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Hemato-biochemical profile and milk production of crossbred Girolando cows supplemented with product dehydrated cashew

Perfil hematobioquímico e produção de leite de vacas mestiças Girolando suplementadas com resíduo de caju desidratado

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Abstract

This paper aims to evaluate the influence of different levels of supplemental product-dehydrated cashew in the feed for crossbred Girolando cows on milk production and hemato-biochemical profile. The experiments were conducted using eight cows that were randomly distributed in a Latin square design (4×4), in which treatments consisted of four supplementation levels with product-dehydrated cashew (PDC) in animal diets, namely: 0% PDC (control diet), 1.0 kg of DCP, 1.5 kg of PDC and 2.0 kg of PDC in total dry matter . The milk and animals were weighed and the body condition of the animals were evaluated within seven days of milk collection during each experimental period. To determine the serum biochemistry and blood count of cows, three blood samples were taken in each period, at 7, 14 and 21 days before the daily supply of supplementation with samples collected from 5 ml of blood by puncturing the jugular vein. Supplementation with 2 kg of PDC reduced milk production and the levels of glucose and total plasma protein compared to the control group, due to the higher level of tannin in this group. Supplementation with PDC raised the total count of the erythrocytes, reduced the mean corpuscular volume (MCV) and non-changed number of leukocytes. Increased levels of phenolic compounds in the diet inhibited the absorption of dietary proteins, which decreased milk production.
Key words: Anti-nutritional factors, intake, supplementation, tannin

Resumo

Este trabalho tem como objetivo avaliar a influência de diferentes níveis do pedúnculo de caju desidratado na alimentação de vacas mestiças da raça Girolando na produção de leite e perfil hematobioquímico. O experimento foi realizado com oito vacas distribuídas aleatoriamente em um quadrado latino (4 × 4), com tratamentos que consistiram de quatro níveis de suplementação com pedúnculo de caju desidratado (PCD) em dietas de animais, a saber: 0% PCD (dieta controle), 1,0 kg de PCD, 1,5 kg de PCD e 2,0 kg de PCD na matéria seca total. O leite e os animais foram pesados e a condição corporal dos animais foi avaliada durante sete dias em cada período experimental. Para determinar a bioquímica sérica e hemograma das vacas, três amostras de sangue foram colhidas em cada período, aos 7, 14 e 21 dias

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antes do fornecimento diário de suplementação com amostras de 5 ml de sangue coletadas por punção da veia jugular. A suplementação com 2 kg de PCD reduziu a produção de leite e os níveis de glicose e proteínas totais no plasma em relação ao grupo controle, devido ao nível mais elevado de tanino deste grupo. A suplementação com PCD aumentou a contagem total de eritrócitos, reduziu o volume corpuscular médio (VCM) e não alterou o número de leucócitos. Aumento dos níveis de compostos fenólicos na dieta inibiu a absorção de proteínas na dieta, o que diminuiu a produção de leite.
Palavras-chave: Consumo, fatores anti-nutricionais, suplementação, tanino

Introduction

To increase the profit from milk production by reducing the feed cost, farmers should attempt to economically produce food, considering available the native forage on the property and the agricultural by-products or the fruit that is available in the region that can serve as alternatives to eating animals.

The frequent price increase of the concentrated supplements that are used in animal diets has stimulated interest in the exploitation of unconventional food in the animal feed industry in Brazil. Thus, the use of by-products of the fruit industry has become a viable alternative because Brazil is the third largest producer of fruits, second only to China and India (AZEVÊDO et al., 2012; FERREIRA et al., 2010; OLIVARES-PÉREZ et al., 2013).

Fruit production in Brazil also grows every year. Because of the high production (96.5%) of cashews, especially in the Northeast, and because cashew cultivation coincides with the dry season, from July to January, with some variations, cashews have the potential to be used in animal feed (LEITE et al., 2013; PEREIRA et al., 2013). During the dry season, the areas of forage in the region are lacking, both in quantity and in quality, which forces farmers to use feed to maintain the herd market. Thus use of feed increases the cost and reduces the sustainability of animal herding, which can often force producers to sell animals at low prices and abandon herding.

To implement the use of cashews as an alternative dietary supplement for ruminants, studies examining the level of inclusion in the diet and the digestive physiology of cashews are needed. Cashews contain tannins, an anti-nutritional factor that affects protein digestibility (LEITE et al., 2013). In this context, measuring the serum metabolites is an efficient way to evaluate the diet and nutritional status of a group of animals because the blood accurately reflects the available quantity of a nutrient in the body.

The blood constituents play a crucial role in maintaining homeostasis, performing multiple functions and acting as carriers of many substances that are important in the peripheral circulation. Thus, measuring the serum levels of nutrients in the blood can be a tool of fundamental importance for monitoring diets containing alternative foods that are not commonly found in an animal's diet because the blood reflects the animal's nutritional status (BEZERRA et al., 2013). The objective of this study was to evaluate the influence of different levels of supplementation with product-dehydrated cashew on milk production and the hemato-biochemical profile of crossbred Girolando cows.

Materials and Methods

Experimental materials, feed, procedures and measurements

The study was conducted at the Livestock Sector of a Private Finance in Bom Jesus-PI, and laboratory testing was carried out in the Veterinary Clinical Pathology Laboratory and Animal Nutrition at the Federal University of Piauí, Campus Professor Cinobelina Elvas. The animals were kept in individual stalls, covered with concrete floor and containing individual feeders and drinkers. Eight crossbred pluriparous Girolando cows were used, with an average body weight of 500 ± 57 kg, between 70th and 154th days in the milk-producing period, with

average production of 6 kg of milk / day ± 1.6.

There were four experimental evaluation periods lasting 21 days each, with 14 days for adaptation and seven for data collection. Cashew was obtained in agricultural proprieties of the city Picos, Piaui State, Brazil and milled in a foraging and dry in the sun for a period of seven days. In addition to the product-dehydrated cashew, the animals were released throughout the day to picket of the native pasture (*Braquiária brizantha*) at 160 days of age. The supplementation of product-dehydrated cashew was given once a day at 6h30.

The animals were randomly assigned to treatment groups using a Latin square design (4 × 4), in which treatments consisted of four levels of supplementation with product-dehydrated cashew in the animal diets, namely: 0 kg of product-dehydrated cashew (control diet), 1.0 kg of product-dehydrated cashew, 1.5 kg of product-dehydrated cashew and 2.0 kg of product-dehydrated cashew.

In periods of data collection, samples of the product-dehydrated cashew were packed in individual plastic bags. At the end of each collection period, a sample of animal, treatment and period was made. These samples were ground through a mill with a 1 mm mesh sieve for chemical analyses.

The chemical analyses of the diets (Table 1) were performed at the Laboratory of Animal Nutrition of UFPI. The analyses were performed on composite samples of pasture and product-dehydrated cashew. Samples were pre-dried at 55 °C for 72 hours, ground with a Willey mill (Tecnal, Piracicaba City, São Paulo State, Brasil) with a 1 mm sieve, stored in air tight plastic containers, and sealed properly until the laboratory analysis analysis of the levels of the dry matter (DM) (Method 967.03 - AOAC, 1990), ash (Method 942.05 -AOAC, 1990), crud protein (CP) (Method 981.10 - AOAC, 1990), and ether extract (EE) (Method 920.29 - AOAC, 1990). To determine the NDF and ADF contents, the methodology of Van Soest et al. (1991) was used with the modifications that were proposed in the Ankon device manual (Ankon Technology Corporation, Macedon, New York, US). Acid detergent lignin (ADL) was determined according to method 973.18 (AOAC, 2002), in which the ADF residue was treated with 72% sulfuric acid. Nonfiber carbohydrates (NFC) were calculated using the equation NFC = OM - (NDFcp + CP + EE). Detergent insoluble protein and acid detergent insoluble protein of the product-dehydrated cashew and native pasture were performed according to the method described by Silva and Queiroz (2002).

Table 1. Chemical composition of the dehydrated cashew product and nature forage *(Braquiária brizantha)*.

Chemical composition (% DM)	Product-dehydrated cashew	Nature forage
Dry matter	74.93	93.50
Crude protein	7.71	8.22
Ether extract	3.51	0.86
Neutral detergent fiber (NDFap)[1]	25.52	24.96
Non-fiber carbohydrates (NFC)[2]	55.85	38.77
Acid detergent fiber (ADFap)[1]	20.42	39.27
Acid detergent lignina (ADL)	16.44	8.38
Neutral detergent insoluble protein (NDIP)	3.52	4.24
Acid detergent insoluble protein (ADIP)	2.16	0.82
Ash	7.42	6.38
Total Fenóis	2.83	0.86
Total Tanin	2.33	0.62

[1] ap = corrected for ash and protein; [2]NFC = OM - (NDFcp + CP + EE).

For determining the total tannin from a sample of the product-dehydrated cashew, extracts were prepared in 80% methanol. There were five successive extractions until the beginning of the boil, with procedures performed in triplicate. Analyses of the extracts were performed to determine total phenols by Folin-Ciocalteau casein (FOLIN; CIOCALTEU, 1927). The Folin-Ciocalteu method involves adding 0.25 ml of the extract into a 100-ml volumetric flask containing 75 ml of water, adding 5 ml of Folin-Ciocalteu reagent (10% aqueous solution), 10 ml of carbonate sodium (7.5%) and distilled water to volume.

The tannins were determined by the method of precipitating casein, which consisted in adding to a 50 ml conical flask 1 g casein powder and aliquots 6 ml of the diluted extract in 12 ml of water, which they were kept under constant stirring for three hours at room temperature (25 ° C). Then the samples Whataman were filtered through filter paper of 9 cm and the resulting filtrate volume completed to 25 mL. Aliquots ranging from 8 to 12 ml, depending on the species, have been removed from this solution and phenols residual, determined by the Folin-Ciocalteu method. The amount of tannins representing the difference the value found between this reading and the obtained determination of total phenols. These phenols and tannins They were expressed as mg of dry matter (MONTEIRO et al., 2005).

The consumption of concentrate supplementation was determined by the difference between the supplementation supplied to the animals and the amount that remained after the animals had eaten. The weight of milk and animals, needed to obtain milk yield (MY) and body weight (BW), were performed daily during the collection. Milk production was corrected to 3.5% fat and calculated from the equation [4324 * PL (kg) + 16. 216 * fat (kg)], proposed by Tyrrell and Reid (1965). Samples of 150 ml of milk from the two milkings from each animal in each period were preserved with Bromopol and subsequently analyzed for fat, protein, lactose and total solids with Ekomilk Total in the Laboratory of Clinical Analysis of Milk (UFPI). For this experiment, all females were subjected to a visual assessment of body condition score (BCS), with scores classified from 1 to 5 (1 for very lean and 5 for obese).

For determining serum biochemical levels and blood cell counts, three blood samples were taken in each period, at 7, 14 and 21 days. Blood was always collected in the morning, before the animals were released into the pasture, by puncturing the jugular vein using disposable needles, measuring 25 x 8 mm (21G), for multiple crops. The blood was then placed in glass tubes without anticoagulant for 10 ml for the biochemical tests. Additionally, 5 ml of blood was placed in glass vacutainer tubes containing 0.05 ml of a 10% aqueous solution of ethylene diamine tetra-sodium (EDTA) for complete blood count. Blood samples were kept in a cooler with ice until their arrival at the Laboratory of Clinical Pathology (CPCE-UFPI), where, within 24 hours, samples were subjected to centrifugation at 980 G for 15 minutes and the serum was separated for immediate determination of variables.

Metabolic parameters were analyzed and the methods used were as follows: total protein by biuret (Labtest Diagnostic SA®, Brazil) method; purple method for serum calcium phthalein (Labtest Diagnostic SA®, Brazil); serum inorganic phosphorus by the method of ammonium dimolybdate (Labtest Diagnostic SA®, Brazil); serum magnesium by the method of sulfonated magnum; glucose by GOD- Trinder method (Labtest Diagnostic SA®, Brazil); and total cholesterol by cholesterol Enzymatic method (Labtest Diagnostic SA®, Brazil). The laboratory analyses were determined by the colorimetric method on a semi-automatic biochemical analyzer (BIOPLUS 2000®).

The consisted global count (CBC) were evaluated of the number of red blood cells,

determination of packed cell volume, hemoglobin, erythrocyte indices absolute, total and differential counts of leucocytes. The red blood cells were counted in a modified Neubauer chamber; therefore, the cells were diluted using a 20 µl semiautomatic pipette. The cell volume was determined using the microhematocrit technique, which was conducted in homogeneous capillary tubes that were 75 mm in length and one millimeter in diameter. The cyanomethemoglobin method was used to determine the hemoglobin levels in the blood. The values obtained by counting the number of red blood cells, packed cell volume and the determination of hemoglobin served to establish the absolute values of the blood indices, by prior typing of the specific unit values for differential leukocyte counts.

The total number of leukocytes was also counted in a modified Neubauer chamber, and blood samples were diluted 1:20 using Turk liquid as the diluting solution, according to the recommendations of Viana et al. (2002). Using blood "in natura", two blood smears were stretched to count the differential leukocytes. After drying, these smears were stained using the rapid Romanowsky type dye (fast Panoptic - LaborClin® LTD, Pinewoods, Paraná, Brazil), according to the animal standardization technique described by Viana et al. (2002). To determine the numbers of eosinophils, basophils, lymphocytes and monocytes, each smear was examined under a microscope at 1000x magnification, and 100 leukocytes in each smear were classified. The cored segmented neutrophils were classified according to their morphology and staining in nucleus neutrophil rod.

Statistical analysis

The data were analyzed using the Statistical Analysis System (SAS, 2005), and the comparison of means was conducted using Tukey's test with a significance level of 5%. For the hematobioquímico profile, we analyzed the data using a split plot analytical framework, with the supplementation levels in the main plot and collection days in subplots.

Results

It was observed that supplement the diet with product-dehydrated cashew influenced the dry matter intake and milk production of animals ($P<0.05$). However, the BW and BCS were not influenced ($P>0.05$) in the evaluated animals (Table 2).

Supplementation with 2.0 kg of product-dehydrated cashew in the diet caused a significant reduction ($P<0.05$) in the milk yield of the cows. No difference in milk production was observed among the control group and the groups that were fed 1.0 kg and 1.5 kg of supplementation ($P>0.05$).

There were no significant differences between the use of different product-dehydrated cashew levels for the production of the fat, protein, lactose, total solids and nonfatty solids of milk ($P>0.05$). The fat, protein and lactose content of milk had mean values of 3.71%, 3.20% and 4.20%, respectively.

It was observed that the levels of blood metabolites minerals (calcium, phosphorus and magnesium) were not affected by product-dehydrated cashew supplementation, as shown in Table 3 ($P>0.05$).

Table 2. Means and probability (P-value) for the consumption of nutrients, body condition score (BCS), body weight (BW) and Milk Production (PL).

Variables	Level of product-dehydrated cashew (kg)				P-value
	0	1,0	1,5	2,0	
Organic Matter intake (kg day PDC^{-1})	0.0^{d}	1.0^{c}	1.5^{b}	2.0^{a}	<.00001*
Dry matter intake (kg day PDC^{-1})	0.0^{d}	0.749^{c}	1.12^{b}	1.49^{a}	<.00001*
Crude protein intake (kg day PDC^{-1})	0.0^{d}	0.077^{c}	0.115^{b}	0.154^{a}	<.00001*
NDF intake (kg day PDC^{-1})	0.0^{d}	0.254^{c}	0.381^{b}	0.508^{a}	<.00001*
ADF intake (kg day PDC^{-1})	0.0^{d}	0.204^{c}	0.306^{b}	0.408^{a}	<.00001*
Ether extract intake (kg day PDC^{-1})	0.0^{d}	0.035^{c}	0.052^{b}	0.070^{a}	<.00001*
Ash intake (kg day PDC^{-1})	0.0^{d}	0.074^{c}	0.111^{b}	0.148^{a}	<.00001*
NFC intake (kg day PDC^{-1})	0.0^{d}	0.558^{c}	0.837^{b}	1.117^{a}	<.00001*
Tannin intake (kg day PDC^{-1})	0.0^{d}	0.031^{c}	0.046^{b}	0.062^{a}	<.00001*
Total tannin intake (kg)	0.0^{d}	0.651^{c}	0.966^{b}	1.302^{a}	<.00001*
Milk production correct 4% (kg day^{-1})	5.187^{a}	5.223^{a}	4.765^{ab}	3.861^{b}	0.0022*
Fat (%)	3.65	3.75	3.76	3.71	0.4632
Protein (%)	3.26	3.17	3.24	3.16	0.3281
Lactose (%)	4.73	4.78	4.77	4.73	0.5533
Total solids (%)	11.61	11.59	11.65	11.69	0.3923
Non fatty solids (%)	8.95	8.90	9.01	8.78	0.2538
Body weight (BW) (kg)	515.25	499.25	482.88	489.38	0.0780
Body condition score (BCS)	≥ 2.5 ≤ 3	≥ 2.5 ≤ 3	≥ 2.5 ≤ 3	≥ 2.5 ≤ 3	0.6750

* Means followed by different letters differ statistically (P <0.05) by the Tukey test; Non-fiber carbohydrates (NFC), Neutral detergent fiber (NDF), Acid detergent fiber (ADF).

Table 3. Means, probability (P-value) and reference values (KANEKO et al., 1997) of serum calcium, phosphorus, magnesium, cholesterol, glucose and total plasma protein (TPP) of crossbred cows Girolando supplemented with stems of dehydrated cashew product.

Metabolites	Level of product-dehydrated cashew (kg)					
	0.0	1.0	1.5	2.0	P-value	Reference
Calcium (mg dL^{-1})	10.75	10.86	10.26	10.50	0.0558	9.7-12.4
Phosphorus (mg dL^{-1})	5.23	6.02	5.84	5.73	0.7773	5.6-6.5
Magnesium (mg dL^{-1})	2.25	2.30	2.16	2.311	0.2348	1.8-2.3
Cholesterol (mg dL^{-1})	107.35	117.00	109.01	107.28	0.8910	80-120
Glucose (mg dL^{-1})	56.80^{ab}	60.95^{a}	57.95^{ab}	53.85^{b}	0.0182*	45-75
Total plasma protein (g dL^{-1})	8.27^{a}	7.97^{ab}	7.87^{b}	7.80^{b}	0.0050*	7.0-8.5

*Means followed by different letters differ statistically (P <0.05) by Tukey's test.

The total cholesterol levels of the animals were also not affected (P>0.05) by product-dehydrated cashew supplementation. However, the concentration of serum glucose and total plasma protein decreased (P<0.05) with increasing levels of supplementation with product-dehydrated cashew. Only supplementation with 2 kg of product-dehydrated cashew reduced serum glucose levels. However, the total plasma protein levels of animals that were fed 1.5 kg to 2.0 kg

supplementations were similar (P>0.05) to each other, and both groups had reduced levels of total plasma proteins compared to the control group. Despite the reduction between groups, all of the animals had serum nutrients levels within the reference range (KANEKO et al., 1997).

The CBC appeared to be affected by supplementation with product-dehydrated cashew, as shown in Table 4 (P<0.05). The group that was fed 1 kg product-dehydrated cashew and the group without supplementation (control group) presented lower counts of total erythrocytes, with no difference between these two groups (P>0.05).

Table 4. Mean values of hematological profile in crossbred Girolando cows kept on pasture and supplemented with levels of stem dehydrated cashew product.

Variables	Level of product-dehydrated cashew (kg)				P-value	Reference[1]
	0.0	1.0	1.5	2.0		
Erythrogram						
Erythrocyte (x106 µl^{-1})	6.00^{b}	5.85^{b}	7.46^{a}	7.71^{a}	0.033*	5.0-10.0
Packed cell volume (%)	32.75^{a}	30.50^{a}	29.81^{a}	29.37^{a}	0.443	24-46
Hemoglobin (g dl^{-1})	11.50^{a}	11.62^{a}	11.63^{a}	11.53^{a}	0.963	8.0-15
MCV (Fl)	41.40^{a}	30.89^{ab}	35.81^{ab}	29.95^{b}	0.047*	40-60
MCHC (%)	37.97^{a}	39.58^{a}	41.70 ^{a}	39.09^{a}	0.585	30-36
Leukogram						
Leukocytes (µl)	8.613^{a}	10.975^{a}	8.844^{a}	10.798^{a}	0.0894	4.0-12
Neutrophils (µl)	2614^{a}	2850^{a}	2763^{a}	4737^{a}	0.2122	600-4000
Eosinophils (µl)	527.8^{a}	737.3^{a}	634.0^{a}	1305.8^{a}	0.3013	0-2400
Monocytes (µl)	276.63^{b}	301.69^{b}	323.50^{ab}	514.19^{a}	0.0277*	250-840
Lymphocytes (µl)	4003.9^{a}	5657.2^{a}	5118.6^{a}	6168.9^{a}	0.2170	2500-7500

MCV = mean corpuscular volume, MCHC = mean corpuscular hemoglobin concentration, TPP = Total Plasma Protein; *Means followed by different letters differ statistically (P<0.05) by Tukey's test;
[1]Interval reference to adult sheep (KRAMER, 2006).

The groups that were fed 1.5 kg to 2 kg of product-dehydrated cashew had significantly higher (P<0.05) erythrocyte values, but no differences were observed (P>0.05) between the erythrocyte counts of these two groups.

The mean corpuscular volume (MCV) was also influenced by product-dehydrated cashew supplementation. The group that was fed 2.0 kg of product-dehydrated cashew showed the lowest MCV, but the groups fed 1.5 kg and 1 kg of product-dehydrated cashew showed no differences from the control group. It was observed that not all the variables of the erythrocyte profile remained within the reference ranges. The MCV and mean corpuscular hemoglobin concentration (MCHC) did not remain within the reference range determined by Kramer (2006); this result was most likely influenced by the fact that treatment in 1.5 and 2.0 kg of supplementation increased the product-dehydrated cashew erythrocyte count.

Concerning the leucogram, the leukocyte profile monocyte count appeared to be affected by product-dehydrated cashew supplementation, as shown in Table 4 (P<0.05), with differences between the group that was fed 2.0 kg product-dehydrated cashew and the control group and the group that was fed 1.0 kg product-dehydrated cashew. It was observed that all of the variables of blood leukocytes remained within the reference range determined by Kramer (2006).

Discussion

The reduction in milk production in the group that received the highest amount of supplementation (2.0 kg) most likely had the greatest amount of tannin and lignin, which are phenolic compounds that impair the digestibility of food, present in the diet.

The main problem with tannin, when present in food, is the complexation with proteins, which affects the digestibility and modifies the palatability (astringent), as with cashews (BRITO et al., 2013; CRUZ et al., 2007). It is believed that the tannin and protein combination and the stability of this complex is due mainly to the formation of hydrogen bonds and hydrophobic interactions between these molecules. Proteins differ enormously in their affinity for tannin. The main characteristics of proteins that react positively with tannin are a high molecular weight, a more open and flexible structure, a high isoelectric point and a high proline content (GEERKENS et al., 2013). This last feature is most likely the most important factor that interferes with the association between proteins and tannins because proline has hydrophobic characteristics and contributes to a more open conformation of the protein. With regard to the structure and presence of major polyphenols in the formation of a tannin-protein complex, we highlight three characteristics: a larger polyphenol group; a flexible conformation, which facilitates retraction of the polyphenol/protein binding; and low solubility of the polyphenol (BUTLER, 1989). The consequence of these factors is the reduction in the rumen microbial protein production, which is responsible for much of the ruminant metabolizable protein because the presence of sulfur amino acids is an essential part in the formation of microbial proteins.

The nutritional values for the chemical components of the milk (fat, protein, lactose and total solids) indicate that the composition of the milk is within the quality standards established by industries. Therefore, the milk produced by the cows supplemented with the product-dehydrated cashew maintained the quality standards required by the market. The chemical composition of the milk observed in this study is also consistent with Carvalho et al. (2006), who evaluated the effects of palm kernel cake in the supplement concentrate of dairy cows on the chemical composition of milk, and found no effects on the percent chemical composition of milk from Girolando cows.

According to the NRC (2001), the concentration of crude protein in the milk of cows may vary between 3.11 and 3.65%. In this study, the percentage of protein in milk ranged from 3.17 to 3.26%, but there were no significant differences ($P>0.05$) among the supplements. The protein concentration in the diet indicates whether there are sufficient amino acids for milk protein synthesis. Thus, the presence of sufficient amino acid precursors for synthesis increases the level of milk production, with a tendency to increase milk protein and lactose concentrations, whereas the concentration of milk fat decreases (WALKER et al., 2004).

The BCS presented by animals in this study was below the levels that are considered suitable for dairy cows in this productive phase. This result can be explained by the low quality and quantity of native pasture that was used during the study period, September. When dairy cows, especially multiparous cows, have an appropriate BCS (3.25 to 3.75), the lactation curve shows higher peak production and higher persistency of lactation than that of cows with a low BCS (<3.0) (FERREIRA et al., 2013). This statement allows the inference that there is a reduction in the milk production, despite the BCS values, because the presented values are smaller than those recommended for this species.

Furthermore, Table 1 shows that most of the protein (45.64%) that is present in cashews is insoluble and connected in the fiber. Consequently, there is a reduction in rumen microbial protein production, which is responsible for much of the ruminant metabolizable protein because the

presence of sulfur amino acids is essential to the formation of microbial proteins (BERCHIELLI et al., 2006). These declines in serum glucose and total plasma protein were due to the presence of phenolic compounds in the cashew, which hinders the utilization of proteins by the animal and consequently affects the relationship between energy and protein. When present in food, tannin complexes with proteins, which affect the digestibility and availability of the protein in the bloodstream of the animal, consequently affecting intestinal absorption. It is believed that the combination of tannin with protein and stability of this complex is due mainly to the formation of hydrogen bonds and hydrophobic interactions between these molecules. These effects were even blander because the cashew dehydration process reduced the levels of phenolics in the product.

The increase in the total count of the red blood cells most likely occurred due to the high iron content in the product-dehydrated cashew; this mineral is essential, along with other hematopoietic components, for the production of globin, which is the primary factor in the production of erythrocytes by the body. Therefore, the high levels of iron in the product-dehydrated cashew can justify a significant increase in red blood cells.

Thus, it is necessary to have sufficient quantities of protoporphyrin and vitamins to ensure that all of these factors are present in adequate amounts, erythrocyte precursors mature in an orderly process and the cells begin the synthesis of normal hemoglobin molecules (Hg) because of the growth stage (YAQUB et al., 2013). In cattle, soil and climatic conditions, the type of rearing and feeding, food quality, hygiene, number of animals, breed, age, sex, and physiological and behavioral stress, beyond subclinical pathological conditions, significantly influence the results obtained from laboratory species (EARLEY et al., 2013; YAQUB et al., 2013). There was increased numbers of monocytes with the addition of product-dehydrated cashew but values remained within the normal range for the species (KRAMER, 2006). The stimulation of production of monocytes is related to the presence of inflammatory responses that can increased values, which did not occur in this study.

Conclusions

Supplementation with 2.0 kg of product-dehydrated cashew in the diet of crossbred Girolando dairy cows managed under similar conditions to those used in this study reduced milk production and the levels of glucose and total plasma protein but did not affect the animals' body condition.

The blood cell counts showed an increase in the total number of leukocytes and a decrease in the mean corpuscular volume (MCV), but all of the variables remained within the normal limits for the species.

Supplementing the diet of Girolando dairy cows that are raised in a native pasture with up to 1.5 kg day^{-1} of product-dehydrated cashew does not change the variables evaluated. It is not recommended to use 2 kg animal day^{-1} of these byproducts.

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