Hypocalcemia in Jersey dairy cows

https://doi.org/10.56238/sevened2024.007-066

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ABSTRACT
Dairy cows of the Jersey breed have stood out in dairy farming for their high productive and reproductive potential and, naturally, face the great metabolic challenges inherent to production. Hypocalcemia is one of the main diseases in the transition period, and the Jersey breed has physiological characteristics that can increase the occurrence of this disease. Prevention strategies continue to be the best option in preventing the disease.

Keywords: Peripartum, Subclinical, Diseases.

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INTRODUCTION

Jersey cows have stood out in dairy farming for their high productive and reproductive potential and, naturally, face the great metabolic challenges inherent to production. When comparing the Holstein and Jersey breeds, the Holstein breed has a higher production, but with a lower content of milk solids, such as fat and protein (Mecclearn et al., 2020; Coffey et al., 2016). The Jersey breed has a milk with a higher solids content, which results in a higher yield for the production of derivatives such as cheese (Capper & Cady, 2012).

Among the metabolic challenges of the transition period, those related to calcium (Ca) metabolism are extremely important, whether in the clinical or subclinical form, and occur in different ways between the Jersey and Holstein breeds. Such differences were observed by Roche and Berry (2006) and Saborio-Monteiro et al. (2017), who reported higher risks of clinical hypocalcemia for Jersey cows than for Holstein cows. Thus, the observed associations between low serum Ca concentration, productive and reproductive performance in Holsteins may not be transferable to Jersey cows.

The mechanisms of homeostasis of Ca concentrations in the blood are regulated by parathyroid hormone (PTH), a hormone produced by the parathyroid gland whenever there is a decline in blood Ca (Goff, 2008). PTH increases renal tubular reabsorption of Ca and over bone tissue PTH increases demineralization, triggering the release of Ca into the blood (Goff, 2008). The increase in PTH in the blood stimulates the renal production of 1,25-dihydroxyvitamin D, which is necessary for the efficient absorption of Ca from the diet by the intestine (Goff, 2008). In the Jersey breed, there is a reduction in the amount of receptors for 1,25-dihydroxyvitamin D in the intestinal epithelium (Goff, 2000), which implies greater chances of developing hypocalcemia in the breed.

The occurrence of subclinical hypocalcemia in Jersey cows in the first 24 hours is routine (Rodrigues et al., 2020). Its casuistry may be associated with the number of lactations, duration of the previous lactation, breed, sex of the calf, among other factors. In Jersey cows, subclinical hypocalcemia can reach 64% of the animals in this productive phase (Valldecabres et al., 2019). Ca, according to Kimura et al. (2006) and Megahed et al. (2018), is one of the most important minerals in the body, its concentration threshold in the blood begins to decrease 1 to 2 days before calving in multiparous cows, and reaches its lowest level between 24 and 48 hours after calving (Oetzel, 2013; Megahed et al., 2018). The decrease in serum Ca, below the limit considered physiological, leads the animal to a picture of subclinical hypocalcemia, a disorder prevalent among multiparous Holstein parturients (Reinhardt et al., 2011) and Jersey cows (Valldecabres et al., 2019) of dairy herds. The Ca level also tends to have a blood drop, especially in the first days after childbirth (Stevenson et al., 2020).

Reductions in Ca levels may be strongly related to inflammatory markers, which may be associated with impaired immune function after childbirth, also interfering with productivity (Feijó et al., 2017). Cows with subclinical hypocalcemia are more likely to develop abomasal displacement, ketosis, metritis, and retained placenta (Rodríguez et al., 2017).

In the postpartum period, metabolic changes are accompanied by increased liver function, immune system activation, and changes in mineral balance to support the onset of lactation (Spaans et al., 2022). Phosphorus, which is important for Ca homeostasis (Wächter et al., 2022) also tends to vary in this period, in addition to decreasing its concentration with the increase in the number of lactations (Lean et al., 2023). Variations in Aspartate Aminotransferase (AST), Gamma Glutamyl Transferase (GGT) concentrations are indicators of alteration in liver function. AST starts a gradual increase days before delivery, while AST has a rapid increase soon after delivery (Spaans et al., 2022).

Subclinical hypocalcemia has been changing cut-off points in recent years, described as blood Ca concentration below 2.25 to 2.50 mmol/L by Oetzel (2004) and Goff (2018) for Holstein animals and below 2.0 mmol/L by Reinhardt et al. (2011) and Zhang et al. (2022) for this same breed. For Jersey animals, Valldecabres & Silva-Del-Rio (2021) considered 2.18 mmol/L as the cut-off point for the diagnosis of subclinical hypocalcemia. The occurrence of this disease is associated with an undesirable outcome with no visible signs, and is responsible for major economic losses, including ketosis (Rodríguez et al., 2017), and uterine disorders (Martinez et al., 2014, 2017; Rodriguez et al., 2017). In the development of ketosis, the formation of ketone bodies such as β-hydroxybutyrate (BHBA) occurs, leading to an increase in the bloodstream (Rodrigues et al., 2020). Elevated BHBA concentrations, for example, may be related to a higher chance of abomasal displacement and reproductive delays (Banuelos & Stevenson, 2021).

Inflammatory markers such as PPT, globulin, and albumin are also influenced by postpartum Ca blood levels. Hypocalcemia can cause alterations in protein synthesis, affecting the concentration of these plasma proteins (Feijó et al., 2017; Alvarenga et al., 2017). Cows with lower blood levels of Ca tend to have a higher milk production than cows with higher blood levels (Menta et al., 2021). Valldecabres & Silva-Del-Rio (2021) observed that Jersey cows with serum Ca concentrations below 2.18 produce 1.85 kg more milk per day.

As a form of prevention, diets adjusted in the prepartum favor the reduction of the chances of developing hypocalcemia and do not compromise dry matter intake. Diets with low phosphorus contents, in this period, result in a lower percentage of hypocalcemic animals in the postpartum period (Keanthao et al., 2021). Anionic diets can be used for the prevention of hypocalcemia and, according to Goff et al. (2019), have an effect on the postpartum plasma concentration of Ca and also on the rumination rate. Urine pH assessment is a way to monitor the efficiency of the prepartum anionic diet (Constable et al., 2019).

Between the pre-calving and postpartum periods, there is an abrupt change in nutrition, but when adjusted correctly it decreases the negative effects on the animal's metabolism (Haisan et al., 2021). When dairy cows are fed anionic diets in the pre-calving period, they are less likely to develop a postpartum Ca imbalance (Amor et al., 2021). To assess the efficiency of the diet, the measurement of urinary pH is a method used to estimate the risks of developing hypocalcemia (Constable et al., 2019; Seifi et al., 2004). Cows fed diets low in Ca and with anionic salts in the pre-calving period tend to have lower pH values before calving (Liesegang et al., 2007).

An adjusted prepartum anionic diet decreases the risks of clinical and subclinical hypocalcemia, while vitamin D supplementation may reduce the incidence of retained placenta and metritis (Martinez et al., 2017). The prevention of hypocalcemia is highlighted, as cows with postpartum disorders may have a longer interval between calving and the first ovulation, in addition to other metabolic diseases (Stevenson et al., 2020). According to Rodríguez et al. (2017), normocalcemic cows present the first estrus before cows with Ca deficiencies.

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