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CORRELATION BETWEEN HYPOCALCEMIA AND RUMINAL ATONY IN DAIRY COWS IN THE IMMEDIATE POSTPARTUM PERIOD

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Apolônia Agnes Vilar de Carvalho Bulhões[1], Aline Bittencourt de Souza[2], Estefany Caroline da Silva Gonçalves[3], Antonio Wallison da Silva de Oliveira[4], Marcia Cristina Pires Ferrão[5], Marcos Vinicius Vidal Silva[6], Gabriel Domenico Hartmann[7], Nadia dos Anjos Seilert[8] and André Teixeira de Oliveira Ariza[9]

ABSTRACT

Objective: To analyze the relationship between hypocalcemia and ruminal atony in dairy cows in the immediate postpartum period, evaluating the impacts of this correlation on animal health and productivity, as well as prevention and nutritional management strategies. Postpartum hypocalcemia is a metabolic condition resulting from the abrupt decrease in calcium levels in the peripartum period, impairing muscle contraction and rumen motility. Decreased rumen activity results in secondary digestive and metabolic problems, such as ketosis and abomasal displacement, as well as increasing the risk of postpartum complications, such as retained placenta and metritis. Research indicates that cows with subclinical hypocalcemia are more likely to have rumen atony and lower digestive efficiency, which has adverse consequences on milk production. Early identification of hypocalcemia, through analysis of blood calcium levels, and the adoption of anionic diets during the transition period, are crucial tactics to mitigate its negative effects. In addition, oral or intravenous calcium administration is often suggested to avoid metabolic complications. Understanding the interaction between

[1] Dr. in Veterinary Science
Federal Rural University of Pernambuco
E-mail: agnes.carvalho.14@gmail.com
[2] Undergraduate student in Veterinary Medicine
Castelo Branco University – UCB
E-mail: medvetalinebitt@gmail.com
[3] Undergraduate student in Veterinary Medicine
Maurício de Nassau University Center – Recife
E-mail: carolsilva141718@gmail.com
[4] Undergraduate student in Veterinary Medicine
UNIFATENE University Center
E-mail: owallison99@gmail.com
[5] Graduated in Veterinary Medicine
Mauritius University Center of Nassau
E-mail: marciacristinamed01@gmail.com
[6] Undergraduate student in Veterinary Medicine
Federal University of Campina Grande
E-mail: zzaiffo@gmail.com
[7] Undergraduate student in Veterinary Medicine
Federal University of Santa Catarina
E-mail: gabrielhartma@gmail.com
[8] Undergraduate student in Veterinary Medicine
Catholic University Center of Tocantins
E-mail: seilertnadia@gmail.com
[9] Graduated in Veterinary Medicine; Post graduate in Sanitary Surveillance and Food Inspection
Regional College of Espírito Santo do Pinhal
E-mail: arizaandre@hotmail.com

hypocalcemia and ruminal atony is crucial for the creation of efficient management strategies, with the objective of improving animal welfare and the productive effectiveness of dairy cows.

Keywords: Puerperal hypocalcemia. Ruminal atony. Dairy cows. Calcium Metabolism. Nutritional Management.

INTRODUCTION

Postpartum hypocalcemia is a frequent metabolic condition in high-yielding cows, constituting a considerable challenge for veterinary medicine, particularly in the immediate postpartum period (Jacques, 2011). This condition arises from the inability of the bovine body to quickly mobilize calcium reserves to meet the demands imposed by lactation and colostrum formation (Brito, 2018). Hypocalcemia can present clinically or subclinically, the latter being more complex to identify, but equally harmful to the health and productivity of the animals (Brito, 2018; Gonçalves, 2006).

Rumen atony is one of the most significant consequences of hypocalcemia, as calcium plays a fundamental role in muscle contraction, also affecting the motility of the gastrointestinal system (Jacques, 2011). Often, low-fat cows exhibit a decrease in rumen activity, causing indigestion and reduced intake, which can lead to secondary metabolic complications, such as ketosis and abomasal displacement (Brito, 2018; Radostits, 2002). This adverse interaction directly affects the productive and reproductive efficacy of cows, increasing the prevalence of puerperal diseases and decreasing the life expectancy of the herd (Jacques, 2011; Brito, 2018; Corbellini, 1998).

Some research conducted on dairy cows from Terceira and Barcelos Islands indicated that 58% of the animals had subclinical hypocalcemia in the first six hours after calving (Brito, 2018) Additionally, hypocalcemia was recognized as a risk factor for diseases such as metritis, retained placenta and mastitis, which emphasizes its clinical importance (Jacques, 2011; Brito, 2018; Radostits, 2002; Rodrigues, 2004).

Considering the adverse effect of hypocalcemia and rumen atony on the health and well-being of dairy cows, it is crucial to understand the relationship between these conditions and establish efficient prevention and management tactics. Thus, the objective of this research is to analyze the literature on this metabolic connection and discuss the main scientific results in the field.

METHODOLOGY

This study was carried out through a systematic review of the literature, using scientific articles published in indexed journals, dissertations, theses and academic works. A search was carried out in databases such as PubMed, Scielo, ScienceDirect and Google Scholar, using terms such as "hypocalcemia in dairy cows", "ruminal

atony", "metabolic disorders in the postpartum" and "nutritional management in dairy cattle".

The inclusion criteria adopted were: studies published in the last 25 years, studies that addressed the relationship between hypocalcemia and ruminal atony, experimental research carried out on dairy cows, and articles that presented relevant data on supplementation and nutritional management in the transition period. Studies that did not deal directly with the subject or that did not have sufficient samples for a reliable statistical analysis were discarded.

After the initial selection, the articles were critically examined, taking into account the methodology employed, the reliability of the data, and the relevance of the conclusions presented. The analysis gave preference to studies that addressed physiological mechanisms, prevention and management tactics, as well as the economic and productive impacts of hypocalcemia linked to ruminal atony.

RESULTS AND DISCUSSIONS

Hypocalcemia is one of the most researched metabolic diseases in dairy cows because of its adverse effect on production and animal health. According to Radostits *et al*. (2002), hypocalcemia is more common in high-producing cows, due to the sudden increase in calcium requirement for colostrum production, leading to an imbalance in mineral homeostasis.

Several studies indicate that hypocalcemia is intrinsically linked to rumen atony, since calcium plays a crucial role in regulating the motility of the digestive system (Goff, 2008). By reducing blood calcium levels below the physiological threshold, smooth muscle contraction decreases, impairing rumen emptying and may result in secondary complications, such as ketosis and abomasal displacement (Silva et al., 2015). Techniques such as constant supervision of calcium levels and modification of feeding in the pre- and post-calving period are essential to ensure herd health and maximize milk production (Radostits, 2002; Almeida & Costa, 2016).

In addition, nutrition plays a crucial role in preventing hypocalcemia. According to Almeida & Costa (2016), the use of anionic diets during the transition phase favors an appropriate acid-base balance, encouraging bone calcium mobilization before delivery and reducing the occurrence of clinical and subclinical hypocalcemia. In addition, the

administration of calcium orally or intravenously has been suggested as an efficient method in preventing the disease (Oliveira *et al*., 2020).

Calcium deficiency also affects the immune system of dairy cows. Studies show that the lack of calcium affects the activity of neutrophils and macrophages, increasing the propensity to postpartum infections, such as mastitis and metritis (Fernandes *et al*., 2019). The research of Mendes *et al* (2017) corroborates this connection, showing that cows with hypocalcemia have higher rates of retained placenta and uterine infections.

Hypocalcemia may also be influenced by genetic predisposition. In certain lines of dairy cows, bone calcium mobilization is less effective, increasing the likelihood of diseases in the postpartum period (Fernandes *et al*., 2019). Therefore, genetic selection may represent a long-term tactic to reduce the occurrence of this disease in dairy herds.

Another important aspect is the management of the environment and stress during the period of change. Research indicates that the reduction of stress factors and the offer of a balanced diet can improve the metabolic adaptation of cows and reduce the occurrence of hypocalcemia (Gonçalves, 2006).

Recent studies also suggest that genetic factors may affect the propensity for hypocalcemia, with specific strains of dairy cows showing an elevated metabolic risk during the transition period (Fernandes et al., 2019). Research by Oliveira *et al*. (2020) indicated that the combination of adequate nutritional supplementation with correct herd management considerably reduces the occurrence of hypocalcemia and its related complications.

In addition, some clinical research indicates that cows undergoing calcium replacement therapy early exhibit a more accelerated recovery of rumen motility and a reduced risk of secondary complications (Medeiros *et al*., 2018). Additionally, recent studies have examined the use of specific vitamin supplements, such as vitamin D and magnesium, with the aim of improving calcium absorption and mobilization (Lima & Soares, 2021).

Thus, the need for a monitoring and early intervention protocol for cows in the transition period is evident, aiming to minimize the negative impacts of hypocalcemia and ruminal atony. The implementation of adequate nutritional practices, combined with preventive supplementation and strict clinical monitoring, are essential strategies to ensure the health and productivity of dairy cows in the immediate postpartum.

FINAL CONSIDERATIONS

Based on the reviewed literature, it is evident that hypocalcemia exerts a multifactorial effect on the health of dairy cows, impacting gastrointestinal tract motility, immunity and productivity. In view of this, it is essential that there are nutritional, genetic and management strategies to minimize their impacts and ensure the health of the herd. Constant supervision of calcium levels and the adoption of preventive measures can considerably reduce the occurrence of hypocalcemia and its related problems. In addition, the persistence of studies on this condition is essential for the creation of new therapeutic and preventive methods, ensuring the viability of milk production and the quality of life of the animals.

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