Original Article

LEVELS OF SUPPLEMENTATION FOR GRAZING PREGNANT BEEF HEIFERS

NÍVEIS DE SUPLEMENTAÇÃO PARA NOVILHAS DE CORTE PRENHES EM PASTEJO

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ABSTRACT: The objective of this work was to evaluate the effect of different levels of multiple supplement supply on the nutritional characteristics and productive performance of pregnant heifers grazing *Brachiaria decumbens* Stapf. during the dry season. The experimental area was composed of four 3.0-ha paddocks with potentially digestible dry matter availability of 1,863 kg/ha. Twenty four crossbred heifers at 32 months and average initial body weight of 416±6 kg were used. The experimental design was in a completely randomized. The treatments consisted of mineral supplement and supply 0.5, 1.0, 2.0 kg/animal/day of multiple supplement. The dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), non-fibrous carbohydrates and total digestible nutrients (TDN) intake showed increasing linear relationship ($P<0.10$) with multiple supplement levels. Coefficients of apparent digestibility of DM, OM and non-fibrous carbohydrates also had linear effect ($P<0.10$) on the multiple supplementation levels. The microbial nitrogen flow and efficiency there was not affect ($P>0.10$) by levels of multiple supplementation; however the microbial nitrogen flow in relation to nitrogen intake showed decreasing linear profile ($P<0.10$). On the average daily gain was observed quadratic effect of multiple supplementation ($P<0.10$). In conclusion, the supply of 1.5 kg of multiple supplement optimizes the performance of grazing heifers during the dry season.

KEYWORDS: Dry season. Multiple supplement. Nutritional parameters. Weight gain

INTRODUCTION

An economically important trait in beef cattle production is the reproductive performance of females. Pre and postpartum feed restriction results in low birth weight, longer interval of postpartum anestrus and low rate of cows cycling in the subsequent reproductive period (GOTTSCHALL; LOBATO, 1996). In contrast, pre-partum greater weight gain of the cow is the main determinant of higher birth weight of the calf, which is directly related to the incidence of dystocia.

Manipulation of weight gain and body condition during pregnancy is a challenge in the Brazilian livestock, and the primary objective is to search for proper weight of the heifer at calving without promoting excessive development of the calf during neonatal period. Feeding alternatives must be tested to enrich the quality of diet based on tropical pastures, and the use of supplementation during the dry season may contribute to increased rates of weight gain and, consequently, better reproductive response at younger ages (VIEIRA et al., 2006).

Herds with poor nutrition have low reproductive rates, delaying the resumption of ovarian luteal cyclic activity, which could be avoided or mitigated by strategic supplementation of these animals during certain months in the year (FIGUEIREDO et al., 2008). The monitoring of pre-calving body condition score, so that animals can give birth in good body condition or to keep in proper condition after delivery, is what is aimed in reproductive management.

The stress at calving and the combined effects of growth and first lactation increase the nutritional requirements of heifers, and when they are submitted to periods of pre- and or post-partum feed restriction, it occurs a subsequent reproductive low response occurs.

The objective of this study was to evaluate the effect of different levels of multiple supplement supply on the nutritional characteristics, performance and body condition score of heifers grazing *Brachiaria decumbens* Stapf. during the dry season.

MATERIAL AND METHODS

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The research protocol was approved by the Institutional Animal Care and Use Committee of the Universidade Federal de Viçosa. The experiment was conducted in the beef cattle sector at Universidade Federal de Viçosa - UFV in a 12-ha area with four paddocks for grazing with continuous stocking, corresponding to treatments in May to August 2010 in the dry season in three periods of twenty-eight days. During the experimental period, the observed averages for temperature (°C) and rainfall precipitation (mm) were 16.8 and 0.5, respectively.

The treatments consisted of mineral supplement (control treatment) and supply of three daily levels of multiple supplement 0.5, 1.0 and 2.0 kg/animal (Table 1) with 300 g of crude protein (CP)/kg dry matter (DM). Twenty-four crossbred pregnant heifers (4-5 months of gestation) with predominance of Zebu breed at initial age of 32 months and average initial weight of 416±6 kg were used. The animals were, properly vaccinated and wormed.

Water was provided *ad libitum*. Multiple supplement was supplied at 10.00 a.m. throughout the experimental period. The heifers in the treatment with multiple supplement at any levels of supply were fed mineral supplement (composition on the basis of natural matter: dicalcium phosphate, 500.00 g/kg; sodium chloride, 477.75 g/kg; zinc sulfate, 14.00 g/kg, copper sulphate, 7.00 g/kg, cobalt sulphate, 0.50 g/kg, potassium iodide, 0.50 g/kg and sodium selenite, 0.25 g/kg) at the similar amount (80g/animal/day). The heifers in the control treatment had unrestricted access to mineral supplement.

Before starting the experiment the animals were grazing *Brachiaria decumbens* receiving mineral supplement. The animals were weighed at the beginning and end of the experiment, without fasting and after being fasted for liquids and solids for 14 hours, aiming to reduce the possible differences in the filling of the digestive tract. The total weight gain (TWG) was quantified by the difference between the final weight and initial weight at fast. The average daily gain (ADG) was obtained by ratio between TWG and the number of experimental days (84). Monitoring the body condition score (BCS) was performed by three trained individuals, using the scale recommended by the NRC (1996).

Table 1. Chemical composition of multiple supplement and pasture on the dry matter basis

Item	Multiple Supplement[2]	*B. decumbens*[1] May	June[3]	July	Mean
		g/kg			
Dry matter	890.7	323.9	487.6	565.1	458.9 ± 71.1
Organic matter	970.5	81.0	71.9	84.7	79.2 ± 3.8
Crude protein	321.2	62.4	54.2	45.9	54.2 ± 4.8
Ether extract	36.7	18.0	18.8	15.6	17.5 ± 1.0
NDFap[4]	112.1	689.4	737.4	774.2	733.7 ± 24.6
NFC[5]	564.9	149.3	117.8	79.5	115.5 ± 20.2
Lignin	2.2	39.9	52.1	61.8	51.3 ± 6.3

[1/]Samples obtained by manual grazing simulation; [2]/Composition on the basis of natural matter: soybean meal (280g/kg), corn (680 g/kg) and urea:ammonium sulfate in 9:1 ratio (40 g/kg); [3/]Sample collected during digestibility trial; [4/]Neutral detergent fiber corrected for ash and protein; [5/]Non fibrous carbohydrates

On the fourteenth day of each experiment period, a collection was performed to determine DM total mass/ha. The area to be sampled was delimited with a metal square (0.5 × 0.5 m) in four random sites in each experimental paddock that represented the average canopy height (CABRAL et al., 2011). The samples were cut at ground level with scissors and then aliquots of each collected sample were taken, and composite samples were prepared for each paddock. Afterwards, the samples were weighed and dried in a forced circulation stove (60°C) by 72 hours, processed in a knife mill (1-and 2-mm) and placed in containers previously identified for further analysis. The DM content (SILVA; QUEIROZ, 2002) was obtained.

Sampling for qualitative assessment of the pasture consumed by the animals was obtained via simulation manual (JOHNSON, 1978) grazing simultaneously to the observation of grazing behavior of the animals also on the fourteenth day of each experimental period. The samples were dried under forced ventilation (60ºC), processed in a knife mill (1-and 2-mm) and then packed in containers previously identified for analysis. During the digestibility trial grazing manual simulation was performed on the eighth day (42nd day of the productive performance).

For assessments of the nutritional characteristics, the same heifers were used and the area of productive performance. The digestibility trial lasted nine days, starting on the 35th day of the productive performance and ending on the 43rd day, the first six days were for adaptation to chromic oxide external marker (to estimate fecal excretion) and titanium dioxide (to estimate supplement intake) and the last three days were for collection of feces at different times, 3 p.m., 10 a.m. and 7 a.m.

It was given 10 grams of chromic oxide marker per animal per day, introduced with the aid of an applicator via the esophagus at 9 a.m. and 10 grams of titanium dioxide marker per animal per day mixed with multiple supplement. Feces were collected immediately after animal defecation or directly in the rectum, at quantities of approximately 200 g, individually identified and dried in a forced air circulation oven (60°C) by 72 hours. After this period, the samples were processed in a knife mill (1-and 2-mm) and samples composed of the three days of collection were made.

On the 9th day of the digestibility trial, "spot" urine sample (10 mL) was collected from animal spontaneous urination 4 hours after supplement supply (VALADARES et al., 1999). After collection, urine samples were diluted in 40 mL of H_2SO_4 (0.036N) and stored at -20°C for subsequent quantification of the levels of creatinine, urea and purine derivatives.

Samples of forage, feces and ingredients used to produce the supplement, processed in a 1-mm sieve mil, were evaluated for DM, organic matter (OM), CP, ether extract (EE) and lignin (H_2SO_4 72% w/w) according to the techniques described by Silva and Queiroz (2002); neutral detergent fiber (NDF) was evaluated according to techniques described by Mertens (2002), using thermostable α-amylase, except for fodder, but omitting the use of sodium sulfite; corrections for protein and ash in the NDF followed the procedures described by Licitra et al. (1996) and Mertens (2002), respectively.

The levels of non-fibrous carbohydrates (NFC) were obtained according to the equation proposed by Detmann and Valadares Filho (2010):

$$NFC = 100 - [MM + EE + NDFap + (CP - CPu + U)]$$

In which: NFC = non-fibrous carbohydrates; MM = mineral matter content; EE = ether extract content; NDFap = neutral detergent fiber corrected for ash and protein content; CP = crude protein content; CPu = urea crude protein content; and U = urea content. All other items are expressed as DM %. Feces samples were analyzed for the levels of titanium dioxide according to the colorimetric technique described by Titgemeyer et al. (2001) and chromic oxide in atomic absorption spectrophotometer as described by Williams et al. (1962). Feces excretion was estimated through the relationship between dose and feces concentration of chromic oxide. To estimate the voluntary feed intake, indigestible neutral detergent fiber (iNDF) was used according to Detmann et al. (2001), quantified by *in situ* incubation procedures with Ankon® bags (F57) for 288 hours in samples processed at 2-mm (VALENTE et al., 2011). The estimate was done by the following equation:

$$IIpDM = \frac{[(FE \times iFC) - iS]}{iFoC}$$

In which: IIpDM = individual intake of pasture dry matter (kg/day); FE = feces excretion (kg/day); iFC = iNDF feces concentration (kg/kg); iS = iNDF intake from the supplement (kg/day) and iFoC = iNDF forage concentration (kg/kg). Estimation of individual supplement intake was obtained by the following equation:

$$SupII = \frac{(FE \times iFC)}{iFG} \times SupFG$$

In which: SupII = supplement individual intake (g/day); FE = feces excretion (g/day); iFC = titanium dioxide feces concentration (g/g); iFG = titanium dioxide in the supplement fed to the group of animals (g/day); SupFG = supplement amount fed to the animals (g/day). Total DM intake (kg/day) was estimated by summing IIpDM and SupII.

Forage samples collected for evaluation of moment mass at a given experimental period were evaluated for DM, NDF and iNDF as described above. The percentage of potentially digestible DM (DMpd) in the forage in each experiment period was estimated according to Paulino et al. (2008):

$$DMpd = 0.98 \times (100 - NDF) + (NDF - iNDF)$$

In which: DMpd = forage content of potentially digestible DM (DM%); 0.98 = cell content true digestible coefficient; and NDF and iNDF = forage content of NDF and iNDF, respectively (DM%).

Urine samples were analyzed for levels of creatinine, according to the modified method of Jaffé; uric acid, by enzymatic-colorimetric with clearing factor of lipid; allantoin, according to the colorimetric method described by Chen and Gomes (1992), and urea by the method Urease/GLDH. The total volume of urine was estimated through the relationship between daily excretion of creatinine in function of the body weight and urine creatinina concentration. Creatinine excretion per body weight unit was obtained according to equation (CHIZZOTTI et al., 2006):

$$CE = 32.27 - 0.01093 \times BW$$

In which: CE = creatine daily excretion (mg/kg BW); and BW = body weight (kg). Urea daily urinary excretion was estimated by multiplying its concentration in urine spot samples and the urinary volume estimated value. The excretion of purine derivatives was calculated by the sum of allantoin and uric acid excreted in the urine. The purines absorbed were calculated from the excretion of purine derivatives by the equation (BARBOSA et al., 2011):

$$AP = \frac{PD - 0.301 \times BW^{0.75}}{0.80}$$

In which: AP = absorbed purines (mmol/day); PD = purine derivatives excretion (mmol/day); 0.301 = the endogenous purine derivatives excretion (mmol) in the urine per unit of metabolic size ($BW^{0.75}$); and 0.80 = the recovery of absorbed purines as purine derivatives in the urine (mmol/mmol). Rumen synthesis of microbial nitrogen compounds was estimated in function of the AP using the equation described by Chen and Gomes (1992):

$$N_{mic} = \frac{70 \times AP}{0.83 \times R \times 1000}$$

In which: N_{mic} = microbial nitrogen compounds flow in the small intestine (g/day); R = N_{RNA}:N_{TOTAL} ratio in the microorganisms (mg/mg); 70 = nitrogen content in the purines (mg/mmol); and 0.83 = intestine digestibility of microbial purine (mg/mg). The 0.134 ratio of N_{RNA}:N_{TOTAL} was used, according to Valadares et al. (1999).

The experiment was analyzed in a completely randomized design with four treatments and six replicates. After the analysis of variance, treatments were compared by means of orthogonal decomposition of the sum of squares of the treatments in linear, quadratic and cubic order effects related to the effect of level of supplementation, with subsequent adjustment of the linear regression equations. Statistical procedures were conducted by means of PROC GLM of SAS (Statistical Analysis System, version 9.2), adopting 0.10 as the critical level of probability of type I error and initial body weight as a covariate.

RESULTS AND DISCUSSION

The mean masses of DM and DMpd during the experimental periods (Table 2) were 3,547 and 1,863 kg/ha, respectively, which corresponded to the momentary mean availability of 48.3 and 25.4 g/kg of body weight (BW) of the heifers.

Average daily gain (DWG) presented a quadratic standard (P<0.10) for multiple supplementation levels (Table 2) and the maximum performance of 677.4 g per day occurred at the level of 1.49 kg of multiple supplement supply. The decreased efficiency of gain increased as the content of the diet supplement highlights the catalytic effect of supplementation of essential limiting microbial substrates cited by Paulino et al. (2008). It is understood as catalytic supplementation the low multiple supplement supply with the intention to meet the basal needs of protein and minerals for microbial ruminal, improving thereby the intake capacity and nutrient degradation.

Table 2. Least square means, coefficient of variation (CV) and significance of effects for productive performance

	Multiple Supplement (kg/day)				CV	*Value*[1] - *P*		
	0	0.5	1.0	2.0	(%)	L	Q	C
Initial body weight (kg)	410.0	411.0	415.8	410.8	_	_	_	_
Final body weight (kg)	431.3	463.2	467.4	470.7	2.5	0.2525	0.1136	0.3381
Daily weight gain[2] (g)	327.4	560.6	610.5	649.9	25.3	0.0041	0.0396	0.3988
Initial body condition score	4.9	4.7	4.8	4.9	_	_	_	_
Final body condition score[3]	4.3	4.5	4.7	5.3	5.3	<0.0001	0.2278	0.7680

[1]L, Q, and C: linear, quadratic and cubic, respectively; [2]$\hat{Y} = 342.78 + 448.2939x - 150.1615x^2$ ($R^2 = 0.9531$); [3]$\hat{Y} = 4.283 + 0.492286x$ ($r^2 = 0.9304$)

Diet composition can be seen in Table 1. The mean content of 54.2 g CP/kg DM of forage was below the minimum necessary to maintain microbial growth and promote digestion of fibrous carbohydrates of low quality forage (LAZZARINI et al., 2009). Nevertheless, weight gain was satisfactory for heifers of the control treatment, but it should be emphasized that this increase was significant in the beginning of the experiment period when there was greater availability of better feeding value forage.

According Pilau and Lobato (2009), the best feed level in the final third of gestation allows the pregnant heifer calves in better conditions to raise its calf and to conceive in the second reproductive period compared to higher feed level in the early phase of gestation pregnancy and with pre-calving restriction. These authors found pregnancy rates of primiparous heifers with better feed level at the first third or final phase of gestation of 53% and 85%, respectively.

The final body condition score (FBCS) showed a positive linear profile (P<0.10), but there was an increase over the initial body condition score (IBCS) for heifers which were at the 2 kg multiple supplement supply level, which presented the minimum score of 5, which corresponds to the recommendation for parturition according to NRC (2000).

By offering diets with better nutritional status for pregnant heifers in late gestation, Pilau and Lobato (2009) observed DWG of 901 g and maintenance of the initial body condition score, which was the main determinant of the return to cyclic ovarian activity and reproductive performance in subsequent breeding season (94% of conception until the middle of the reproductive period).

Increasing linear effect (P<0.10) of the levels of multiple supplement supply was observed on the intakes of DM, OM, CP, EE, NFC, and total digestible nutrients (TDN), and there was no effect (P>0.10) for intake of pasture DM (PDM) and pasture OM (POM), neutral detergent fiber corrected for ash and protein (NDFap), indigestible NDF (iNDF) and digested NDF (dNDF) (Table 3).

The linear effect for intake of DM and OM and the no effect on the intakes of PDM and POM demonstrates that there was no substitution effect of supplement intake on forage intake. The increasing profiles in the intake of CP, EE and NFC occurred by increasing the multiple supplement supply in the different treatments and this was the largest source of these nutrients (Table 1) compared to pasture. In contrast, intake of NDFap and NDFi showed the same profile (P> 0.10) of PDM intake (Table 3), as the primary source of these fractions was the forage.

The positive linear pattern for the TDN intake with the multiple supplementation (Table 3) seems to reflect the increase in the intakes of CP, EE and NFC, with no significant increase in the extraction of energy from NDFap because there was no effect on the DNDF intake (Table 3). Results obtained in tropical conditions with low quality forages indicate that direct responses on total intake or on digested components are stimulated by supplementation with nitrogen compounds up to levels of 80 to 100 g CP/kg DM in the diet (LAZZARINI et al. 2009; FIGUEIRAS et al., 2010). There was no exclusively supplementation with nitrogenous compounds in this experiment as quoted by the authors, and probably this is the reason for the no maximization of dNDF use.

Table 3. Least square means, coefficients of variation (CV) and significance of effects for voluntary intake

Item	Multiple Suplement (kg/day)				CV	*Value*[1] – *P*		
	0	0.5	1.0	2.0	(%)	L	Q	C
			kg/Day					
Dry matter[2]	9.58	10.13	10.80	11.65	8.8	0.0016	0.7654	0.8565
Pasture dry matter	9.58	9.64	9.61	9.67	9.0	0.8783	0.9958	0.9334
Organic matter[3]	8.89	9.42	10.08	10.90	8.8	0.0011	0.7562	0.8478
Pasture organic matter	8.89	8.94	8.92	8.97	9.0	0.8783	0.9958	0.9334
Crude protein[4]	0.52	0.68	0.91	1.16	11.8	<0.0001	0.3669	0.4484
Ether extract[5]	0.18	0.20	0.22	0.25	9.0	<0.0001	0.6038	0.6976
Non fibrous carbohidrates[6]	1.13	1.41	1.81	2.26	11.0	<0.0001	0.3974	0.4832
NDFap	7.06	7.16	7.22	7.35	8.9	0.4653	0.9583	0.9668
iNDF	2.47	2.48	2.48	2.50	9.0	0.7967	0.9892	0.9392
dNDF	4.22	4.37	4.18	4.20	7.2	0.7503	0.8116	0.3780
Total digestible nutrients[7]	4.76	5.42	6.03	6.43	9.7	<0.0001	0.1776	0.8118

NDFap = neutral detergent fiber correct for ash and protein; iNDF = indigestible neutral detergent fiber; dNDF = Digested neutral detergent fiber; [1]L, Q, C, and F: linear, quadratic, cubic and fourth degree, respectively; [2]$\hat{Y} = 9.63 + 1.0422x$ ($r^2 = 0.9897$); [3]$\hat{Y} = 8.94 + 1.0098x$ ($r^2 = 0.9896$); [4]$\hat{Y} = 0.53 + 0.3247x$ ($r^2 = 0.9865$); [5]$\hat{Y} = 0.18 + 0.0376x$ ($r^2 = 0.9879$); [6]$\hat{Y} = 1.15 + 0.5717x$ ($r^2 = 0.9867$); [7]$\hat{Y} = 4.94 + 0.8184x$ ($r^2 = 0.9157$)

Total apparent digestibilities of DM and OM showed positive linear profiles (P<0.10) according to the levels of multiple supplementation (Table 4). There was a quadratic effect (P<0.10) of the levels of multiple supplement supply on apparent digestibility of CP, of the levels of TDN in relation to DM intake and no effect for digestibility of NDFap (P> 0.10).

Table 4. Digestibility coefficients and total digestible nutrients in heifers according to different treatments

Item	Multiple supplement (kg/day)				CV	*Value*[1] – *P*		
	0	0.5	1.0	2.0	(%)	L	Q	C
Dry matter[2]	48.86	51.93	52.16	53.27	4.6	0.0079	0.1811	0.3786
Organic matter[3]	53.40	55.74	56.45	57.86	4.1	0.0035	0.3286	0.6254
Crude protein[4]	25.09	41.66	48.69	54.02	13.9	<0.0001	0.0014	0.4392
Ether extract[5]	6.77	28.44	27.21	25.41	25.9	0.0008	0.0001	0.0192
Non fibrous carbohydrates[6]	33.87	37.24	54.18	63.24	38.1	0.0049	0.7524	0.4044
NDFap	59.82	61.20	58.90	58.67	5.2	0.3157	0.8065	0.2598
Total digestible nutrients[7]	49.69	53.44	55.85	55.11	3.2	0.0001	0.0019	0.8634

NDFap = neutral detergent fiber correct for ash and protein; [1]L, Q, C, and F: linear, quadratic, cubic and fourth degree, respectively [2]/$\hat{Y} = 48.871267 + 1.931924x$ ($r^2 = 0.7613$); [3]/$\hat{Y} = 54.058637 + 2.066234x$ ($r^2 = 0.8973$); [4]/$\hat{Y} = 25.638598 + 34.184885x - 10.041036x^2$ ($R^2 = 0.9924$); [5]/$\hat{Y} = 6.80 + 77.9333x - 81.2000x^2 + 23.4667x^3$ ($R^2 = 1$); [6]/$\hat{Y} = 33.412233 + 15.685105x$ ($r^2 = 0.9235$); [7]/$\hat{Y} = 49.651971 + 9.482739x - 3.373618x^2$ ($R^2 = 0.9990$)

The linear positive standard for digestibility of DM and OM with the multiple supplementation seems to reflect the increase at the proportion of CP, EE and NFC in the diet because there was no difference in the digestibility of NDFap. As for the TDN, its estimate is made by the sum of digestibility of different fractions of the feedstuff (CP, EE, NDFap and CNF), so this is the reason of the quadratic pattern observed for this variable. Apparent digestibility of CP, EE and NFC were lower for the control treatment because of the effect of higher proportion of metabolic fecal fraction in relation to ingested nutrient (CABRAL et al., 2006; BARROS et al., 2011).

Increasing linear effect (P<0.10) of the levels of multiple supplements supply were observed on the ureic nitrogen urinary excretion (UNUE) (Table 5), a pattern similar to that found by several authors (PEREIRA et al., 2007; MORAES et al., 2009; FIGUEIRAS et al., 2010; COUTO et al., 2010).

There was no effect (P>0.10) for flow of microbial nitrogen compounds (FMNC) and microbial nitrogen synthesis efficiency (MNSE) in relation to multiple supplementation levels. The flow of microbial nitrogen compounds in relation to nitrogen intake (FMNC/NI) showed a decreasing linear profile (P<0.10) in the different treatments (Table 5).

Several authors (LAZZARINI et al., 2009; FIGUEIRAS et al., 2010; SOUZA et al., 2010) also did not find increase in FMNC with supplementation in comparison to control in tropical conditions. The mean estimate of MSE of 105 g CPmic/kg TDN was lower than the 120 g CPmic/kg TDN suggested by Valadares Filho et al. (2010).

Table 5. Nitrogenous compounds metabolism in heifers according to the different treatments

Item	Multiple Supplement (kg/day)					*Value*[1] – *P*		
	0	0.5	1.0	2.0	CV (%)	L	Q	C
UNUE[2]	8.50	35.10	54.10	87.90	57.1	<0.0001	0.6182	0.8772
FMNC	81.28	95.08	100.18	95.17	16.8	0.2506	0.1346	0.8821
MNSE	107.88	103.05	112.92	97.03	14.8	0.3035	0.4824	0.2838
FMNC/NI[3]	98.70	83.52	75.05	54.26	18.0	<0.0001	0.6945	0.7144

UNUE = ureic nitrogen urinary excretion (g/day); FMNC = flow of microbial nitrogen compounds (g/day); MNSE = microbial nitrogen synthesis efficiency (g microbial CP/kg TDN); FMNC/NI = flow of microbial nitrogen compounds in relation to nitrogen intake (g/g nitrogen intake); [1]L, Q, and C: linear, quadratic, cubic, respectively; [2]/$\hat{Y} = 12.4 + 38.8810x$ ($r^2 = 0.9884$); [3]/$\hat{Y} = 96.785467 - 21.602107x$ ($r^2 = 0.9901$)

Lazzarini et al. (2009) found that nitrogen intake was lower than the FMNC at the lowest level of dietary crude protein (5.28% CP) and evaluation of FMNC/NI by using the regression equation in function of the levels of CP levels in the diet indicated that the estimates of these variables become equivalent to each other in 7.13% CP.

In this study, there was no equivalence between nitrogen intake and production of FMNC even with the level of 54 g CP/kg DM of the diet in the control treatment, reinforcing the hypothesis that nitrogen utilization increased at the tissue level, which resulted in less formation of urea in the liver and less recycling to the rumen.

CONCLUSION

The multiple supplementation of pregnant heifers in the dry season increases performance and improves the body condition score, thus it contributes positively to the next breeding season. The supply of 1.5 kg of multiple supplement with 300 g CP/kg DM promotes maximum performance.

RESUMO: Objetivou-se avaliar o efeito do fornecimento de diferentes níveis de suplemento múltiplo sobre as características nutricionais e o desempenho produtivo de novilhas prenhes sob pastejo em *Brachiaria decumbens* Stapf. no período da seca. A área experimental constituiu-se de quatro piquetes de 3,0 hectares cada, com disponibilidade média de matéria seca potencialmente digestível (MSpd) de 1863 kg/ha. Os animais experimentais foram 24 novilhas prenhes mestiças com predominância de sangue zebuíno com idade e peso médio inicial de 32 meses e 416±6 kg, respectivamente, em um delineamento inteiramente casualizado. Os tratamentos consistiram em suplemento mineral e fornecimento de 0,5; 1,0 e 2,0 kg/animal/dia de suplemento múltiplo. Verificou-se efeito quadrático dos níveis de fornecimento de suplemento múltiplo ($P<0,10$) sobre o ganho médio diário. Os consumos de matéria seca (MS), matéria orgânica (MO), proteína bruta, extrato etéreo, carboidratos não fibrosos (CNF) e nutrientes digestíveis totais apresentaram relação linear crescente ($P<0,10$) com os níveis de fornecimento de suplemento múltiplo. Os coeficientes de digestibilidade aparente da MS, MO e CNF apresentaram perfil linear crescente ($P<0,10$) para os níveis de suplementação múltipla. Não houve efeito dos níveis de suplementação múltipla sobre o fluxo de compostos nitrogenados microbianos e eficiência de síntese microbiana, mas o fluxo de compostos nitrogenados microbiano em relação ao nitrogênio ingerido apresentou perfil linear decrescente ($P<0,10$). O fornecimento de 1,5 kg de suplemento múltiplo otimiza o desempenho de novilhas prenhes em pastejo no período da seca, mas não influencia o consumo de matéria seca do pasto e o fluxo de compostos nitrogenados microbianos.

PALAVRAS CHAVE: Estação seca. Ganho de peso. Parâmetros nutricionais. Suplemento múltiplo

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