ORIGINAL ARTICLE

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Naturally acquired diarrhea in calves from birth to 25 days of age: incidence, clinical Signs, and response to treatment

Diarreia naturalmente adquirida em bezerros do nascimento aos 25 dias de idade: ocorrência, sinais clínicos e resposta ao tratamento

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ABSTRACT: Diarrhea has a multifactorial etiology and is one of the main diseases affecting dairy calves, promoting high mortality rates in the first weeks of life. This study aimed to assess diarrhea incidence and clinical aspects, as well as clinical responses to treatment (oral and intravenous) with electrolyte solutions. A total of 40 crossbred newborn calves were subjected to daily physical examination until 25 days. Calves with diarrhea (score 3) and dehydration (8% to 10%) received electrolyte replacement therapy orally or intravenously, according to estimated fluid loss, as well as a maintenance volume (oral). Blood and urine samples were collected between 16 and 24 hours after birth and at 5, 10, 15, 20, and 25 days; in diarrheic animals, these materials were collected immediately after the identification of diarrhea and at 2, 12, 24, and 48 hours after treatment initiation. Globular Volume (GV) and Total Plasma Proteins (TPP) were evaluated, in addition to physicochemical urine characteristics. Failures in the transfer of passive immunity may have contributed to the occurrence of diarrhea in 30 calves (75%), which maintained good body condition with no complications. Urine analysis showed a higher pH in non-diarrheic calves (6.7) compared to diarrheic calves (6.2) (p=0.0029), indicating acidification; higher GV, TPP, and urine density were found for diarrheic calves, with reductions 2 hours after hydration and slight variations up to 48 hours, indicating the effectiveness of hydration and acidosis correction.

KEYWORDS: Bovine neonatology, Colostrum, Enteropathy, Dehydration, Fluid therapy.

RESUMO: Diarreia, de etiologia multifatorial, é uma das principais doenças de bezerros leiteiros, com elevada mortalidade nas primeiras semanas de vida. Objetivou-se, neste trabalho, avaliar sua ocorrência, aspectos clínicos e resposta clínica ao tratamento (oral e parenteral) com solução eletrolítica. Diariamente, os bezerros foram submetidos à inspeção física até os 25 dias. Animais diarreicos (escore 3) e desidratados (8-10%) receberam terapia de reposição eletrolítica oral ou intravenosa conforme estimativa de fluidos perdida, e volume de manutenção por via oral. Sangue e urina foram colhidos entre 16 e 24 horas após o nascimento, aos 5, 10, 15, 20 e 25 dias e, dos animais diarreicos, imediatamente após a identificação da diarreia, 2, 12, 24 e 48 horas após o início do tratamento. Avaliou-se volume globular (VG), proteínas plasmáticas totais (PPT) e características físico-químicas da urina. Falhas na transferência de imunidade passiva podem ter influenciado a ocorrência de diarreia, verificada em 30 bezerros (75%), que mantiveram boa condição corporal e não apresentaram complicações. A análise de urina evidenciou pH maior nos bezerros sem diarreia (6,7) em relação àqueles diarreicos (6,2) (p=0,0029), indicando acidificação, assim como valores mais elevados de VG, PPT e densidade urinária, com redução após hidratação e variações discretas até 48 horas, indicando eficácia da hidratação e correção da acidose.

PALAVRAS-CHAVE: Neonatologia bovina, Colostro, Enteropatia, Desidratação, Fluidoterapia.

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INTRODUCTION

Diarrhea is mainly characterized by feces with a slightly soft to liquid consistency, which is an easily identifiable sign, however, not specific to digestive disorders (Millemann, 2009). Its etiology is multifactorial (Uhde et al., 2008; Izzo et al., 2011), as a wide variety and association of pathogens can be isolated from feces of calves, both with and without diarrhea, in the same herd (Bartels et al., 2010; Silverlas et al., 2010; Meganck et al., 2015).

These different etiological agents cause specific enteric infections, whose pathogenesis results in alterations in the intestinal mucosa, leading to decreased absorption (absorptive), poor digestion (osmotic), or increased secretion (secretory). Most cases occur as a combination of these mechanisms (Foster; Smith, 2009). Diarrhea causes loss of water and electrolytes in feces, along with a decrease in food intake, regardless of the pathogen or mechanism involved. Consequently, hypovolemia, metabolic acidosis, endotoxemia, hyponatremia, pre-renal azotemia, increased D-lactate concentrations, and negative energy balance (due to anorexia and malabsorption) occur, which generally lead to death of animals with severe diarrhea when not corrected (Smith; Berchtold, 2014).

In Brazil, variations in morbidity and mortality rates due to diarrhea and other diseases in specific herds reflect the diversity of milk production systems (Weiller et al., 2020; Santos; Bittar, 2015).

However, some aspects of naturally acquired diarrhea are still rarely studied, despite the increased availability of vaccines against specific bacterial and viral agents and emphasis on the transfer of passive immunity through colostrum ingestion. Antimicrobials are often used, despite their restricted indications for specific agents and controversial efficacy, whereas the replacement of fluids and electrolytes is little used and even less recommended under field conditions. In this context, the objective of this study was to evaluate the incidence of naturally acquired diarrhea, its clinical aspects, and the response to treatment with electrolyte solution administered orally and intravenously, in crossbred calves from birth to 25 days of age.

MATERIAL AND METHODS

This study, approved by the Ethics Committee on Animal Use at the Brazilian Agricultural Research Corporation (Embrapa Dairy Cattle) (CEUA/EGL, protocol 5809061119), conducted at the Multi-User Facility for Livestock Bioefficiency and Sustainability at the Jose Henrique Bruschi Experimental Field in Coronel Pacheco, Minas Gerais, Brazil, from December 2019 to February 2020.

Data on temperature, relative air humidity, and local rainfall variations (recorded biweekly) were obtained from a Weather Station of the National Institute of Meteorology (INMET) in Coronel Pacheco.

This study evaluated 40 crossbreed calves, born at full term, both male and female, kept under the same management conditions from birth to 25 days of age.

Pregnant cows in the last two weeks of gestation were kept in maternity paddocks and monitored for signs of calving. The calves were separated from their mothers as soon as they were born, identified, and had their navels treated with 10% iodine tincture. Subsequently, they were housed in a barn, in individual stalls arranged side by side, separated by wooden fences, with concrete floors covered with rubber mats and lined with wood shavings, where they remained until 25 days of age. They were subjected to physical examination, which consisted of inspecting their body condition and behavior and measuring vital parameters, according to Feitosa (2014). Subsequently, they were provided with freshly milked colostrum from their respective mothers or with colostrum from a colostrum bank, at a volume of 10% of their body weight, at a temperature between 35 and 39 °C. Maternal colostrum that did not reach the Brix level of 25% was supplemented with colostrum powder (Alta Genetics - SCCL - Saskatoon Colostrum CO. LTD), as recommended by the manufacturer; samples from the colostrum bank were used when necessary, ensuring the same Brix percentage.

The colostrum supply was prioritized through bottle-feeding with voluntary intake. However, in cases of refusal or difficulty in swallowing, an esophageal tube was used to administer the recommended total volume for each calf. Over the following three days, each calf received transitional milk in "milk bar" containers: three liters in the morning (8:00 a.m.) and three liters in the afternoon (3:00 p.m.). Freshly milked whole milk was provided on the following days, at the same times and volumes, until they reached 25 days of age. Water was supplied in metal buckets from the first day onwards, changed once a day in the afternoon. Commercial concentrate feed was kept available in individual troughs from the third day onwards. The calves were transferred to another area at 25 days, thus concluding the evaluations.

The barn where the animals were kept had been subjected to rigorous cleaning processes before the start of the experiment, consisted of a dry cleaning (sweeping), followed by disinfection using a fire broom, wet cleaning (jet of soapy water with a high-pressure washer), and disinfection with 2% chlorine. This cleaning process was followed by a 30-day fallow period. The stalls were cleaned daily in the morning by removing organic material and replacing the wood shavings with fresh ones. Utensils used to supply milk, water, and concentrate feed were washed daily with soap and running water and then immersed in a 2% chlorine solution, followed by rinsing and drying.

The animals underwent a complete daily physical examination, starting with inspections of body condition, overall state, behavior, appetite, and feces (color; odor; volume; presence of abnormal elements; and consistency, on a scale of 0

to 3), according to Walker et al. (1998); subsequently, vital parameters were measured (temperature, respiratory and heart rates, capillary refill time, eyeball retraction, and skin turgor). Animals with alterations in vital parameters were evaluated according to Feitosa (2014). Dehydration was estimated whenever signs were identified, following criteria proposed by Dearo (2001) and Lisboa (2004).

The animals were manually restrained by a trained assistant. Urine samples were collected through spontaneous urination or manual stimulation. Blood samples were collected by jugular puncture after local asepsis with 70% alcohol, using 27×8 mm needles, a vacuum system, and vials containing EDTA. All these collections were made between 16 and 24 hours after birth and at 5, 10, 15, 20, and 25 days of age, in the morning, before breastfeeding. Additional blood and urine samples were collected from animals presenting diarrhea immediately after the identification of diarrhea (T0) and at 2, 12, 24, and 48 hours after treatment initiation.

Blood samples were analyzed within six hours after collection to determine the following parameters: red blood cell count (cells × 10^6 μL^{-1}) and total leukocyte count (cells × 10^3 μL^{-1}) in a Neubauer chamber, globular volume (GV; %) by microcentrifugation, and total plasma proteins (TPP) by refractometry. Urine samples, stored between 2 and 8 °C for a maximum of 12 hours, were evaluated for volume, color, and appearance; density was analyzed by refractometry, whereas pH was determined using a digital pH meter.

Treatment

Animals that had feces with a fluid consistency (score 3) and no presence of blood or abnormal elements, no fever, and an estimated dehydration between 8% and 10% received electrolyte replacement (intravenous or oral). The replacement volume (L) was calculated by multiplying the body weight (kg) by the estimated degree of dehydration and then dividing by 100 (L = body weight × 10 / 100).

Intravenous hydration consisted of using a commercial lactated Ringer's solution through an 18 or 20 G catheter at a speed of 40 mL kg^{-1} $hour^{-1}$, according to Dearo (2001), with continuous monitoring of the calf during replacement. Oral hydration consisted of using a solution containing 2.5 g of NaCl, 1.5 g of KCl, 8.2 g of sodium acetate, and 28 g of dextrose in one liter of water, according to Lisboa (2004) with an adaptation (sodium bicarbonate was replaced by sodium acetate). This solution was orally administered through an ora-esophageal tube, initially offering half the volume, with the second half offered after 2 hours. A maintenance volume (daily requirements) was provided after replacement, calculated by multiplying the body weight by 100; it was made available in buckets to all animals for voluntary intake. The replacement volume was offered 2 hours after administration of the morning milk, whereas the maintenance volume was provided immediately after the completion of the replacement volume. Maintenance consumption was checked at 22 hours, providing water or more maintenance volume (48 hours) if the calf still had a fecal score of 3 or enophthalmos. Total consumption was measured at 24 and 48 hours after the treatment initiation.

Statistical analysis

Data with a normal distribution were compared between groups and at different evaluation times using repeated-measures analysis of variance (MANOVA); differences were identified using the Tukey's test at a 95% significance level ($p \leq 0.05$).

RESULTS AND DISCUSSION

The management of calves during the colostrum period followed the guidelines established in the current specialized literature. However, the number of diarrhea cases was high, in contrast to expectations.

Colostrum intake was monitored as recommended by DCHA (2020), paying attention to quantity and quality, which are among the main factors for a proper transfer of passive immunity (TPI) in calves (Jaster, 2005; Quigley et al., 2013; Williams et al., 2014). The results showed that 75% of the evaluated calves had at least one episode of diarrhea, as found by Carvalho et al. (2014), who reported that 100% of the sampled calves had diarrhea, regardless of the feeding strategy and despite indicators of good TPI.

The mean total plasma proteins (TPP) as a parameter associated with the concentration of absorbed serum Ig for an adequate TPI was satisfactory. According to MacFarlane et al. (2014) and Elsohaby et al. (2019), the minimum TPP concentration should be 5.6 or 5.8 g dL^{-1}, respectively; considering these authors, only three (7.5%) and six (15%) calves, respectively, presented TPI failure in the present study.

The calves were evaluated from birth to 25 days of age, which is a critical period when the highest mortality rates and health problems tend to occur (Signoretti, 2018). Diarrhea was diagnosed in 30 calves (75%), with some calves experiencing a single episode (19 animals; 63.3%) and others up to four episodes (11; 36.7%) during the period. The observed cases exceeded the recommendations of Coelho (2009) and Teixeira et al. (2017), who consider an occurrence of 25% of calves affected by diarrhea up to 60 days of age as acceptable. An important result to highlight is that ten calves (25%) did not experience diarrhea at any time during the evaluation period, as well as no deaths were recorded among calves with or without diarrhea, in accordance with Teixeira et al. (2017), who indicate mortality rates below 10% for a higher production efficiency.

The findings of the present study are consistent with results of several studies that have identified diarrhea as an important cause of morbidity in calves, especially during the

first 15 days of life (Cho et al., 2013; Meganck et al., 2015). A higher prevalence of diarrhea was found in the second week, as also found by Bendali et al., 1999; USDA, 2008; Trotz-Williams et al. (2007), Bartels et al. (2010), and Carvalho et al. (2014). Additionally, the diarrhea rates in the first weeks of life found in France (14.6%) (Millemann, 2009) and in the United States (29%) (Virtala et al., 1996) are significantly lower than those found in the present study.

As previously mentioned, 75% of the calves had at least one episode of diarrhea, which is consistent with recent rates in Brazil reported by Santos and Bittar (2015) and Carvalho et al. (2014): between 54% and 100%.

One factor possibly related to the number of diarrhea cases found in the present study is the evaluation period (December to February), when high temperatures (average of 26.3 °C) and relative air humidity (average of 79.5%) are common, which are significant factors in the epidemiology of diarrhea. A survey conducted at the research center of Embrapa Southeast Livestock (São Carlos, São Paulo, Brazil) indicated that approximately 70% of deaths of suckling dairy calves occur from November to March (Chagas, 2015).

The age at the first episode of diarrhea ranged from 3 to 21 days (mean of 8.4 days), with 93.3% of cases occurring before 15 days (28 out of 30 calves; 93.3%), 53.3% between 8 and 14 days, and 40% in the first week. Two calves had their first episode when they were over 15 days old (19 and 21 days) (Table 1). The cases evolved between one and six days (60.4%), with the majority lasting for one day (43.3%), without recurrences; two animals presented a total of 8 and 9 days of diarrhea, with four episodes each, over 25 days.

The most common clinical changes during diarrhea were: dehydration (9 out of 30 calves; 30%), followed by loss of body condition (4; 13.3%), apathy (10; 33.3%), and anorexia (5; 16.7 %). Additionally, five (12.5%) of all evaluated 40 calves showed anorexia whereas seven (17.5%) exhibited apathy at times when their feces were normal.

The means of rectal temperature and heart and respiratory rates during the diarrhea course were 38.7 °C, 124 bpm, and 38 mpm, respectively. Considering the absence of evident signs of pain and reference values (Feitosa, 2014), tachycardia and tachypnea may be related to dehydration and metabolic acidosis, which are common in diarrhea cases (Wattiaux, 2000; Ravary-Plumioën, 2009).

Alterations in posture, reflexes, and behavior can occur due to dehydration, high serum levels of D-lactate, and electrolyte disturbances, mainly regarding sodium, potassium, and bicarbonate, which are lost in varying proportions depending on the severity of diarrhea (Lorenz, 2009). Furthermore, Wattiaux (2000) stated that diarrhea also results in hypoglycemia, which may be related to apathy and loss of body condition, especially in younger calves, which are usually the most affected.

Globular volume (GV) practically did not vary between calves with and without diarrhea (Table 2); however, the variation in TPP was significant ($p<0.05$). This difference is apparently not justified, as a relative increase in all blood components is expected during dehydration, mainly GV and TPP, in the absence of anemia (Jain, 1993). Seven calves had TPP greater than 8.5 g L^{-1}, while three had GV higher than 46%, which is the reference limit (Kaneko, 2008). Only one calf presented high TPP and GV simultaneously. It is noteworthy that the animals were not categorized by age in these evaluations, therefore, it was not appropriate to infer about the adequacy of TPI.

Skin turgor and appearance of mucous membranes (shine and moisture) were not very effective in indicating dehydration, differing from capillary refill time, which was above 2 seconds in 12 calves with diarrhea, and enophthalmos (≥ 4 mm), which was observed in eight calves. According to Constable et al. (1998a, b), heart rate, pulse quality, and temperature of the extremities contribute to the assessment of blood volume and cardiac output, as well as are useful for severe cases with the potential to progress to death—a condition that did not occur in this study.

Considering the studied age range, urine density and pH varied little in calves without diarrhea, with slightly lower means in the first week of life (density of 1.015 and pH of 6.2) compared to calves older than 15 days (density of 1.017 and pH of 6.4). However, urine density was higher immediately after birth, differing from all subsequent evaluations ($p<0.001$), with a decrease until 15 days and an increase at

Table 1. Duration of diarrhea cases (total number of days when animals had diarrhea) in 30 crossbred male and female calves, and percentage of sick calves in the herd, considering all cases of diarrhea, including recurrences.

Days with diarrhea	Number of animals	% of sick animals	% of the herd
1	13	43.3	32.5
2	6	20.0	15
3	1	3.3	2.5
4	4	13.3	10
5 and 6	2 / 2	6.7 / 6.7	5.0 / 5.0
8 and 9	1 / 1	3.3 / 3.3	2.5 / 2.5

Table 2. Means of globular volume (GV) and total plasma proteins (TPP) in blood samples from crossbreed male and female calves, from birth to 25 days of age, in relation to fecal score.

Fecal score	Globular volume (%)	TPP (g dL^{-1})
1 and 2	30.1A	6.8A
2	29.9A	6.5B
3	31.2A	6.9A
p-value	0.6824	0.0368

25 days (table 3), but remaining within the normal range throughout the study period. The pH was lower at 10 days (6.28), similar to those found at 0, 5, and 15 days (p>0.05), and was higher at 20 and 25 days, but still within the range referenced by Lubetskaya and Melnichuk (1999).

Metabolic acidosis has effects on urine pH, is widely discussed in studies on the pathogenesis of diarrhea, and is considered an important cause of death (Ravary-Plumioën, 2009; Smith; Berchtold, 2014) and one of the most important factors for diarrhea treatment (Naylor et al., 2006; Ravary-Plumioën, 2009). Therefore, the reduced pH found at 10 days also reflects the significant period with the greatest diarrhea occurrence (second week), even though high levels of dehydration were not observed.

According to the fecal score, urine density did not vary (1.014 to 1.015), however, pH was higher in calves with a fecal score of 1 (6.7), whereas it was lower (6.2) in calves with a fecal score of 3 (p = 0.0029), indicating a slight acidification of urine in animals with diarrhea (Table 4).

The balance between positive and negative ions (cation and anions) is important for regulating the acid-base balance of blood and body fluids (Wheeler, 1980), affecting most the plasma bicarbonate concentration, consequently affecting urine pH. Systemic effects are evident only when respiratory and renal compensation is insufficient to eliminate the acid or alkaline load (Patience, 1991). Thus, the reduction in pH found for calves with diarrhea, even slight, may have resulted in electrolyte imbalance and metabolic acidosis resulting due to bicarbonate loss, compromising the capacity to neutralize organic acids, mainly lactic acid (Ravary-Plumioën, 2009).

The urine pH levels in calves with and without diarrhea were lower than those found for adult animals (7.4 to 8.4), which are significantly more affected by the amount of anionic and cationic salts in the diet (Davidson et al., 1995; Krzywiecki et al., 2005). According to Lubetskaya and Melnichuk (1999), calves fed exclusively or predominantly with milk have more acidic urine (pH between 6.2 and 7.3); therefore, metabolic acidosis should be considered when the pH is below 6.0. The urine pH in calves with and without diarrhea remained within the limits defined by Lubetskaya and Melnichuk (1999), but close to the level defined to characterize metabolic acidosis in calves with diarrhea.

Urine pH can provide useful information about acid-base balance, as evidenced in the present study. Hartsfield et al. (1981) emphasized that the metabolic acidosis correction is empirical and imprecise in most cases under field conditions. Maruta et al. (2008) reported a high positive correlation between the degree of metabolic acidosis induced by ruminal lactic acidosis with urinary pH and excess bases, as well as between urine and blood pH, which presented similar patterns to those found in adult cattle through gas analysis. Therefore, they defined a decrease in urine pH as indicative of metabolic acidosis, as found in the present study.

Diarrheic calves that presented systemic alterations and estimated dehydration between 8% and 10% received electrolyte solutions (intravenous and/or oral), alternately, which specifically aimed at hydration and replacement of electrolytes, as recommended by Naylor (1999) and Smith and Berthold (2014).

The treatment was established in accordance with the guidelines defined by Smith et al. (2019) for calves with diarrhea, prioritizing plasma expansion, correction of electrolyte imbalances, and supply of glucose to favor sodium cotransport and facilitate water reabsorption, as well as alkalinizing agent to correct metabolic acidosis. Dehydration and uncompensated metabolic acidosis are the most significant consequences of diarrhea in calves (Smith; Berchtold, 2014; Boccardo et al., 2017). Oral replacement of electrolytes and buffer is recommended for calves with moderate dehydration (less than 8%) and presenting sucking reflex (Lorenz et al., 2011). In the present study, the hydroelectrolytic replacement, whether oral or intravenous, was performed only in diarrheic animals with estimated dehydration between 8% and 10.

Considering the nine calves subjected to the hydration protocol, the hematological parameters (GV and TPP) and urine density at the beginning of diarrhea (T0) were higher, with a significant decrease 2 hours after treatment (T2) and slight variations between 12 and 48 hours, denoting the effectiveness of hydration. The differences found were significant (p<0.05) for TPP and urine density and pH at T0 compared to T2 (Table 5).

Table 3. Mean and standard deviation (mean±SD) of urine density and pH in clinically healthy crossbred calves (fecal score 0, 1, and 2), evaluated from birth to 25 days of age.

Age in days	Density		pH	
	Mean	SD	Mean	SD
0	1026A	14.3	6.48A	0.7
5	1015B	9.5	6.47A	0.9
10	1014B	7.9	6.28B	0.6
15	1010C	6.4	6.46A	0.6
20	1011C	6.7	6.82C	0.5
25	1015B	8.7	6.83C	0.7

Means followed by different letters in the columns are significantly different from each other at 99% probability level (p<0.01) by the T-test.

Table 4. Means of urine density and pH in crossbreed male and female calves, from birth to 25 days of age, in relation to fecal score.

Fecal score	Urine density	Urine pH
1	1014A	6.7A
2	1015A	6.5A
3	1015A	6.2B
p-value	0.6258	0.0029

Table 5. Variations in means of globular volume (GV - %) and total plasma proteins (TPP - g dL^{-1}) and urine density and pH in nine calves with diarrhea and dehydration (estimated between 8% and 10%) before (T0) and after treatment (T2 to T48) with replacement of water and electrolytes (intravenous and/or oral).

Time	GV	TPP	Urine density	Urine pH
Before treatment	33.7A	7.3A	1017A	5.9A
2 hours after treatment	28.0A	6.5B	1005B	6.7B
12 hours after treatment	29.7A	6.5B	1012A	6.9B
24 hours after treatment	30.2A	6.4B	1013A	6.4B
48 hours after treatment	30.6A	6.3B	1010A	6.5B
p-value	0.5205	0.0032	0.0447	0.0453

Means followed by different letters in the columns are significantly different from each other by the T-test.

TPP and GV decreased after treatment, as expected, and remained stable. Urine density—which indicates the kidneys' capacity to reabsorb water and concentrate urine—decreased after hydration and increased 12 hours after treatment, remaining within the normal range at all evaluation times. Urine density denotes that the loss of fluids through feces was not severe enough to reduce the renal filtration rate. It also indicates the effectiveness of hydration, which was evident by the reduction in TPP, GV, and urine density, in addition to the correction of acidosis by increasing urine pH to normal levels after treatment (Figure 1).

The results found were consistent with Doré et al. (2019) and Sayers et al. (2016), who reported that the effectiveness of oral solutions was similar or even superior to intravenous treatment, which were used for replacing water and electrolytes in 5 and 4 calves, respectively, in the present study.

The continuous monitoring of the animals allowed for the early identification of dehydration and administration of a fluid therapy as soon as signs of severity were detected (generally, on the second day of the diarrhea course). The study was conducted with calves in the first month of life, which is consistent with Naylor (1987), who reported that differences in severity of age-related acidosis can be explained by susceptibility to enteric pathogens, with more intense and rapid dehydration in younger calves.

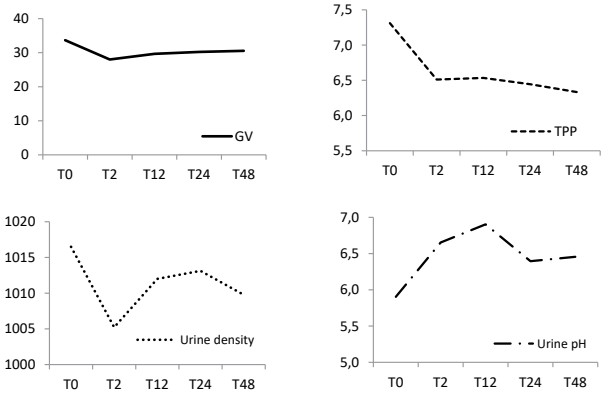

Figure 1. Variations in means of globular volume (GV - %), total plasma proteins (TPP - mg dL^{-1}), and urine density and pH in nine calves with diarrhea and dehydration (estimated between 8% and 10%) before (T0) and after treatment (T2 to T48) with replacement of water and electrolytes (intravenous and/or oral).

CONCLUSIONS

The morbidity and mortality of newborn calves are among the most significant causes of economic losses in herds. Diarrhea is possibly the most important cause of calf mortality due to rapid and severe dehydration, which leads to metabolic imbalance. It is associated with failure to transfer passive immunity and environmental challenges, which, when combined, make neonates particularly sensitive to infections.

Basic care provided in the first three days of life, safe and adequate colostrum intake in terms of quantity and quality, and daily hygiene maintenance of the environment and utensils used are essential for reducing morbidity and mortality and promoting the health of neonates.

The incidence of diarrhea in the evaluated herd was high, however, few animals exhibited severity requiring replacement of water and electrolytes for recovery.

The probable causes for the cases of diarrhea found in the evaluated calves include late colostrum intake due to staying with their mothers in the first few hours, especially during nighttime calving, as well as the evaluation period, as high temperatures and relative air humidity are common between December and February, favoring the contamination and proliferation of microorganisms.

Proper management of newborn calves with constant monitoring in the first weeks of life allowed for the early identification of dehydration and the initiation of fluid therapy in cases of severity. Fluid therapy, administered intravenously or orally, ensured the replacement of water and electrolytes and the correction of metabolic acidosis, as evidenced by the normalization of urine density and pH after treatment, which contributed to the absence of deaths.

This study is consistent with the literature and aims to assist breeders and field veterinarians with their routines by highlighting the importance and effectiveness of basic care for newborn calves and rehydration therapy in case of enteric diseases.

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