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Urea levels in multiple supplement for lambs grazing on buffelgrass

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ABSTRACT. The objective of present trial was to evaluate the intake of supplement dry matter, productive performance, carcass traits, and weight and yields of commercial meat cuts of lambs grazing on dormant buffelgrass pastures and receiving multiple supplementation containing different urea levels. Urea levels used were: 5, 8, 11 and 14% on dry matter. Thirty-six male lambs were used, nine animals per treatment, with 18.0 ± 2.0 kg initial body weight, distributed into four groups. The experimental design was completely randomized with nine replications. Urea levels in supplement did not influence productive performance, cold and hot carcass weight and yield and commercial meat cuts weight and yield (leg, shoulder, rib and brisket). Use of multiple supplements containing 11 and 14% of urea levels for lambs in dormant grazing pastures during the dry season may increase bioeconomic performance of this activity, as they promoted lower supplement intake and similar productive performance.

Key words: *Cenchrus ciliaris*, dormant pastures, protein supplementation.

RESUMO. Teores de uréia no suplemento múltiplo de cordeiros mantidos em pastos de capim-búffel. O objetivo do presente estudo foi avaliar o consumo de matéria seca de suplemento, o desempenho produtivo, os parâmetros de carcaça e os rendimentos de cortes cárneos comerciais de cordeiros mantidos em pastos diferidos de capim-búffel recebendo suplementos múltiplos com diferentes teores de uréia. Foram utilizados quatro teores de uréia, sendo 5, 8, 11 e 14% na matéria seca. Foram utilizados 36 cordeiros machos, nove animais por tratamento, com peso corporal inicial médio de 18,0 ± 2,0 kg, distribuídos em quatro grupos. O delineamento experimental adotado foi o inteiramente casualizado com nove repetições. Os teores de uréia no concentrado não influenciaram os ganhos médios diários, os ganhos de peso totais, os pesos corporais finais, os pesos e os rendimentos de carcaça quente e fria e os pesos e rendimentos de cortes cárneos comerciais (pernil, paleta, costela e carré). O fornecimento de suplementos múltiplos contendo 11 e 14% de uréia para ovinos criados em pastagens diferidas na estação seca resultaram em melhores desempenhos bioeconômicos para a atividade, já que, com menores consumos de suplemento os animais atingiram desempenhos semelhantes.

Palavras-chave: *Cenchrus ciliaris*, diferimento de pastagens, suplementação protéica.

Introduction

Sheep production is one of the most important economic activities in the Brazilian semi-arid. However, this activity is characterized as extensive or ultra-extensive, showing low stocking rate of native pastures, low meat and milk yields, low reproductive efficiency and high mortality rate of herds, resulting in low economic performance for farmers (MOREIRA et al., 2008).

In this region, there are few alternatives to produce feed for herds, especially during the dry season. Buffelgrass (*Cenchrus ciliaris* L.) is one of them, and may be used mainly in the dry season as dormant or differed grass (SANTOS et al., 2005). According to Souza and Espíndola (1999), dormant buffelgrass pastures may produce more than 4,500 kg of dry matter per hectare.

However, in this condition forage shows poor quality, compromising the productive performance of animals. According to Santos et al. (2005), the chemical composition of dormant buffelgrass in the Brazilian semi-arid was 63.00 to 81.60% dry matter, 3.37 to 5.23% crude protein, 69.30 to 73.02% neutral detergent fiber, 53.02 to 57.47% acid detergent fiber, and 10.80 to 16.38% non fibrous carbohydrates.

The use of protein or multiple supplements may increase the use of dry forage, stimulating the growth of microbial mass in the rumen (COSTA et al., 2008).

Thus, adequate protein to animals by supplementation may stimulate dry matter intake and increase forage digestibility, improve productive performance, carcass traits and yields of commercial meat cuts.

For beef cattle, the use of protein or multiple supplementations for animals grazing on dormant grass during the dry season has resulted in higher productive performance (MOREIRA et al., 2004, 2006; RUAS et al., 2000; ZANETTI et al., 2000). However, information about the use of protein supplementation for lambs grazing on dormant buffelgrass is scarce in domestic and international literature about this topic.

The objective of this present research study was to evaluate the supplement dry matter intake, productive performance, carcass traits and yield of commercial meat cuts of lambs grazing in buffelgrass pastures and receiving multiple supplementation containing different urea levels.

Material and methods

The present trial was carried out at “Campo Experimental da Caatinga” in Petrolina, Pernambuco State, Brazil. Four urea levels in concentrate supplement (5, 8, 11 and 14% of dry matter) were compared. Four hectares of buffelgrass were used and divided in four paddocks of 1.0 ha each. Nine lambs were distributed per paddock. Every week, the animals changed the paddocks.

Forage mass of pre and post graze were estimated using a frame in squared format (0.25 m^2). Weekly, two samples of forage were collected in pre and post graze for each paddock, and cuts were made in ground levels.

Leaf and stem mass were estimated by separation and quantification of dry weight of forage mass components (approximately 100 g) in pre and post graze. Samples of the entire plant, leaves and stems were weighted *in natura* and sent to dry matter determinations during 72 hours at 55°C. Crude protein, ash and *in vitro* digestibility of dry matter levels were determined according to methodologies proposed by Silva and Queiroz (2002), while the levels of neutral detergent fiber and acid detergent fiber were determined according to Van Soest et al. (1991).

Sward height was measured as the length of the last completely expanded leaf. To measure sward height, a 0.50 m long wooden ruler was used. Twenty measurements were preformed per paddock during the collection period, in pre and post graze.

Concentrate was offered once a day, at 8h. The amount of supplement was adjusted daily to avoid orts greater than 20% of supplement offered. Concentrates were isoenergetic and contained 40% total digestible nutrients and 20, 30, 40 and 50% crude protein (Table 1).

Table 1. Rate of ingredients and estimate of crude protein and total digestible nutrients levels of concentrates.

Component	Inclusion (% of dry matter)			
	5	8	11	14
Whole cottonseed	.50	17	37	49
Mesquite meal	58.5	39	16	1
Urea	5	8	11	14
Ammonium sulfate	1	1	1	1
Mineral and vitamin mix[1]	35	35	35	35
Chemical composition (% of dry matter)				
Crude protein	20	30	40	50
Total digestible nutrients	40	40	40	40

[1]Chemical composition per kg = Ca - 135.00 g; P - 75.00 g; S - 12.00 g; Mg - 8.00 g; Na - 158.00 g; Fe - 1.500 mg; Zn - 3.100 mg; Mn - 2.580 mg; I – 62.00 mg; Se 15.00 mg; Co - 62.00; vitamin A – 250.00 mg; vitamin D - 100.00 mg; vitamin E - 500.00 mg; F – 720.00 mg.

Supplement dry matter intake was calculated by the follow equation: DMI = S – O, where DMI = supplement dry matter intake, S = amount of supplement and O = amount of orts, in dry matter basis.

Thirty-six male lambs were used, nine per treatment, castrated, with initial body weight of 8.0 ± 2.0 kg. The experimental period extended from September to December 2007, during 70 days. Animals were weighted weekly, in the morning, with fast of solids for 16 hours.

Total weight gain (TWG) was determined by the follow equation: TWG = FBW – IBW, where: FBW = final body weight and IBW = initial body weight. The average daily gain (ADG) was obtained by dividing TWG by the number of days of the experimental period, while FBW was the weight obtained in the last weighting.

After slaughter, the carcasses were weighed and carcass yield was calculated according to the follow equation: HCY (%) = (HCW/SBW) x 100, where HCD = hot carcass yield, HCW = hot carcass weight, and SBW = slaughtered body weight. The left part of carcass was cut in leg, shoulder, rib and brisket, according to Cezar and Sousa (2007). These data were presented as also in relation to the half carcass.

The experimental design was completely randomized with nine replications. Statistical analyses were performed with *Statistical Analysies System* – SAS (1999) softare, using analysis of variance and linear regression. Supplement dry matter intake was presented as descriptive statistics.

Results and discussion

Quantitative (forage, leafand stem mass) and qualitative characteristics (sward height and chemical composition) of dormant buffelgrass observed in this present research are similar to the values reported by Souza and Espíndola (1999) and Santos et al. (2005). These values (Table 2) indicate that the buffelgrass pasture used is a typical buffel pasture found in the Brazilian semi-arid during the dry season.

In general, dormant buffelgrass presented high forage mass and stem-to-leaf ratio, low crude protein levels, low *in vitro* dry matter digestibility and huigh neutral and acid detergent fiber levels, resulting in a poor quality forage. In this case, the use of protein or multiple supplements may increase the productive performance of animals.

Table 2. Qualitative and quantitative characterization of dormant buffelgrass grazed by lambs.

Component	
Pre-grazing sward height (m)	1.00
Pre-grazing forage mass (kg DM ha^{-1})	5,790
Pre-grazing leaf mass (kg DM ha^{-1})	811
Pre-grazing stem mass (kg DM ha^{-1})	4,979
Chemical composition (% of dry matter)	
Dry matter (% as fed)	53.24
Crude protein	5.76
Ash	7.08
Neutral detergent fiber	75.76
Acid detergent fiber	39.79
In vitro dry matter digestibility	41.66

Different urea levels in multiple supplement did not affect ($p > 0.05$) FBW, ADG and TWG of lambs grazing on dormant buffelgrass (Table 3). Supplement dry matter intake was 76 ± 67, 58 ± 35, 91 ± 49 and 142 ± 117 g $animal^{-1}$ day^{-1} for animals that received supplements containing 14, 11, 8 and 5% urea, respectively.

Table 3. Supplement intake and productive performance of lambs grazing on dormant buffelgrass pastures receiving multiple supplementation containing different urea levels.

Component	Urea levels (% of dry matter)				RE	CV
	5	8	11	14		(%)
Supplement intake (kg $animal^{-1}$ day^{-1})	0.0142	0.091	0.058	0.076	-	-
Initial body weight (kg)	18.77	18.32	19.34	18.74	$\hat{Y} = \overline{Y} = 18.79$	12.22
Final body weight (kg)	22.07	20.73	22.11	21.55	$\hat{Y} = \overline{Y} = 21.62$	11.13
Average daily gain (kg)	0.047	0.034	0.040	0.040	$\hat{Y} = \overline{Y} = 0.038$	70.72
Total weight gain (kg)	3.30	2.41	2.77	2.81	$\hat{Y} = \overline{Y} = 2.68$	70.18

RE = Regression equation, CV (%) = coefficient of variation.

In this research study, results showed lower productive performance than that found by Ruas et al. (2000), Zanetti et al. (2000), Moreira et al. (2004), Moraes et al. (2006), who reported higher productive performance for beef cattle receiving protein or multiple supplementation. Higher total dry matter intake found in studies carried out by Ruas et al. (2000) and Zanetti et al. (2000) may justify those results. However, a study by Moreira et al. (2004) found higher dry matter intake of supplement. Probably, supplement dry matter intake (58 to 142 g day^{-1}) found in the present study was not enough to promote better productive performance of animals.

Responses about productive performance of bovines receiving protein or multiple supplementation were used to help in this discussion, because few studies with lambs using this same concept were found, although they are different species. In addition, protein and multiple supplementation to beef cattle grazing on dormant pastures during the dry season is a consolidated tool to improve productive performance.

Considering 20, 30, 40 and 50% crude protein in concentrates and supplement intakes (142, 91, 58 and 76 g day^{-1}), crude protein intakes from concentrate were 28.4, 27.3, 23.2 and 38.0 g $animal^{-1}$ day^{-1}, respectively. Te greatest observed difference – approximately 15 g $animal^{-1}$ day^{-1} (23.2 g vs. 38.0 g) – was insufficient to promote better productive performance. Possibly, these similar protein supplies resulted in similar ADG, TBW and TWG to animals.

The average daily gain obtained in this present research study was higher than values presented by Souza and Espíndola (1999) (11.5 to 16.6 g $animal^{-1}$ day^{-1}) using ten lambs ha^{-1} in exclusively buffelgrass pastures. Productive performance found in this research was similar than found by Souza and Espíndola (1999) when using lambs grazing on buffelgrass during the rainy and dry seasons and receiving Guandu or Leucena supplementation. These authors observed AVG from 26.7 to 50.0 g $animal^{-1}$ day^{-1}.

In general, productive performance found in this research is an important indicator of the possibility of exploring lamb production during the dry season. Nevertheless, the maximum AVG observed in present study was 50.0 g $animal^{-1}$ day^{-1}. In traditional lamb production systems in the Brazilian semi-arid, especially during the dry season, high weight loss and/or high mortality rate of lambs are observed. On the other hand, in this case it was possible to obtain weight gain of animals.

Urea levels in concentrate did not influence ($p > 0.05$) hot and cold carcass weight and yield (Table 4). These results can be justified by the absence of significant effects of urea levels on productive performance resulting in similar final body weight and carcass traits.

Results found are similar to those reported by Souza et al. (2004), who evaluated the weight gain, carcass traits and commercial meat cuts yields of feedlot finishing lambs receiving different urea levels in ration, as well as similar carcass weights and yields. In this study, the urea levels in ration varied between 0 and 1.2%, and no significant effects of urea levels were observed on the productive performance of feedlot lambs.

Table 4. Hot and cold weights and yield of carcass of lambs grazing on buffelgrass pastures receiving multiple supplementation containing different urea levels.

Component	Urea levels (% of dry matter)				RE	CV (%)
	5	8	11	14		
Hot carcass weight (kg)	9.56	9.25	9.56	9.59	$\hat{Y}=\overline{Y}=9.49$	9.68
Cold carcass weight (kg)	7.45	7.08	6.89	7.37	$\hat{Y}=\overline{Y}=7.20$	12.69
Hot carcass yield (%)	44.50	43.89	44.17	44.46	$\hat{Y}=\overline{Y}=44.25$	10.33
Cold carcass yield (%)	34.56	33.61	32.05	34.11	$\hat{Y}=\overline{Y}=33.58$	13.99

RE = Regression equation, CV (%) = coefficient of variation.

In general, hot and cold carcass weight and yield obtained in the present trial were low, especially when compared with others studies that evaluated carcass traits of lambs grazing on tropical pastures and receiving concentrate supplementation. For instance, Menezes et al. (2008) found 11.9 and 12.1 kg for hot carcass weight of lambs grazing on Tanzânia grass (*Panicum maximum* cv. Tanzânia) and Aruana grass (*Panicum maximum* cv. Aruana), receiving protein supplementation with 24.6 to 24.9 kg of slaughtered body weight. Probably, higher energy concentrations of supplements formulated using 50% ground corn, 30% f soybean meal and 20% wheat middlings, and the higher rates of concentrate offered (0.30 to 0.50 kg animal^{-1} day^{-1}) compared to the concentrate used in the present trial may have justified these results.

In addition, in the present study native breed animals were used with lower meat production potential in comparison with specialized meat sheep breeds. Moraes et al. (2008) evaluated carcass and animal traits of lambs native to the Brazilian semi-arid grazing on buffelgrass during rainy-dry season transition and observed 7.28 to 8.15 kg and 7.57 to 8.46 kg of cold and hot carcass weight respectively, in addition to 36.84 to 38.86 and 34.47 to 37.21 kg of cold and hot carcass yield. These values observed by Moraes et al. (2008) are close to those found in this study using the same animal genotype.

Commercial meat cuts weights and yields (leg, shoulder, rib and brisket) were not affected ($p > 0.05$) by different urea levels in supplement (Table 5). These results can be justified by the absence of a significant response of urea levels on carcass weight and yield. According to Souza et al. (2004), there were no significant differences for weight and yield of commercial meat cuts of lambs raised with increasing urea levels in ration because the different diets did not promote changes in carcass weight and yield, which is in accordance with results found in the present study. There is a linear positive correlation between carcass weight and the weight of commercial meat cuts.

Table 5. Weight and yields of commercial meat cuts of lambs grazing on buffelgrass pastures receiving multiple supplementation containing different urea levels.

Component	Urea levels (% of dry matter)				RE	CV,%
	5	8	11	14		
Leg (kg)	1.19	1.22	1.30	1.36	$\hat{Y}=\overline{Y}=1.27$	22.27
Leg (% of half carcass)	33.70	33.99	37.25	38.55	$\hat{Y}=\overline{Y}=35.87$	23.01
Shoulder (kg)	0.61	0.55	0.68	0.65	$\hat{Y}=\overline{Y}=0.62$	19.70
Shoulder (% of half carcass)	17.20	15.61	19.41	18.32	$\hat{Y}=\overline{Y}=17.64$	19.89
Brisket (kg)	1.03	1.01	1.15	1.06	$\hat{Y}=\overline{Y}=1.06$	14.30
Brisket (% of half carcass)	28.88	28.14	32.87	30.06	$\hat{Y}=\overline{Y}=29.99$	14.56
Rib (kg)	0.26	0.28	0.30	0.26	$\hat{Y}=\overline{Y}=0.28$	18.70
Rib (% of half carcass)	7.42	7.77	8.65	7.38	$\hat{Y}=\overline{Y}=7.81$	18.97

RE = Regression equation, CV (%) = coefficient of variation.

Leg was the heaviest commercial weight meat cut observed in the present trial, representingmore than 30% of half carcass. The leg weight obtained was similar to that found by Menezes et al. (2008), who evaluated the carcass traits and the commercial meat cuts of Santa Inês grazing on Andropogon grass (*Andropogon gayanus* cv. Planaltina), Tanzânia grass (*Panicum maximum* cv. Tanzânia) and Aruana grass (*Panicum maximum* cv. Aruana) receiving concentrate containing 21.7% of protein during the dry season and reported leg weight of 1.30 kg using animals with similar slaughtered body weight.

Leg yields were higher than reported by Menezes et al. (2008), who observed values of 28.4 to 29.9%. Possibly, the different animal genotypes used promoted these differences in leg weight. Shoulder weight and yield obtained in this research study were similar to results reported by Oliveira et al. (2010) that related values varying from 0.61 to 0.66 kg and 16.45 to 18.71%. Additonally, Oliveira et al. (2010) also observed similar brisket + rib weight and yield comparable to the present study. These authors found 1.34 kg and 37.80% of brisket + rib weight and yield, respectively while in the present research study these values were 1.60 kg and 42.29%, respectively for weight and yield of brisket and rib. In general, commercial meat cuts weight and yield were adequate to regional market demands, and was possible during the dry season by use of dormant buffelgrass and protein supplementation.

Conclusion

Productive performance, carcass traits and commercial meat cuts were not affected by urea levels (5, 8, 11 and 14%) in supplements for lambs grazing on dormant buffelgrass.

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