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# Performance and immune response of steers Nellore finished in feedlot and fed diets containing dry leaves of *Baccharis dracunculifolia*

## Desempenho e resposta imune de novilhos Nelore terminados em confinamento e alimentados com dietas contendo folhas secas de *Baccharis dracunculifolia*

## Rendimiento y respuesta inmune de novillos en confinamiento alimentados con inclusión de hojas secas de *Baccharis dracunculifolia* en su dieta

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**Abstract**

This study was carried out to investigate the effects of addition *Baccharis dracunculifolia* leaves *in nature* on animal performance, feed intake, ingestive behavior, and blood parameters of Nellore steers finished in feedlot on high-grain diets. A total of 40 Nellore steers, with an average body weight of 412.9 ± 22.0 kg were distributed in individual pens, equipped with automatic drinkers and masonry feeders. The steers were randomly assigned to one of four studied diets, therefore the CONT – basal diet; BAC05 – basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (5 g/animal/day); BAC10 – basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (10 g/animal/day); and BAC15 – basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (15 g/animal/day). The use of plants *in nature* did not affect final body weight, average daily gain, dry matter intake, or feed efficiency. Neither on ingestive behavior activities and plasma concentrations of urea, creatine, aspartate aminotransferase, gamma-glutamyl transferase, and creatine kinase no effects were detected between diets. The inclusion of plants *in nature* in steer’s diet did not negatively impact performance and health. However, further field studies with beef cattle are needed for greater clarification of its effects and dosages.

**Keywords:** Beef cattle; High-grain diet; Ingestive behavior; Plasma metabolites.

**Resumo**

Este estudo foi realizado para investigar os efeitos da adição de folhas de *Baccharis dracunculifolia in natura* sobre o desempenho animal, ingestão de alimentos, comportamento ingestivo e parâmetros sanguíneos de novilhos nelore terminados em confinamento e alimentados com dietas de alto grão. Um total de 40 novilhos Nelore, com peso corporal médio de 412.9 ± 22.0 kg foram distribuídos em baias individuais, equipadas com bebedouros automáticos e comedouros em alvenaria. Os novilhos foram alocados ao acaso e alimentados com quatro diferentes dietas: CONT – dieta basal, BAC05 – dieta basal e inclusão de folhas de *B. dracunculifolia in natura* (5 g/animal/dia); BAC10 dieta basal e inclusão de folhas de *B. dracunculifolia in natura* (10 g/animal/dia) e BAC15 – dieta basal e inclusão de folhas de *B. dracunculifolia in natura* (15 g/animal/dia). O uso das folhas da planta da *B. dracunculifolia in natura* não alterou o peso final, ganho médio diário, ingestão de matéria seca e eficiência alimentar. Da mesma forma, as atividades do comportamento ingestivo, as concentrações de ureia, creatinina, aspartato amino transferase, gama glutamil transferase, creatinina quinase não foram alterados pelas dietas. Assim, a inclusão de folhas de planta *B. dracunculifolia in natura* na dieta de novilhos não teve impacto negativo no ganho em peso e saúde dos animais. No entanto, mais estudos de campo com bovinos de corte são necessários para maiores conhecimentos dos seus efeitos e dosagens a serem usadas.

**Palavras-chave:** Bovinos de corte; Dietas de alto grão; Comportamento ingestivo; Metabólitos plasmáticos.

**Resumen**

Este estudio se realizó para investigar los efectos de la adición de hojas de *Baccharis dracunculifolia in natura* en el desempeño animal, la ingestión de alimentos, comportamiento ingestivo y los parámetros sanguíneos de novillos Nellore terminados en cebaderos y alimentados con dietas altas en granos. con un peso corporal promedio de 412,9 ± 22,0 kg se distribuyeron en corrales individuales, equipados con bebederos automáticos y comederos en concreto. Los novillos fueron distribuidos aleatoriamente y alimentados con cuatro dietas diferentes: CONT - dieta basal, BAC05 - dieta basal e inclusión de hojas de *B. dracunculifolia in natura* (5 g/animal / día); BAC10 - dieta basal e inclusión de hojas de *B. dracunculifolia in natura* (10 g/animal/día) y BAC15 - dieta basal e inclusión de hojas de *B. dracunculifolia in natura* (15 g/animal/día). El uso de las hojas de la planta *B. dracunculifolia in natura* no alteró el peso final, la ganancia diaria promedio, la ingestión de materia seca y la eficiencia alimenticia. Asimismo, las actividades de comportamiento ingestivo, concentraciones de urea, creatinina, aspartato aminotransferasa, gamma glutamil transferasa, creatinina quinasa no fueron alteradas por las dietas. Por tanto, la inclusión de hojas *in natura* de la planta *B. dracunculifolia* en la dieta de los novillos no tuvo un impacto negativo en la ganancia de peso y la salud de los animales. Sin embargo, se necesitan más estudios de campo con ganado de carne para comprender mejor sus efectos y las dosis a utilizar.

**Palabras clave:** Ganado de carne; Dietas ricas en cereales; Comportamiento ingestivo; Metabolitos plasmáticos.

## 1. Introduction

The efficiency in beef cattle production is considered a great challenge and has been a target of innumerable research and discussions over the years, indicating the need to maximize production through the development of the entire meat production chain. The finishing phase in a feedlot of the animals, which was been studied in this work is one of the phases more important on the production cycle. This is an onerous phase due to the high costs of a quality feed, thus allowing the animals to express their full genetic potential. Thus, the use of new alternatives to increase the productivity of the cattle herd has been studied more frequently, being the class of growth promoters in the highlighted (Fugita et al., 2018; Monteschio et al., 2017; Ornaghi et al., 2017; Souza et al., 2019).

In the last decades, antibiotics were commonly administered in the diet of animals with the function of modulating bacterial flora, but their use is undergoing some restrictions in European Union (OJEU, 2003) and the USA (FDA, 2015). Therefore, alternative products that promote a satisfactory animals' performance without compromising the quality of the final product (meat) offered to beef consumers are being investigated (Cruz et al., 2014; Guerrero et al., 2018; Monteschio et al., 2017; Rivaroli et al., 2016).

In this situation many studies are being carried out in this area, searching for a natural substitute that meets such requirements. The use of plant extracts is an alternative to replace antibiotics (Benchaar et al., 2008; Cruz et al., 2014; Valero et al., 2016), besides acting as antimicrobials and antioxidants, benefiting the immune and digestive system of animals (Jayasena & Jo, 2013; Ornaghi et al., 2017).

This includes the plant of *Baccharis dracunculifolia*, being a native plant from Brazil, commonly known as "Alecrim do campo". This extract is composed of aliphatic hydrocarbons, cyclic hydrocarbons, terpenes (baccharin), isopropanol, flavonoids (isosakuranetin, aromadendrin-4′-methyl ether) and phenolic acid (artepelin C, caffeic acid, *p*-coumaric acid, ferulic acid) (Campos et al., 2016; Kumazawa et al., 2003); however, having the artepelin C as the principal compound (Veiga et al., 2017), besides presenting potential as antioxidants (Oliveira et al., 2003), classifying themselves as biological, antimicrobial, antioxidant and anti-inflammatory agents (Tiveron et al., 2016).

This study was carried out to evaluate the effects of the addition/inclusion of plant leaves of *Baccharis dracunculifolia in nature* on animal performance, feed intake, ingestive behavior activities, and blood parameters of steers finished in the feedlot with high-grain diets.

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## 2. Materials and Methods

### *2.1. Ethics committee*

This experiment was approved by the committee for ethics in the use of animals (CEUA) of the Universidade Estadual de Maringá, following protocol 3624120116.

### *2.2. Animals and experimental diet*

Forty Nellore purebred steers with a mean initial body weight (BW) of 412.9 ± 22.0 kg were used in this study. Steers were distributed randomly in individual pens, with dimensions of 10 $m^2$ for each animal, partially covered and equipped with automatic drinkers and masonry feeders. The period of adaptation to the feedlot and concentrate diet was 14 days; afterwards, the experimental period was extended to 56 days until animals reached a mean final body weight of 499.9 ± 25.6 kg. During the experimental period, Nellore steers were weighed monthly to record weight gain and productivity variables. We used the quantitative method (Pereira et al., 2018), carried out by means of field research to assess the performance, feed intake, ingestive behavior, and blood parameters of Nellore steers finished in feedlot on high-grain diets

Steers were randomly assigned to one of four studied diets with ten steers per diet group. The diets tested were CONT – basal diet; BAC05 – basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (5 g/animal/day); BAC10 – basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (10 g/animal/day); and BAC15 – basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (15 g/animal/day). The plant included in the diet was made every 15 days, to calculate and adjust the dose by period depending on the intake of dry matter (DM)/d per animal. Preparation of diets was made with a pre-mix of plant *in nature* in the soybean meal and ground corn then led to the feed mixer together with other ingredients. The Leaves of *B. dracunculifolia in nature* had a powder texture and were obtained of a single property through the manual collection of the leaves of the plant, which were processed in a knife mill to be offered to the animals.

The basal diets, consisting of pre-dried Tifton 85 hay, corn grain, and the dry leaves of *B. dracunculifolia* in nature was mixed with soybean meal, ground corn, yeast, mineral salt, and top-dressed daily into the morning feeding of respective treatments pens (1.60 kg of mixture/steers daily). Soybean meal was also top-dressed into the morning feeding of CONT

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pens (1.60 kg/steers daily), without the addition of the experimental ingredients. All diets were isonitrogenous, isoenergetic, and formulated to meet the requirements for a gain of 1.7 kg/d (NRC, 2000) with adequate concentrations of nutrients for the growth and finishing of animals (Table 1).

**Table 1.** Ingredient composition of total mixed ration offered during the experiment.

| **Ingredients, g/kg od DM** | **CONT[a]** | **BAC05[b]** | **BAC10[c]** | **BAC15[d]** |
|---|---|---|---|---|
| Pre-dried hay | 150 | 150 | 150 | 150 |
| Corn grain | 710 | 710 | 710 | 710 |
| Soybean meal | 51.0 | 51.0 | 51.0 | 51.0 |
| Ground corn | 85.0 | 85.0 | 85.0 | 85.0 |
| Yeast | 0.40 | 0.40 | 0.40 | 0.40 |
| Mineral salt[e] | 3.20 | 3.20 | 3.20 | 3.20 |
| *Baccharis dracunculifolia* | - | 0.05 | 0.10 | 0.15 |

[a]CONT = basal diet; [b]BAC05 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (5 g/animal/day); [c]BAC10 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (10 g/animal/day); and [d]BAC15 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (15 g/animal/day). [e]Mineral mix composition (kg): calcium, 50 g; magnesium, 57 g; sodium, 81 g; sulfur, 3.75 g; cobalt, 20 mg; copper, 500 mg; iodine, 25 mg; manganese, 1.500 mg; selenium, 10 mg; zinc, 2.000 mg; vitamin A, 400.000 UI; vitamin D3, 50.000 UI; vitamin E, 750 UI; ether extract, 168 g; urea, 200 g. **Source:** Authors.

### *2.3. Chemical analyses*

The chemical compositions of ingredients and experimental diets were presented as g/kg of DM (Table 2).

**Table 2.** Chemical composition of total mixed ration offered during the experiment.

| **Item** | **DM[1]** | **Ash** | **CP[2]** | **EE[3]** | **NDF[4]** | **ADF[5]** | **NNE[6]** | **TDN[7]** | **DE[8]** |
|---|---|---|---|---|---|---|---|---|---|
| Ingredients (g/kg of DM) | | | | | | | | | |
| Pre-dried hay | 337 | 73.1 | 155 | 18.1 | 828 | 358 | 461 | 581 | 25.6 |
| Corn grain | 853 | 16.4 | 96.1 | 47.1 | 175 | 45.8 | 845 | 635 | 2.80 |
| Ground corn | 875 | 15.7 | 90.7 | 39.8 | 136 | 43.6 | 838 | 857 | 37.8 |
| Soybean meal | 850 | 67.0 | 489 | 19.0 | 159 | 87.8 | 450 | 822 | 36.2 |
| Yeast | 920 | 46.1 | 331 | 21.0 | 26.0 | 9.22 | - | - | - |
| Mineral salt | 986 | 945 | - | - | - | - | - | - | - |
| *Baccharis dracunculifolia* | 539 | 61.3 | 130 | 22.3 | 533 | 356 | 602 | 655 | 28.9 |
| Diet | 776 | 32.1 | 138 | 39.8 | 269 | 95.9 | 750 | 651 | 10.8 |

[1]*DM*, dry matter; [2]*CP*, crude protein; [3]*EE*, ether extract;[4]*NDF*, neutral detergent fiber; [5]*ADF*, acid detergent fiber [6]*NNE*, non nitrogen extractive;[7]*TDN*, total digestible nutrients; [8]*DE*, digestible energy. **Source**: Author's.

DM was estimated after oven drying at 65° C for 24 h and milling through a 1-mm screen following method ID 934.01 (AOAC, 2005). Ash content was measured by combustion at 550° C for 16 h according to method ID 942.05 (AOAC, 2005). Nitrogen concentration was determined by the Kjeldahl method (ID 988.05) (AOAC, 2005). Following the determination of nitrogen concentration, crude protein was calculated by multiplying the nitrogen content by a factor of 6.25. Ether extract content was determined by method ID 920.39 (AOAC, 2005). The neutral detergent fiber (NDF) content was measured according to the recommendations of Mertens (2002) using α-amylase and was expressed inclusive of residual ash. The acid detergent fiber was measured by using method ID 973.18 (AOAC, 2005) and was expressed inclusive of residual ash. The non-nitrogen extract was obtained by equation according to AOAC (2005). The digestible energy was calculated according to the recommended equations (NRC, 2000). Total digestible nutrients (TDN) content of diets was obtained by the methodology descript by Kearl (1982), using the equation for pre-dried:

Hay = – 17.2649 + 1.2120 (% CP) + 0.8352 (% ENN) + 2.4637 (% EE) + 0.4475 (% CF).

Energetic foods = 40.2625 + 0.1969 (% CP) + 0.4228 (% ENN) + 1.1903 (% EE) + 0.1379 (% CF).

Protein foods = 40.3227 + 0.5398 (% CP) + 0.4448 (% ENN) + 1.4218 (% EE) – 0.7007 (% CF).

### *2.4. Animal performance*

Diets were offered at 08:00 and 16:00 h every day. Feed intake was estimated as the difference between the feed supplied and refusals in the trough. To determine growth performance, animals were weighed at the beginning of the experiment and then every month (after fasting for 16 h), throughout the experiment. The average daily gain was calculated as the total BW gain divided by the length of the experimental period (56 days). Feed efficiency was calculated as the ratio between average daily gain and DM intake.

When the Nellore steers reached a mean final body weight of 499.9 ± 25.6 kg, they were slaughtered in a commercial slaughterhouse 153 km from the Iguatemi Experimental Farm. Animal transport was carried out in the late afternoon to minimize stress. Upon arrival at the slaughterhouse, animals were kept in resting pens and were subsequently stunned using a penetrating captive bolt pistol as per Brazilian federal inspection regulations according to the Brazilian RIISPOA – Regulation of Industrial and Sanitary Inspection of Animal Products.

***2.5. Ingestive behavior activities***

Data relative to the ingestive behavior of steers were obtained between the 7$^{th}$ and 8$^{th}$ weeks of a feedlot. The record of the quantitative data on the basic behavioral patterns was according to Silva et al. (2005), through visual observation of the animals every 5 min during 1 minute performed by a trained team during 12 uninterrupted hours. A spreadsheet was used to organize the records collected chronologically regarding the duration of feeding and drinking by the number of action observation times. For ruminating and idle periods, the total time spent on each activity was determined by the sum of the repetitions.

***2.6. Blood analyses***

Blood samples were evaluated every 18 days for a total of three individual collections per animal in the vacutioner® tube and maintained at a temperature of 25$^0$ C with the mean for facilitating the coagulation, and then were performed the serum separation by centrifugation (Centrifuge, Rotina 420-R, Tuttlingen, Germany), being used a speed of 3000 rpm/15 min. The evaluation of parameters like urea and creatine was performed according to Vasconcelos et al. (2007). The activities of muscle injury indicative enzymes aspartate aminotransferase (AST) and creatine kinase (CK) were measured in a spectrophotometer (Spectrophotometer UV-Vis-Evolution 200, Massachusetts, United State of America) using commercial enzymatic dosage kits (Bioclin, Belo Horizonte, Brazil) according to the manufacturer's instructions. The gamma-glutamyl transferase (GGT) was performed using Roche assay reagents in the Roche 900 series automated clinical chemical analyzer (Roche Diagnostics, Indiana, United State of America).

***2.7. Statistical Analyses***

The experimental design was completely randomized with four treatments and ten replications. The results were statistically interpreted using regression equations performed in SAS (2004) (PROC REG):

$$Yijk = \beta 0 + \beta 1Xi + \beta 2\ Xi^2 + \alpha ijk + \varepsilon ijk$$

where: *Yijk*, *β0*, *Xijk*, *αijk*, and *εijk* are Dependent variables (plant levels); Regression coefficient; Independent variables; Regression deviations; and Residual error, respectively.

## 3. Results

The inclusion of up to 15 g/animal/day of the leaves of *Baccharis dracunculifolia in nature* in the steers' diets finished in the feedlot did not affect ($P \geq 0.47$) final body weight, average daily gain, dry matter intake, and feed efficiency (Table 3).

**Table 3.** Performance parameters of steers supplemented or not with plant *in nature* during the feedlot-finishing period.

| Parameters | Experimental diets | | | | SEM[5] | *P*-value | |
|---|---|---|---|---|---|---|---|
| | CONT[1] | BAC05[2] | BAC10[3] | BAC15[4] | | L | Q |
| Initial body weight, kg | 415 | 415 | 413 | 409 | 3.89 | 0.61 | 0.85 |
| Final body weight, kg | 499 | 499 | 506 | 496 | 4.56 | 0.97 | 0.86 |
| Average daily gain, kg/d | 1.50 | 1.50 | 1.66 | 1.55 | 0.05 | 0.53 | 0.72 |
| Dry matter intake, kg/d | 9.13 | 9.29 | 9.16 | 9.09 | 0.13 | 0.84 | 0.89 |
| Feed efficiency[6] | 0.17 | 0.16 | 0.18 | 0.17 | 0.01 | 0.47 | 0.75 |

[1]CONT = basal diet; [2]BAC05 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (5 g/animal/day); [3]BAC10 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (10 g/animal/day); and [4]BAC15 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (15 g/animal/day); [5]SEM - standard error of the mean; [6]kg average daily gain/kg dry matter feed intake. **Source:** Authors.

No treatment effects were detected ($P \geq 0.23$) for ingestive behavior activities during the 12 uninterrupted hours for activities drinking, feeding, rumination, idleness (Table 4).

**Table 4.** Ingestive behavior activities parameters of steers supplemented or not with plant *in nature* during the feedlot finishing period.

| Activities | Experimental diets | | | | SEM[5] | *P-value* | |
|---|---|---|---|---|---|---|---|
| | CONT[1] | BAC05[2] | BAC10[3] | BAC15[4] | | L | Q |
| Drinking, Nu. visits | 3 | 3 | 4 | 3 | 0.36 | 0.85 | 0.95 |
| Feeding, Nu. visits | 21 | 22 | 22 | 24 | 1.02 | 0.23 | 0.48 |
| Rumination time, hours | 100 | 109 | 70.0 | 112 | 8.02 | 0.97 | 0.61 |
| Idleness time, hours | 500 | 486 | 520 | 471 | 9.27 | 0.51 | 0.52 |

[1]CONT = basal diet; [2]BAC05 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (5 g/animal/day); [3]BAC10 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (10 g/animal/day); and [4]BAC15 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (15 g/animal/day); [5]SEM - standard error of the mean. **Source:** Authors.

No treatment effects were detected ($P \geq 0.12$; Table 5) for plasma concentrations of urea, creatine, aspartate aminotransferase, gamma-glutamyl transferase, and creatine kinase.

**Table 5.** Concentrations of plasma urea (mg/dl), creatine (mg/dl), aspartate aminotransferase (U/l), gamma-glutamyl transferase (U/l), creatine kinase (U/l) in steers supplemented or not with plant *in nature* during the feedlot finishing period.

| **Parameters** | **Experimental diets** | | | | **SEM[5]** | ***P-value*** | |
|---|---|---|---|---|---|---|---|
| | **CONT[1]** | **BAC05[2]** | **BAC10[3]** | **BAC15[4]** | | **L** | **Q** |
| Urea | 38.5 | 40.0 | 37.0 | 38.0 | 1.26 | 0.47 | 0.62 |
| Creatine | 2.79 | 2.99 | 2.77 | 3.29 | 0.09 | 0.13 | 0.23 |
| Aspartate aminotransferase | 186 | 197 | 174 | 181 | 6.11 | 0.49 | 0.79 |
| Gamma glutamyl transferase | 44.5 | 46.2 | 43.7 | 47.8 | 1.94 | 0.12 | 0.22 |
| Creatine kinase | 334 | 384 | 429 | 430 | 24.8 | 0.14 | 0.31 |

[1]CONT = basal diet; [2]BAC05 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (5 g/animal/day); [3]BAC10 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (10 g/animal/day); and [4]BAC15 = basal diet and inclusion of *B. dracunculifolia* leaves *in natura* (15 g/animal/day); [5]SEM - standard error of the mean. **Source:** Authors.

## 4. Discussion

The finished period, especially feedlot is a term in which beef cattle need a contribution against diseases, metabolic disorders, and ruminal digestion as fermentative modulators (Russell & Strobel, 1989; Souza et al., 2018). The *B. dracunculifolia* has great importance in Brazilian botany (Bankova et al., 1999; Campos et al., 2016; Silva Filho et al., 2004), because of their antibacterial effect (Silva Filho et al., 2008; Veiga et al., 2017) this same effect is found both in the plant *in nature* and in the propolis and/or as it can be called "green propolis" that is produced by bees that use the nectar of the plant flowers.

The studies reported by other authors (Valero et al., 2014; Zawadzki et al., 2011) prove that the use of propolis in beef cattle diets can improve the average daily gain. This improvement is due to the efficiency of the use of nutrients in the rumen, as a decrease in the losses coming from the methane gas (Callaway et al., 2003). However, the results from the current experiment did not report an improvement on average daily gain variables with the addition/inclusion of the leaves of *B. dracunculifolia*.

According to laboratory works performed by Búfalo et al. (2009); Massignani et al. (2009); Parreira et al. (2010) and Guimarães et al. (2012) using *B. dracunculifolia in nature* as substrate proves *in vitro* the antiviral, antiprotozoal, antioxidant, and antibacterial power; in particular the antibacterial effect is related to the greater sensitivity of the gram-positive bacteria to the action mechanisms of this extract, corroborating with the results found by Zawadzki et al. (2011) and (Valero et al. (2014) on natural propolis.

Even without the differentiation between the treatments from animals that received or not the supplementation with the plant extracts, the average daily gain can be considered satisfactory for feedlot animals fed a high grain diet on the Nellore breed (Françozo et al., 2013; Maggioni et al., 2010). The final body weight, dry matter intake, and feed efficiency had similar results between treatment animals throughout the experimental period (Table 3). The plant *in nature* presents high levels of flavonoids and phenol (Kumazawa et al., 2003; Paula et al., 2017), consequently, these concentrations in steers' diet negatively influenced ruminal dynamics, justifying the lack of effect detection for feed efficiency.

Ingestive behavior activities (feeding, drinking, ruminating, and idle; Table 4) were similar among the treatments that received the vegetal extract or not, this resemblance is possibly explained due to the similarity between the feedlot pens, as well as the basal diet offered to the animals. Corroborating with these results other works carried out under similar conditions and with the inclusion of natural additives (essential oils) as those from our research group (Ornaghi et al., 2017) who did not detect either effect for ingestive behavior on young bulls receiving a high concentrated diet.

Results for feeding and ruminating are in according with (Eiras et al., 2014; Missio et al., 2010; Ornaghi et al., 2017) who also evaluated ingestive behavior on beef cattle feedlot supplemented with a high concentrated diet. The low levels for these activities are understood due to the greater energetic support that this type of diet provides; thus, the animals reach their nutritional requirements and cease their consumption. According to Van Soest (1994), a diet with a higher percentage of forage increase the time used for rumination, that is, a high concentrate diet due to the size of its particles may have reduced the rumination capacity of the present study steers. Another factor that may have compromised the rumination rate is the high levels of phenolic substances found in *B. dracunculifolia* (Park et al., 2002; Tiveron et al., 2016) which adversely affected the use of feed by ruminal bacteria.

The observation of the beef cattle behavior from feedlot presents great importance, to guarantee the maximum production of the animals without taking unnecessary management, avoiding more intense periods used by the animals in the use of feed intake. In addition, the feed offered to animals at shorter intervals of time is aimed at improving the absorption of the nutrient (Ítavo et al., 2011).

Stresses being by transport, dehydration, or nutrient-poor diets influence metabolism, through changes in plasma concentrations of urea, total protein, and creatine kinase (Buckham et al., 2008; Earley & O'Riordan, 2006; Tarrant et al., 1992). Corroborating with this affirmation Berschauer et al. (1983) report that with increasing feed intake there is a decrease in blood urea concentrations. In the present study, the results for urea, creatine, and creatine kinase were above what is classified as a reference for cattle (Table 5). Therefore, these results indicate that the steers did not suffer any type of metabolic alteration during the experimental period, but in the period before the experiment.

The plasma blood concentration of steers fed *B. dracunculifolia* for aspartate aminotransferase and gamma-glutamyl transferase were higher according to the results found by Gandra et al. (2012). The possible explanation for this small difference is the forage: concentrate ratio of the diet, since high concentrate diets can induce liver injury (Mori et al., 2007). Therefore, with the inclusion of the plant extract, no clinical alterations were observed due to infectious, neurological, or metabolic diseases, which could negatively influence the performance and health of the steers.

## 5. Conclusion

The inclusion up to 15 g/animal/day of dry leaves of *Baccharis dracunculifolia in nature* does not affect animal performance, ingestive animal behavior, and blood plasma parameters on finished steers in a feedlot. The results from this study suggest that the use of this plant in the diet of steers does not cause any feed injury.

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