ISSN: 2688-822X
DOI: 10.33552/AAHDS.2018.01.000502
Archives of
Animal Husbandry & Dairy Science
Iris Publishers

Case Report

Prevention of Milk Fever: A Herd Health Approach to Dairy Cow Nutrition

Nese Kocabagli*

Department of Animal Nutrition and Nutritional Diseases, Faculty of Veterinary Medicine, Istanbul University-Cerrahpasa, Turkey

***Corresponding author:** Nese Kocabagli, Department of Animal Nutrition and Nutritional Diseases, Faculty of Veterinary Medicine, Istanbul University-Cerrahpasa, TR-34320 Istanbul, Turkey.

Received Date: September 27, 2018

Published Date: October 12, 2018

Abstract

Milk fever (parturient paresis-hypocalcemia), a metabolic disease, affects high producing dairy animals usually within one or two days after calving, resulting in a huge reduction in milk production. Therefore, the disease becomes economically important. Hypocalcemia can also be a cause of acidosis, ketosis, mastitis, retained placenta, displaced abomasum and metritis. This article presents a practical, on-farm approach for the prevention of milk fever in dairy cattle.

Keywords: Dairy cows; Milk fever; Nutrition

Introduction

The large increase in milk yield and the structural changes in the dairy industry of the world have caused major changes in the management and feeding of dairy cow. This increase has led to the development of a sustainable herd of health consciousness. Veterinarians working in such cattle farms have begun to realize the importance of preventive medicine services in terms of effective herd health management in order not to consider themselves as a physician dealing with treatment alone. Herd health and production management program represent the first level to optimize dairy farm performance. One of the most important keys to optimize performance is nutrition. There are a few diseases in dairy cattle which occur due to improper feeding or nutritional management. Milk fever is one of such disorders which occurs due to faulty feeding practices during the pregnancy and/or immediately after calving of dairy cattle [1-3]. Milk fever can also be called the "gateway disease" as it increases the risk of other diseases such as acidosis, ketosis, mastitis, retained placenta, displaced abomasum and metritis [4]. De Garis & Lean [5] have reported that the incidence of hypocalcemia in dairy cows is 3.45% in North America, 6.17% in Europe, and 3.5% in Australia [5]. The economic losses caused by milk fever have been reported as 334 USD for each case including the estimated production losses and treatment costs [6]. However, losses from subclinical hypocalcaemia are estimated to be several times more than clinical cases in a herd [7]. Therefore, prevention of milk fever or subclinical hypocalcaemia in periparturient animals has significant importance in finance and welfare.

Milk fever (hypocalcaemia) is caused by the disturbance in "Ca homeostasis". Mainly three factors influence calcium homeostatic mechanism:

a. Excessive loss of Ca++ in the colostrum beyond the capacity of absorption from intestine,

b. Impairment of absorption of Ca++ from intestine at parturition, and

c. The slowness of the mobilization of Ca++ from storage in skeleton that leads to problems in maintaining normal serum levels [8].

The key to prevention of milk fever is management of a close-up dry cow or management during late pregnancy. The traditional way of preventing milk fever is to limit Ca intake during the dry period. Several methods have been proposed to prevent milk fever. These include: regulation of the ratio of rations Ca and phosphorus (P), feeding the animals with different mineral salts, vitamin D, metabolites or synthetic analogues, intramuscular and intravenous parathyroid hormone (PTH)applications and increasing the rate of ration acidity [9] (Table 1).

Table 1: Nutritional factors responsible for milk fever [16].

	Factor	Effect
1	General nutritional status at prepartum period	Increases K-pasture, over fat cow and very thin cows
2	Reduction in feed intake on day of calving	Reduction in Ca intake and absorption
3	Increase in Ca intake prepartum	Increase in passive absorption and quiescence of Parathyroid gland
4	Increase in P intake prepartum (>80 g P/d)	Inhibits Vit-D metabolism
5	Reduction in Mg concentration at prepartum	Reduction in production and secretion of PTH
6	Dietary Cation Anion Differences	Increase DCAD balance

There are different control methods to prevent milk fever related to herd management practices such as [10]:

a. Dietary magnesium level control peripartum.

b. Body condition control.

c. Controlling dietary carbohydrate intake peripartum.

d. Shortening of the dry period

e. Prepartum milking.

f. Reduced milking in early lactation.

In this review, nutritional approach for the prevention of milk fever will be explained briefly in terms of the most commonly used.

Dietary calcium restriction in the close-up dry period

This has been the traditional approach and the principle is based on the theory of preventing the calcium homeostatic mechanisms from becoming quiescent during the dry period. According to the National Research Council [14], the recommended Ca and P ratios for a mature cow during the dry period should be 0.39% (33-43g) and 0.24% (20-26g) in the dry matter. However, for this method to be successful, prenatal Ca consumption should not exceed 10-30g per day [11]. It is difficult to formulate such low calcium diets unless whole crop or corn silage is being fed and the animal still requires a certain level of dietary calcium to maintain bone integrity. In such a situation supplementation of zeolite and vegetable oils can be done as both are known to reduce the absorption of calcium sufficiently.

Dietary Cation-Anion Difference (DCAD)

Dietary cation-anion difference [DCAD = (Na + K) – (Cl + S)] of ration is directly related to milk fever. The DCAD of ration can easily be calculated if percentages of concentrations of sodium (Na), potassium (K), chlorine (Cl) and sulphur (S) ions of the ration are known [12,13]. This strategy was developed in order to combat the high potassium in their forages, which makes the low calcium strategy ineffective. This can be very effective, but it is more difficult to undertake than the low calcium strategy. Potential problems include low palatability of some anionic salts and the requirement for regular urine pH testing.

A negative DCAD (-50 -100mEq/kg DM) has been shown to have an effect on calcium metabolism [11,14]. It can induce a more acidic intestinal pH for calcium absorption and facilitate recruitment of bone reserves, increase the excretion of calcium in urine and consequently activate calcium reabsorption and recruitment processes [11, 15]. In a recent study, Bani Hassan et al. [1] reported that adjusting DCAD at neutral values (0, -30mEq/kg range) may both lower the milk fever prevalence and increase ration palatability by lowering acidogenic salts in the ration. A useful method for determining whether an animal is responding to added dietary anions is to monitor urinary pH. Urinary pH between 5.5 and 6.2 is associated with effective administration of anions [16-18]. If urinary pH is <5.5 dietary anions should be reduced to avoid severe metabolic acidosis [11].

Additional oral calcium supplementation

It is not advisable to use this method as a first line of milk fever prevention. Supplementation should be done depending on the quality of ration provided and the level of calcium in it, as there are chances of negative effects for breaking of calcium homeostatic pathways in the body of animal. The commercially available forms of calcium chloride decrease the incidence of milk fever and abomasum displacement when given within 12-24 hours following delivery [19]. However, it should be kept in mind that preparations containing calcium chloride may cause ulcers in the mucous membranes of the mouth and digestive tracts.

In the prevention of milk fever in high-milk cows, the following measures can be taken with regards to nutrition in view of the above information:

1. During the dry period, for example, a cow weighing 600 kg should consume 30-40 g Ca / day, 20-25 g P/ day, with Vitamin A, Mg, K, Se (maximum 50.000 IU), vitamin D (15.000-25.000 IU). and vitamin E requirements must be met [14].

2. If milk fever is a problem of the herd, daily Ca consumption in the last weeks of the dry period should be limited to 20-25 g per animal. In this way, high P and low Ca intake activates the parathyroid gland, contributing to Ca mobilization faster than the postnatal bones of the animal and reduces the risk of milk fever.

3. The most important cause of milk fever is the high Ca and K in the dry period due to the use of high amounts of leguminous roughages or unsuitable mineral additives. Foods rich in calcium should not be fed before calving particularly during the last trimester of pregnancy period. In order to prevent milk fever, keeping the ration K level below 1.8% is extremely important [17].

4. Magnesium also plays an important role in maintaining calcium homeostasis around calving. Total intakes of about 40 to 50 grams of dietary Mg (about 0.30 to 0.45% of diet dry matter) have been suggested [5].

5. In cases where high rumen pH is suspected, 100g/day ammonium chloride (or ammonium sulfate) may be given by mixing the concentrate before the first two days before and after the delivery.

6. If milk fever is common in the herd, feeding with a ration of DCAD= -150, -200mEq/kg DM with anionic salt additive in the last 3-4 weeks of the dry period contributes to the control or prevention of milk fever.

7. The most important finding that can show the adequacy of nutrition-related measures is the urinary pH to be taken 1-2 weeks before delivery. If the urine pH is greater than 8, the possibility of milk fever is high. The optimum urinary pH with low probability of milk fever has been reported to be 6.0-6.5 for Holstein cows and 5.5-6.0 for Jersey cows [18].

8. The blood Ca level within 24 hours before delivery is above 8 mg/ 100 ml, indicating that there is no problem with milk fever.

9. The administration of 75g of $CaCO_3$ after delivery may also reduce the risk of milk fever.

Conclusion

There are different control methods to prevent milk fever related to nutrition. However, there is only limited information about how the different methods are most efficiently implemented as detailed strategies. Hopefully, the future will bring more detailed information on the optimal use of control methods under different management conditions.

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