.. Among the risk indicators associated with an increased risk of pneumonia are: poor colostrum feeding method, night time feeding, poor navel desinfection, farm size, housing conditions, floor type. Farm A has the higher incidence rate of navel ill than farm B most likely due to less rigorous disinfection. A Swedish study on calf morbidity in 3081 calves in the first 90 days of life in 122 dairy herds found the incidence rate of disease (in cases per calf-months at risk) to be: arthritis (0.002), diarrhea (0.035), omphalophlebitis (navel ill 0.005), respiratory disease (0.025) (Svensson et al., 2003).

Almost all herds are positive for Cryptosporidium and about 50% of all calves at any point in time from 1 to 3 weeks of age will be positive for the organism so the goal is not to eliminate the pathogen but to control or manage the disease. Due to resistant nature of the Cryptosporidium oocysts it is virtually impossible to eliminate the disease from a herd (Moore, 1989). Oocyst of *Cryptosporidium* and *Eimeria spp.* are resistant to many commonly used farm disinfectants and their removal can be difficult to achieve through management of the environment alone, particularly in more intensive continuous rearing systems. The studies suggest that if halofuginone lactate is used as a preventive treatment for cryptosporidiosis, it should be combined with hygiene measures and improved environmental management (Silverlas et al., 2009; De Waele et al., 2010; Trotz-Williams et al., 2011).

The growth rate reflects the overall outcome of management and husbandry. On farm A calves have smaller growth rate than farm B. A clinically anemic calf exhibits depressed appetite, reduce efficiency of body weight gain and greater susceptibility to disease, which it might explain the smallest growth rate in calves from farm A.

Relative humidity is the most important factor influencing pathogen survival in aerosols. Relative humidity between 60 and 75% results in the shortest survival time for the greatest number

of potential pathogens. Its effects varies greatly between pathogens, some survive best in humid conditions and other in dry air. None of the two farms measure relative humidity. Kelly et al. (1984) reported a higher incidence of scours but not of respiratory disease in 95% relative humidity housed calves compared to 75%. The goal of calf housing (outside/inside barn housing) is to create a dry, draft free micro environment that facilitates good disease control, manure handling and labor efficiency practices especially in winter time.

The cost of disease are linked to a reduced growth rate and increased mortality rate (Andrews et al., 2000). Initial value of the calf is around 200-250 EUR. Total cost from birth to 12 weeks age is about 350-400 EUR. The estimation of a calf rearing cost calculation for the first 12 weeks include: milk powder (calf requires 5L/day at 10% concentration, weaned at 7 weeks), calf starter mix (0.75 kg/day until weaning, 2.5kg/day until 12 weeks), barley straw (feeding and bedding, 100kg/calf until 12 weeks age), mortality rate (most calf deaths in the first week of live) and veterinary and medical spend (Breen et al., 2012).

The following recommendations should be implemented in the two farms: better record keeping system that includes recording of heifer growth, disease event information; necropsy examinations of perinatal death cases; monitoring and management of body condition score; nutritional management program specific to stage o lactation (early, mid and late lactation); improve general hygiene practices and the infectious disease control program (immunization protocol, quarantine of newly purchased animals, isolation of clinical disease cases).

Conclusions

Prevention and control of diarrhea and pneumonia needs to be a primary focus during the pre-weaned period as well as the provision of adequate nutrition.

Proper management during the neonatal period can markedly reduce morbidity and mortality, whereas improper management will lead to economic losses from increased cost of veterinary intervention, death losses, growth retardation and suboptimal reproductive performance.

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