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Original Article

Evaluation of sheep fed on multinutritional blocks with garlic extract

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A B S T R A C T

The aim of this study was to evaluate the effects of supplementation with three formulations of nutritional blocks and its consumption by 60 sheep from the Pantaneiro genetic group. The animals were weighed (35 kg ± 4.69) and separated into three groups of 20 each: G1 (control block), G2 (block with palatalising), and G3 (block + garlic extract). The solidified mineral supplement of silage of pearl millet (*Pennisetum glaucum*) provided *ad libitum* had an estimated consumption of 0.6%/kg/day. The sheep were kept in pastures in a grazing system cultivated with the grass *Brachiaria brizantha* 'Marandu'. The best performance was obtained by G2 ($P < 0.05$) for weight gain, with 105 g of feed conversion ratio 75% more efficient than G1 and 107% more efficient than G3. The provision of multinutrient blocks for sheep kept in pastures of *U. brizantha* 'Marandu' contributed to the improvement of the animal's nutritional status. Among the formulations tested, the block with palatalising showed the highest rate of food conversion. The block with garlic extract had an inhibitory effect on reinfection by gastrointestinal nematodes after 30 days.

INTRODUCTION

The sheep industry in Brazil is subject to constant growth (IBGE, 2015). However, the tropical forage crops cannot provide all the essential nutrients to support the productive and reproductive performance of the sheep in the pasture. In general, sheep present nutritional deficits that intensify as they mature and feed on older forage during the seasons (BUENO; SANTOS; CUNHA, 2007; CHAGAS et al., 2007). Based on these assumptions and the ability of the ruminants to consume food, mineral-protein supplementation can be used as a tool to address the nutritional deficits, by balancing the mineral and energy needs appropriate for climatic conditions prevalent in each region, in order to obtain greater productivity.

This supplementation may be offered to animals in the form of powder, granules, liquid, and blocks. The use of multinutritional blocks allows the animal to compensate for the deficiency of nitrogen in fibrous foods, thus enhancing its availability. It also enhances the consumption and digestibility of nutrients as an alternative for the supply of minerals, vitamins, and herbal medicines, offering advantages of ease of storage, transport, and use compared to other forms (Donovan et al., 1988; FAO, 2007).

Among the phytotherapeutics, we highlight garlic extract, which has been added as a dietary supplement for ruminants for the treatment of infestation by gastrointestinal nematodes (BIANCHIN; CATTO, 2004; Strickland et al., 2009). Its use is intended to combat the resistance acquired by nematodes against various anthelmintics (BATATINHA et al., 2004) available in the

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market. According to Strickland et al. (2009), the anthelmintic action of garlic extract (*Allium sativum* Linn), consumed voluntarily over time, reduces the levels of nematode eggs per gram (EPG), in the feces and promotes increased performance of sheep.

The objective of this work was to evaluate the performance and consumption of mineral-protein supplementation, in the form multinutritional block in the diet of sheep in pastures of *U. brizantha* 'Marandu', and the extracts of herbal medicines based on garlic.

MATERIALS AND METHODS

The research was authorized by the Commission for Ethics in the Use of Animals of Anhanguera Educacional Ltda.– CEUA/AESA, opinion number 1082/2011.

The experiment was conducted at Centro Tecnológico de Ovinocultura (CTO), located at the following geographic coordinates: 20°33'52.06"S 54°32'29.09"O. Sixty sheep of the Pantaneiro genetic group were used, with mean weights of 35 kg ± 4.69, identified, and submitted to the control of endo and ectoparasites. The animals were kept in a pasture of *Brachiaria brizantha* 'Marandu' of 2.4 ha^{-1} area, subdivided into three pickets, with water supply *ad libitum* and silage of pearl millet (*Pennisetum glaucum*), with an estimated consumption of 4% of bodyweight. The animals were weighed twice a day (at 8:30 a.m. and 4:00 p.m.) every fortnight for 64 days to verify their performance.

The experimental design comprised randomized blocks developed with three treatments, each with five replications. Each plot constituted an average of four animals, bringing the total to 60, in order to respect the basic principles of experimentation: repetition, randomization, and local control (PIMENTEL GOMES, 1990). The treatments with different multinutritional blocks were: Treatment 1 (Control) - multinutritional block (G1), Treatment 2 - multinutritional block + palatalising (G2), and Treatment 3 - multinutritional block + phytotherapy based on garlic (G3).

The multinutritional block was balanced according to the standards of the National Research Council (NRC, 2007) for nutrition of sheep under field conditions, with an expected intake of 0.6%/kg bodyweight (Table 1). Garlic-based phytotherapy (*A. sativum* Linn) was inserted into the multinutritional block in the proportion of 40 g kg^{-1} of the supplement. The palatalising was prepared by inserting the molasses powder into the multinutritional block in the proportion of 45 g kg^{-1} of the supplement.

The blocks were directly weighed from the trough every week, and the remains of the feed were taken from the samples in each trough for subsequent laboratory analysis. Six pasture samples were taken every fortnight from each picket by removing the soil from an area of 0.25 m^2 each and dividing it into two subsamples, one for chemical analysis and the other for the analysis of the separated constituents. Samples of leaf blade and secondary material (dry leaves + stem + sheath) of silage of pearl millet were taken daily for chemical analysis, in addition to the leaves collected from the troughs for determining the actual consumption.

Table 1 – Nutritional facts present in blocks given to sheep.

Macroelements	Quantity (g/kg)	Microelements	Quantity (mg/kg)
Calcium (Ca) min.	190.54	Cobalt (Co)	89.9
Sulphur (S)	19.4	Copper (Cu)	249.38
Phosphorus (P)	35.3	Fluoride (Fl) max.	198.03
Magnesium	6.48	Iodine (I) min.	117.71
Sodium (Na)	5.387	Manganese (Mn) min.	35.1
		Selenium (Se)	78.74
Urea	4%		
NPN Max.	11.25		
TDN estimated	130.38		

Source: LCB Nutrição Animal LTDA, Campo Grande, MS, Brasil (2012).

The biomass harvested from the composite samples was separated by date, type, and experimental group. Each sample was packed in a paper bag, identified, and subsequently dehydrated in an oven using forced air circulation to 55°C for 48 hours. They were then subjected to disintegration in a knife mill (Wiley, Marconi), consisting of a sieve with 1 mm screens, and sent for chemical composition analysis to the laboratory of Biotechnology Applied to Animal Nutrition of the Catholic University Dom Bosco (UCDB). We determined the levels of dry matter (DM), organic matter (OM), and crude protein (CP), according to the methodologies described by Silva; Queiroz (2002). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were determined according to the methods described by Van Soest (1965). *In vitro* digestibility (DIV) was determined using the Tilley; Terry (1963) technique adapted to the rumen. This technique, developed by ANKOM® and described by Holden (1999), uses the methodology of ruminal fermentation (anaerobic incubator, model MA443, Marconi). All analyses were conducted in triplicate.

Finally, the total consumption (TMC), average daily consumption (DMC), daily averaged weight gain (GWD), total mean weight gain (GWT), feed conversion index (ICA), and food efficiency index (IEA) were calculated.

The evaluation of the garlic-based phytotherapy (*A. sativum* Linn) extract inserted into the formulation of the G3 group was carried out by testing the feces samples for EPG, according to the methodology of Gordon and Whitlock (1939). The sample was tested before the start of the evaluation and seven days after application of anti-interference (2.5%) monepantel. After the first EPG evaluation, all sheep were treated with vermifuge as recommended in previous studies, as a way of ensuring the uniformity of infection status in the herd before starting the diet.

The data were submitted to analysis of variance (ANOVA, $P < 0.05$), regression linear, and Pearson's correlation. In the case of significant difference in the results for related characteristics, multivariate analysis was carried out using the statistical program SAS version 9.1 (2004). The differences between treatments were tested by Tukey test ($P < 0.05\%$).

RESULTS AND DISCUSSION

Performance analysis of animals was significant ($P < 0.05$) for final weight, total average gain, and average daily gain (Table 2).

Table 2 – Performance evaluation and consumption of multinutritional blocks with different formulations supplied to ewes during the 64-day period.

Variables	Experimental groups				
	G1	G2	G3	*CV*	*P*
Number of animals	20	20	20	-	-
Initial weight (kg)	31.65a	32.40a	33.61a	*12.85*	*0.3338*
Final weight (kg)	36.03b	39.44a	37.32ab	*11.44*	*0.0481*
GWT (kg)	4.38ab	7.04a	3.72b	*26.01*	*0.0156*
GWD (kg)	0.068b	0.110a	0.057b	*26.01*	*0.0156*
TMC (kg)	1.044a	0.953b	1.060a	*0.098*	*0.0001*
DMC (g)	14.90b	13.40c	15.30a	*0.095*	*0.0001*
ICA	0.184b	0.105a	0.218c	*23.45*	*0.0027*
IEA	5.448b	9.521a	4.592c	*32.99*	*0.0331*

Total average weight gain (GWT); Average daily weight gain (GWD); Average daily consumption (DMC); Total average consumption (TMC); Feed conversion index (ICA); Feed efficiency index (IEA); Coefficient of variation (CV); Treatment effect (P); The averages of the different letters in same line indicate significant ($P < 0.05$) using Tukey test.

The ewes in the G2 group were significantly heavier ($P < 0.01$) than those of the G1 group at the end of the experiment, not differing from G3. Compared to the ewes in the GWT group, G2 group presented 60.73% weight gain over that in G1, and G3 presented 89.25% weight gain over the lowest weight gain during the trial period. Similarly, the G2 group presented a significantly higher GWD ($P < 0.05$) than that of the other groups.

The GWD values obtained from groups G1 and G2 were similar to those reported by other authors who observed variations of between 70 and 104 g (ATTI; BEN SALEM, 2008; CORDÃO et al., 2014; MARTÍNEZ-MARTÍNEZ et al., 2012). Moreover, it was observed that sheep responded well when treated with multinutritional blocks; however, the amount of protein present in different values and formulas of forage supplied may alter the absorption of nutrients by animals (ATTI; BEN SALEM, 2008; CORDÃO et al., 2014; MAKKAR; SÁNCHEZ; SPEEDY, 2007), causing significant differences in performance within the experiments.

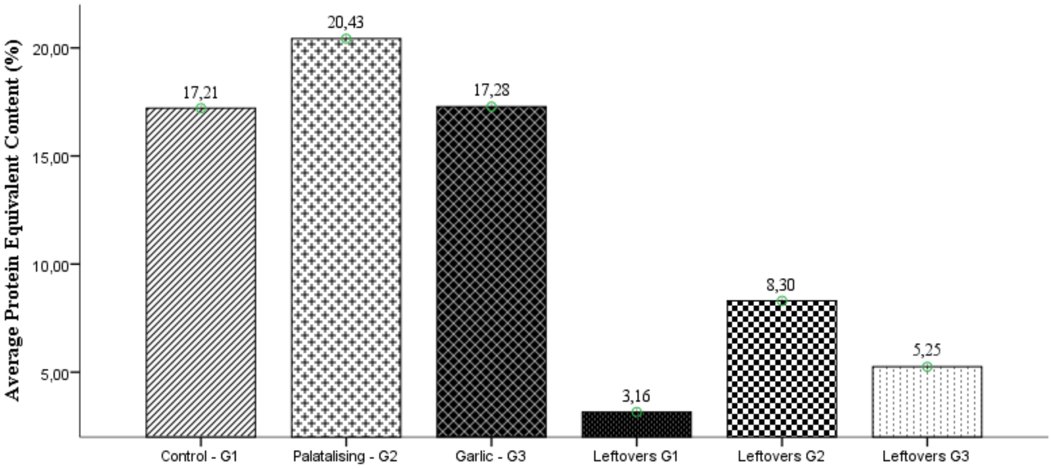
A significant difference ($P < 0.05$) was observed for the total consumption of the multinutritional blocks: the G1 and G3 groups did not differ with consumption of 14.90 g and 15.30 g, respectively. However, with palatalising, the G2 group had the lowest average daily consumption of 13.40 g. It can be inferred that the G2 group obtained better performance ($P < 0.05$) with ICA of 0.105. This indicates that the G1 group (0.184) consumed 75% more and the G3 group (0.218) consumed 107% more of the multinutritional block to obtain the same performance as those of group G2.

Our results showed that the supply of the multinutritional block to sheep raised in the field promotes weight gain. Variations in multinutritional block consumption found in the present study, when compared to the results of other authors, can be attributed to various other factors. The factors include the concentration of minerals in the fodder and the intake, which can vary depending on the pasture, soil management, the species, and age of the plant, beyond the period of the year (CHAGAS et al., 2007). The IEA showed that among the three treatments, the sheep in the G2 group showed 51.76% more efficient use of diet than sheep from the G3 and 42.77% more efficient use of diet than the sheep from the G1.

To obtain satisfactory body weight gains per grazing area, ruminants need a sufficient and high-quality diet to meet their nutritional demands, due to the low ICA presented by the animals in general (BORTOLO et al., 2001).

The average chemical analysis of different formulations of multinutritional block and their leftovers in the trough showed significant difference (P < 0.009) for the protein equivalent (EqP). Application of T test showed greater EqP in the block with palatalising, G2 (20.43 ± 4.59), in all initial samples, which were greater than the level of the manufacturer's warranty (13.038%). The lower rate of EqP was observed in the leftovers from the control block, G1 (3.16 ± 1.10), as illustrated in Figure 1. It may be the result of environmental action due to volatilization of urea in the formulation of the multinutritional block.

Figure 1 – Protein equivalents of the multinutritional blocks used in groups G1, G2, and G3 and their respective sampling leftovers during the trial period.



The average values of dry matter (91.35 ± 0.53), mineral matter (78.43 ± 3.64), and organic matter (3.64 ± 21.56) did not differ between the blocks from each group (P > 0.05) as shown in Table 3.

Table 3 – Chemical composition of multinutritional block samples of the experimental groups.

Variables	G1	G2	G3	*CV*	*P*
DM	91.76	91.13	91.16	*3.63*	*0.522*
OM	21.10	21.84	21.73	*3.93*	*0.986*
MM	78.89	78.15	78.26	*3.93*	*0.986*

Dry matter (DM); Organic matter (OM); Mineral matter (MM); Coefficient of variation (CV); Treatment effect (P).

The ewes showed low interest in the pearl millet silage, resulting in more leftovers in the trough (Table 4). Different factors may be responsible for variations in individual DM consumption, such as physiological status, diet composition, the quality and quantity of food offered, and illness or stress (RESENDE et al., 2008).

Table 4 – Average of provision and consumption of silage of pearl millet (*P. glaucum*) in fresh experimental groups.

Variables	**G1**	**G2**	**G3**	***CV***	***P***
Average batch supply day $^{-1}$ (kg)	23.750	23.750	23.750		
Average consumption batch day $^{-1}$ (kg)	16.765	16.681	18.878	*26.31*	*0.344*
Average consumption animal day $^{-1}$ (kg)	0.838	0.834	0.943	*26.31*	*0.345*
Average batch left day $^{-1}$ (kg)	7.521	7.605	5.408	*55.63*	*0.055*
That leaves average animal day $^{-1}$ (kg)	0.376	0.381	0.270	*55.67*	*0.056*

Coefficient of variation (CV); Treatment effect (P).

The chemical analysis of the silage of pearl millet revealed a significant difference (P < 0.05) for CP, NDF, and ADF (Table 5), compared to the leftovers collected in the trough. The other chemical variables did not present significant differences (P > 0. 05).

Table 5 – Chemical composition and DIV of average samples of silage of pearl millet (*P. glaucum*) and leftovers of the experimental groups.

Variables	Fresh silage	Leftovers of silage			*CV*	*P*
		G1	G2	G3		
DM	39.71	37.95	39.16	43.24	*16.82*	*0.572*
OM	96.37	97.47	97.67	97.50	*13.71*	*0.105*
CP	8.08a	5.31b	4.86b	5.20b	*9.78*	*0.001*
NDF	62.06a	72.74b	71.12b	70.57b	*3.87*	*0.001*
ADF	35.49a	42.30c	38.35b	39.27b	*5.97*	*0.001*
DIVDM	66.38a	63.26ab	61.18b	62.14b	*3.64*	*0.006*
DIVOM	65.91	63.88	64.21	64.13	*8.67*	*0.143*
DIVNDF	48.61	48.93	50.32	49.32	*11.31*	*0.095*
DIVADF	48.69a	43.34b	39.69c	44.15b	*13.74*	*0.006*

Dry matter (DM); Organic matter (OM); Crude protein (CP); Neutral detergent fiber (NDF); Acid detergent fiber (ADF); *In vitro* digestibility of dry matter (DIVDM); *In vitro* organic matter digestibility (DIVOM); *In vitro* digestibility of neutral detergent fiber (DIVNDF); *In vitro* digestibility of acid detergent fiber (DIVADF); Coefficient of variation (CV); Treatment effect (P); The averages of different letters in the same line indicate significant (P < 0.05) using Tukey test.

The CP values obtained in this study were similar to the levels reported by other authors, with values between 6.17% and 10.68% (AMARAL et al., 2008).

The NDF (62.06 ± 3.68) of fresh silage of pearl millet remained within the range of variation observed in previous studies (AMARAL et al., 2008; GUIMARÃES JR; GONÇALVES; RODRIGUES, 2009). The chemical values of ADF (35.49 ± 2.34) found were similar to those seen in previous studies (GUIMARÃES JR; GONÇALVES; RODRIGUES, 2009) in DM of fresh silage.

With respect to the consumption of silage, the level of NDF observed was probably the main factor limiting the consumption of roughage. According to Van Soest (1994), levels of NDF greater than 550 g kg^{-1} DM have a negative correlation with forage intake, since this constituent directly reflects the large capacity of occupation of rumen space and indirectly reflects the density of available energy.

The DIV parameters of DM and ADF of fresh silage showed different (P < 0.05) values compared to the leftovers due to dehydration caused by the environment (Table 5). The values found corroborated with those of other authors (GUIMARÃES JR; GONÇALVES; RODRIGUES, 2009).

It was observed that the highest leaf blade mean and highest average pasture availability were found in the G2 pasture, and these results were significant (P < 0.05) during the experimental period (Table 6). The relation leaf x stem and the distribution of leaves in the forage are factors that exert influence in the selective process of consumption (PORTO et al., 2009), since the green parts of the plant are the most nutritious and hence preferred by the animals (VAN SOEST, 1994).

Table 6 –Averaged availability of *B. brizantha* 'Marandu' pasture.

Variables	Experimental groups			*CV*	*P*
	G1	G2	G3		
Pasture size (ha)	0.65	0.82	0.66	-	-
Leaf blade (%)	74.09b	87.3a	76.18b	*15.87*	*0.001*
Dry leaves and stems (%)	25.9ª	12.69b	23.81a	*28.85*	*0.034*
Averaged availability of pasture (kg ha^{-1})	1.063.44b	2.171.66a	917.28c	*25.65*	*0.002*

The averages of different letters in the same line indicate significant (P < 0.05) using Tukey test.

The result of the chemical analysis of forage (*U. brizantha* 'Marandu') of the experiment showed a significant difference (P < 0.05) between DM, OM, CP, NDF, and ADF (Table 7).

The dry matter (DM) contents were similar to those found in previous studies, ranging from 19.95% to 27.60% for green leaf (SANTOS et al., 2004; SOUSA et al., 2007). Regarding CP, the values observed were similar to those found previous studies, in which variation was noted from 8.10% to 13.71% (ZERVOUDAKIS et al., 2002).

The low value observed in leaf blades of *U. brizantha* 'Marandu' of G1 group, compared to that in other experimental groups (Table 7), can be explained, in part, by the highest accumulation of secondary material being observed in this group (Table 3), which resulted in more favorable chemical composition, i.e. lower levels of NDF of the leaf blades (COSTA et al., 2005). No differences were found (P > 0.05) in the OM content between groups for the secondary material (Table 7).

Table 7 – Chemical composition and averaged DIV of *B. brizantha* 'Marandu' samples.

Variables	Leaf blade			Secondary material						
	G1	G2	G3	G1	G2	G3	*CV*	*P1*	*P2*	*P3*
DM	25.73	29.89	29.59	55.47	57.08	42.19	*21.92*	*0.001*	*0.833*	*0.374*
OM	88.36	90.01	90.38	93.30	93.01	91.71	*29.23*	*0.017*	*0.011*	*0.551*
CP	9.01	8.24	6.69	2.70	2.66	4.42	*5.31*	*0.001*	*0.003*	*0.003*
NDF	62.99	52.10	66.80	78.73	74.24	72.20	*17.66*	*0.041*	*0.214*	*0.337*
ADF	27.98	28.16	31.29	46.79	46.64	37.80	*18.67*	*0.002*	*0.605*	*0.493*
DIVDM	77.75	78.08	72.14	44.24	42.19	45.06	*7.94*	*0.001*	*0.010*	*0.525*
DIVOM	80.74	79.06	73.83	43.70	40.42	45.46	*23.61*	*0.001*	*0.007*	*0.413*
DIVNDF	71.41	57.72	62.44	36.07	25.55	33.14	*29.42*	*0.001*	*0.013*	*0.137*
DIVADF	42.81	29.81	32.88	31.16	34.16	27.83	*53.36*	*0.001*	*0.008*	*0.219*

Dry matter (DM); Organic matter (OM); Crude protein (CP); Neutral detergent fiber (NDF); Acid detergent fiber (ADF); *In vitro* digestibility of dry matter (DIVDM); *In vitro* digestibility of organic matter (DIVOM); *In vitro* digestibility of neutral detergent fiber (DIVNDF); *In vitro* digestibility of acid detergent fiber (DIVADF); Coefficient of variation (CV); Treatment effect (P1) (P < 0.05); Effect of treatment of foliar blade material (P2) (P < 0.05); Effect of secondary treatment material (P3) (P < 0.05).

Group 2 (52.1%) showed better NDF values of the pasture than G1 (62.9%) and G3 (66.8%), with a 28.21% lower variation than that of G3. This resulted in better conversion of forage by grazing animals, as expected, since NDF contents of tropical forages were high. In general, the NDF value was above 65% in sprouts and 75% to 80% in the later stages of maturation (COSTA et al., 2005).

The results found for the ADF of green leaves corroborate with the finding of other authors, ranging from 21.20% to 40.22% (MEDEIROS et al., 2007; MOREIRA et al., 2009). The ADF values of secondary material analysis were also similar to those reported in previous studies (MORAES et al., 2005; PARIZ et al., 2011; ROTH, 2008). Higher ADF values reveal low digestibility of forage offered during the experiment. However, these data are typical of *B. brizantha* 'Marandu' (PARIZ et al., 2011). In this study, it was shown that the increase in the ADF content in relation to secondary material is due to the maturity of the forager, environmental conditions imposed before the grazing, implementation of management, and increased DM (MORAES et al., 2005).

The leaf blade DIVDM values were higher than those found in previous studies, wherein these values range from 67.40% to 65.8% (EUCLIDES et al., 2009; PORTO et al., 2009). It is known that flourishing and problems caused by elongation of stems (VAN SOEST, 1994) reduce the amount of leaf blade, increase the levels of insoluble carbohydrates, and reduce the digestibility of *B. brizantha* 'Marandu' (TORO VELÁSQUEZ et al., 2010). Previous studies have reported DIVDM levels ranging from 42.9% to 59.8%, similar to those found in the secondary material (PACIULLO et al., 2007; PORTO et al., 2009). In this sense, the highest digestibility of leaf blade can be associated with lesser development of cells of the secondary wall (BRITO; RODELLA; DESCHAMPS, 2003).

For leaflet DIVMO, averages of 80.74, 79.06, and 73.83% were observed for group G1, G2 and G3, respectively. These DIVMO values were higher than those found in the secondary material, indicating greater occurrence of leaf senescence due to concomitant lignification of the secondary cell wall (DESCHAMPS, 1999).

The highest digestibility coefficients of the NDF (63.86%) and ADF (35.17%) observed in the leaf blade, in relation to the secondary material, were consistent. This is because the leaves of the forage showed lower of NDF and ADF. According to Duble; Lancaster; Holt (1971), the low levels of NDF in tropical grasses increase DIVNDF levels to reach 82%. The authors report the inverse correlation, a fact observed for the DIVNDF of the secondary material.

The evaluation of the average chemical composition and DIV of *B. brizantha* 'Marandu', after calculating the Pearson correlation coefficient, showed that CP was positively correlated with OM and DIVDM, DIVOM, DIVADF, and DIVNDF. However, CP presented a negative correlation with NDF and ADF, demonstrating that the higher the crude protein concentration in *B. brizantha* 'Marandu', the higher its digestibility (Table 8).

Table 8 – Pearson correlation of *B. brizantha* 'Marandu' samples from experimental groups.

	CP	DM	OM	NDF	ADF	DIVDM	DIVOM	DIVNDF	DIVADF
CP	1	0.463	0.871**	-0.774**	-0.950**	0.972**	0.968**	0.915**	0.967**
DM	00.463	1	0.506	-0.462	-0.555	0.449	0.403	0.370	0.454
OM	0.871**	0.506	1	-0.745**	-0.812**	0.849**	0.863**	0.765**	0.862**
NDF	-0.774**	-0.462	-0.745**	1	0.768**	-0.760**	-0.765**	-0.654*	-0.814**
ADF	-0.950**	-0.555	-0.812**	0.768**	1	-0.913**	-0.902**	-0.867**	-0.964**
DIVDM	0.972**	0.449	0.849**	-0.760**	-0.913**	1	0.992**	0.946**	0.959**
DIVOM	0.968**	0.403	0.863**	-0.765**	-0.902**	0.992**	1	0.947**	0.963**
DIVNDF	0.915**	0.370	0.765**	-0.654*	-0.867**	0.946**	0.947**	1	0.931**
DIVADF	0.967**	0.454	0.862**	-0.814**	-0.964**	0.959**	0.963**	0.931**	1

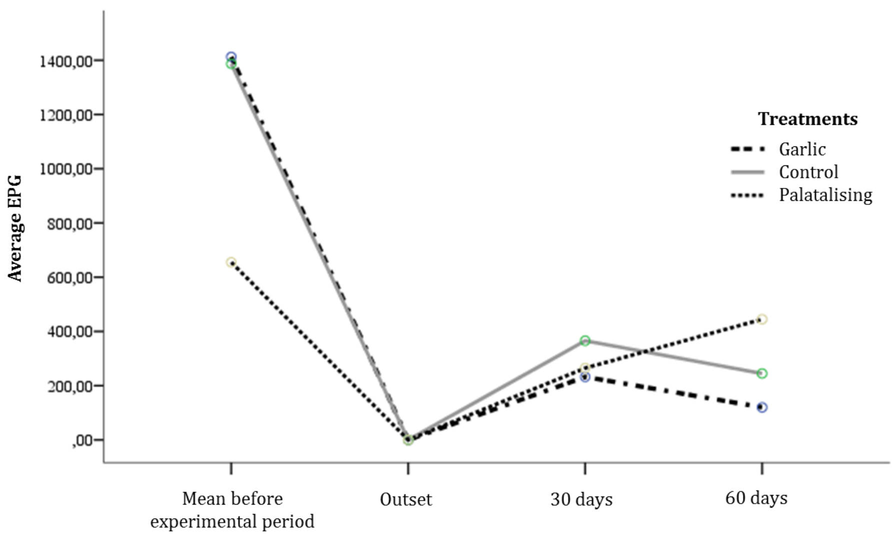
Crude protein (CP); Dry matter (DM); Organic matter (OM); Mineral matter (MM); Neutral detergent fiber (NDF); acid detergent fiber (ADF); *In vitro* digestibility of dry matter (DIVDM); *In vitro* digestibility of organic matter (DIVOM); *In vitro* digestibility of neutral detergent fiber (DIVNDF), and *in vitro* digestibility of acid detergent fiber (DIVADF). ** Significant correlation (P < 0.01); * Significant correlation (P < 0.05).

Thus, as pasture intake is limited by NDF, its digestibility is also related to the ADF, since it reveals the quantity of rumen-insoluble fibers (lignin, silica, and cutin) present in the diet (VAN SOEST, 1994). Therefore, the higher supply of leaf blade (Table 3) in the pasture where the G2 was maintained was associated with the results of the chemical analyzes, influenced in part by its performance. It also revealed that the higher supply of forage of better nutritional value (COSTA et al., 2005) reduced the consumption of the block to levels that optimize the animal performance.

In forage supplementation trials, the consumption of the supplement may induce the animals to substitute forage intake and improve the amount of diet ingested due to the greater energy availability. Thus, the animal becomes more selective while grazing and only ingests those species or parts of forage of better nutritive value (SANTOS et al., 2004). In this sense, it can be suggested that the non-protein nitrogen (NPN) present in the multinutritional block was vital to enhance the nutritional efficiency of the diet. This is because the greater amount of N provided favors the presence of the ruminal microbiota, resulting in greater digestibility of the fiber in the vegetable matter.

The EPG test revealed a significant effect (P < 0.05) of interaction between treatments and experimental period (Figure 2).

Figure 2 – Averaged values of EPG Test from Pantaneiro sheep before and during the trial period with multinutritional blocks feeding.



A positive linear effect was observed in the G2 group at the beginning of the experimental period, demonstrating its tendency to increase the level of reinfection over time. However, the G3 group obtained a negative quadratic effect for the reinfection levels, as it remained below the levels of the other experimental groups. This result may be related to the phytotherapeutic action of the garlic extract added to the animal's diet, which reduces the levels of infection by gastrointestinal nematodes in ruminants (BATATINHA et al., 2004; BIANCHIN; CATTO, 2004; STRICKLAND et al., 2009).

However, there are contrary opinions on the use of garlic (*A. sativum* Linn), as Burke et al. (2009) reported that garlic was not recommended as an aid to control gastrointestinal nematodes in goats or sheep. As the anthelmintic used has no residual effect (APVMA, 2010), the inhibitory effect on reinfection is related to the use of garlic-based phytotherapy.

CONCLUSION

The supplementation of multinutritional blocks for sheep kept in pastures of *B. brizantha* 'Marandu' contributed to the improvement of sheep nutritional status. Among the formulations tested, the palatalising block showed the best conversion rates and food efficiency index. The block with garlic extract showed an inhibitory effect on the reinfection by gastrointestinal nematodes after 30 days.

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