



Short Communication

Nutritive value of diets containing pods of faveira (*Parkia platycephala* Benth.) for confined finishing sheep

Lília Raquel Fé da Silva¹, Arnaud Azevêdo Alves¹, Vânia Rodrigues Vasconcelos¹,
Hoston Tomas Santos do Nascimento², Miguel Arcanjo Moreira Filho¹

¹ Universidade Federal do Piauí – UFPI.

² Agropecuária – EMBRAPA MEIO NORTE.

ABSTRACT - Performance and apparent digestibility were evaluated in sheep fed diets containing different amounts of faveira (*Parkia platycephala*) pods in replace to corn. Twenty crossbred Santa Inês lambs of approximately four months of age and average 21 kg were kept in individual stalls in randomized blocks and distributed according to weight. The following characteristics were evaluated: average daily gain, feed conversion and voluntary intake of dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), total carbohydrates (TCH), non-fibrous carbohydrates (NFC); and apparent digestibility of DM, OM, CP, NDF, ADF, TCH, NFC and total digestible nutrients (TDN). *P. platycephala* pods inclusion in the diets promoted no significant difference in the intakes of dry matter, organic matter, total carbohydrate and total digestible nutrients and also sheep performance. There was no treatment effect in the digestibility of organic matter, crude protein, fatty acids, neutral detergent fiber or total digestible nutrients. There was no effect of treatment for organic matter digestibility, crude protein, fatty acids, neutral detergent fiber or total digestible nutrients. The inclusion of up to 75% of faveira pods in substitution to corn grains in diets for finishing animals does not influence weight gain or feed conversion, although the replacement of more than 50% compromises the digestibility of dry matter.

Key Words: energy value, *in vivo* digestibility, lambs, voluntary intake

Introduction

Northeast Brazil has favorable environmental conditions for the development of meat, but nutritional barriers represent a major limiting factor that can explain the low rate of production in this region.

The appropriate performance of ruminant production is mainly related to feed intake, which, in turn, depends on the consumption of dry matter (DM) and energy concentration (Cunha et al., 2008). Research with legumes has indicated the potential of some species to be used as forage supply of good quality or for supplementation in phases when animals have higher nutritional requirements.

In general, forage legumes have a higher protein value, high digestibility and good resistance to dry seasons and contribute to the improvement of soil fertility (Morais & Vasconcelos, 2007). A promising option to increase the sheep industry in this region is the use of *Parkia platycephala* Benth pods as forage.

P. platycephala, known as faveira, is a leguminous tree belonging to subfamily *Mimosoideae*. The species naturally occurs in northern areas of Northeast Brazil, and is characteristic of areas called “chapadas” or “agreste” in the Mid-North sub-region (Piauí and Maranhão). Pod production is variable among trees and also from year to year. In the Piauí state, the annual production is of 1208 kg/ha, mainly concentrated from September to November, with an average production of 26 kg/plant/year (Alves et al., 2007).

Considering the chemical composition of the species, studies developed with these pods and seeds have shown the nutritional quality of this legume. Machado et al. (1999) obtained 95% of dry matter of pods, 9.3% of crude protein, 12.8% of neutral detergent fiber, 10.4% of acid detergent fiber, 0.12% of calcium and 0.11% of phosphorus. Alves (2004) demonstrated the potential energy of pods of this species for use in ruminant diets; it is an important source of carbohydrates for rapid fermentation. This allows the

production of propionic acid in the rumen and raises the efficiency of energy use by reducing losses through methane fermentation. Therefore, the study of the feasibility of *P. platycephala* pods in sheep feeding is justified because they represent an important source of carbohydrates, which can influence the animal body and carcass quality, and also contribute to minimizing the costs of concentrates. This study was carried out to evaluate the inclusion of *P. platycephala* pods in substitution to corn in diets for finishing sheep, analyzing its effect on voluntary intake, apparent digestibility and weight gain.

Material and Methods

The research was conducted at the Department of Animal Science, Center of Agrarian Sciences in Universidade Federal do Piauí, Teresina - PI, located at 5°02'31.34" South and 42°46'56.95" West. The use of pods of *Parkia platycephala* Benth replacing corn at the levels of 0, 25, 50 and 75% based on dry matter, corresponding to the experimental treatments (Table 1) was evaluated.

Sampling was performed in a natural population of faveira in Piauí State, specifically in the region of Regeneração. Pods were sampled at the senescence stage, at the point that they were considered physiologically mature. Then, pods were transported to the Animal Nutrition Laboratory at the Department of Animal Science (LANA/DZO/UFPI) and crushed in a forage machine to obtain particle sizes of 3-5 cm for preparation of diets.

Twenty crossbred Santa Inez lambs with four months-old and initial average body weight of 20.84±0.7 kg were used. Animals were weighed, dewormed and supplemented with vitamin complex and kept in stalls containing troughs with water and mineral mixture.

The experimental period for the performance assay was comprised of 56 days, preceded by a period of 14 days

for adaptation to the stalls and the diets, which incurred in a 70-day period for the whole experiment. Animals were subjected to diets with different percentages of faveira pods (0, 25, 50 and 75%), sampled by weight and arranged in randomized blocks with four treatments and five repetitions. For the evaluation of performance, diets were formulated according to the NRC (2007) for a daily gain of 200 g (Table 2).

Animals were fed daily at 8 a.m. and 4 p.m. with water and minerals, in order to provide leftovers of 15% in relation to the consumption of the previous day. During the days of data collection, leftovers were collected and quantified before each meal, taking aliquots of 20% that were placed in plastic bags, properly identified and stored in freezer (-5 to -10 °C). Based on the difference between the feed supplied and leftovers, the daily intake of individual nutrients in g/animal/day, g/kg of body weight (BW) and g/metabolic weight (MW) was estimated.

In order to obtain the daily weight gain, the animals were weekly weighed, fasting for the previous 14 hours during the experimental period. The rate of feed conversion was obtained by the ratio between the total dry matter intake and the total weight gain during the experiment.

At the end of the performance assay, animals were transferred to metabolic cages with dimensions of 1.0 × 0.5 m, equipped with feeders, troughs and devices for separation and collection of urine and excrements. There was a period of seven days to adapt to the cages, followed by the stage of collecting data and samples with a duration of five days. The digestibility was obtained by the method of total collection, held twice a day right after each diet. Excrements were weighed and samples corresponding to 20% of the excrement were collected. The samples were stored in a freezer (-5 to -10 °C), obtaining a composite sample of each animal at the end of the period.

Samples of feed leftovers and excrements were defrosted, homogenized and sent to the Laboratory

Table 1 - Chemical composition of the ingredients of the experimental diets

Nutrient	Ingredient			
	Ammoniated brachiaria cv. Marandu	Soybean meal	Corn	<i>Parkia platycephala</i>
Dry matter (g/kg NM)	858.4	875.9	782.1	871.0
		g/kg DM		
Crude protein	108.8	495.6	117.4	106.1
Ether extract	20.0	11.0	24.0	21.0
Neutral detergent fiber	788.0	145.2	132.9	142.7
Acid detergent fiber	477.6	115.4	43.4	138.3
Mineral matter	50.0	69.0	9.0	33.0
Non-fiber carbohydrates	33.1	279.2	639.6	697.2

NM - natural matter; DM - dry matter.

Table 2 - Feed and chemical composition of diets containing faveira pods in substitution to corn

Ingredient	Feed composition			
	0%	25%	50%	75%
	g/kg DM			
Ammoniated signal grass hay	426.8	423.9	423.2	423.9
Ground corn	408.9	304.2	203.6	102.0
Soybean meal	164.2	169.9	169.6	169.9
Crushed <i>P. platycephala</i> pods	00.0	102.0	203.6	304.2
Chemical composition				
Dry matter (g/kg NM)	858.0	853.7	870.7	850.6
	g/kg DM			
Mineral matter	36.0	39.0	40.0	43.0
Crude protein	173.5	170.8	192.4	192.4
Neutral detergent fiber	429.2	446.1	463.0	482.8
Acid detergent fiber	237.5	241.0	260.5	271.5
Ether extract	33.0	27.0	25.0	24.0
Non-fiber carbohydrates	328.6	317.9	279.6	272.0

NM - natural matter; DM - dry matter.

of Animal Nutrition (LANA) of DZO/CCA/UFPI. Samples were oven-dried (55 ± 5 °C, 72 hours) and crushed in a slicer with sieves of 1 mm. The intake values of dry matter (DM), mineral matter (MM), crude protein (CP) and ether extract (EE) were determined according to Silva & Queiroz (2002), and neutral detergent fiber (NDF) and acid detergent fiber (ADF), as described by Souza et al. (1999). The content of non-fibrous carbohydrates was estimated according to Hall (2000), with the formula $CNF = TCHO - NDF$. The total content of digestible nutrients (TDN) was calculated according to Weiss et al. (1992): $TDN (\%) = CP\% + NDF\% + NFC\% + (2.25 \times DEE\%)$.

The results were submitted to regression analysis using PROC REG on the software SAS (Statistical Analysis System, version 8).

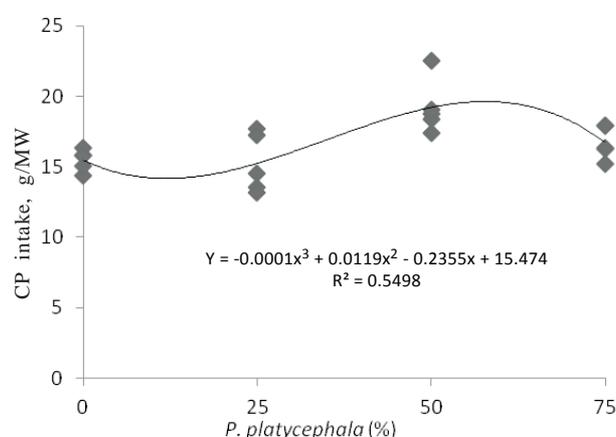
Results and Discussion

Faveira pods included in the diets did not influence ($P > 0.05$) the dry matter (DM) intake, which presented means of 1.142 ± 175 g/animal/day, 40.0 ± 3.0 g/kg BW and 92.37 ± 7.79 g/unit of metabolic weight (Table 3). These values can be considered appropriate in relation to the recommendation of the NRC (2007), which is 81.91 g/metabolic weight/day for sheep with mean body weight of 30 kg and weight gain of 200 g/day. It must be emphasized that faveira pods have high palatability, with great acceptance by animals and high rate of ruminal degradation of DM, which promotes higher rate of passage and consequently similar concentrate intake (Alves et al., 2007).

The highest crude protein (CP) intake was estimated at 23.0 g/MW, when corn grains were substituted by

67.7% of faveira pods (Figure 1). In general, the CP intake was superior of the established by NRC (2007), which is 10.68 g/MW, for this animal category according to the performance. Considering the protein digestibility of those diets, with mean of 70.07 ± 1.66 g/100 g of DM and the protein intake, which was of 204.86 ± 33.90 g/animal/day, the daily intake of digestible proteins was estimated at 143.54 g.

The inclusion of faveira pods in the diets did not influence the consumption of neutral detergent fiber (NDF), with mean of 403.96 ± 75.81 g/animal/day. As representative of structural carbohydrates, NDF is one of the main factors that determine consumption by ruminants; however, there was no difference in DM intake in this study and this



CP - crude protein; MW - metabolic weight.

Figure 1 - Crude protein intake according to the dietary faveira pods levels.

Table 3 - Voluntary intake and performance of finishing sheep fed diets containing faveira pods (% DM)

Item	Percentage of pods (%)				CV (%)	P		
	0	25	50	75		Linear	Quadratic	Cubic
Dry matter intake								
g/day	1.146	1.070	1.169	1.183	15.3	0.560	0.576	0.475
g/kg BW	38.0	38.0	43.0	40.0	9.4	0.118	0.365	0.128
g/MW	88.95	88.12	98.28	94.12	8.4	0.125	0.641	0.130
Organic matter intake								
g/day	912.80	842.20	944.20	923.40	15.6	0.642	0.702	0.321
g/kg BW	30.0	30.0	35.0	31.0	8.9	0.136	0.318	0.054
g/MW	70.79	69.34	79.41	73.52	8.5	0.167	0.441	0.050
Crude protein intake								
g/day	198.46	183.86	228.38	208.75	16.5	0.288	0.871	0.094
Neutral detergent fiber intake								
g/day	365.43	348.66	438.27	463.49	18.7	0.026	0.547	0.282
g/kg BW	12.2	12.6	16.4	15.2	12.0	0.002	0.313	0.030
Non-fibrous carbohydrates intake								
g/day	430.66	402.76	347.64	358.01	13.5	0.022	0.427	0.390
Total digestible nutrients intake								
g/day	868.84	848.63	826.19	863.21	14.7	0.878	0.620	0.810
g/kg BW	28.0	30.0	30.0	29.0	9.3	0.580	0.358	0.944
g/MW	67.39	69.82	69.40	68.74	8.2	0.753	0.554	0.822
Sheep performance								
Weight gain (kg/day)	216.60	224.40	196.40	231.40	19.0	0.846	0.475	0.254
Feed conversion (kg DM/kg BW)	5.2	5.1	5.9	5.2	29.2	0.463	0.290	0.071

DM - dry matter; BW - body weight; CV - coefficient of variation; MW - metabolic weight.

shows that NDF intake is non-restrictive to rumen fill, which is related to the low forage:concentrate ratio of the diet.

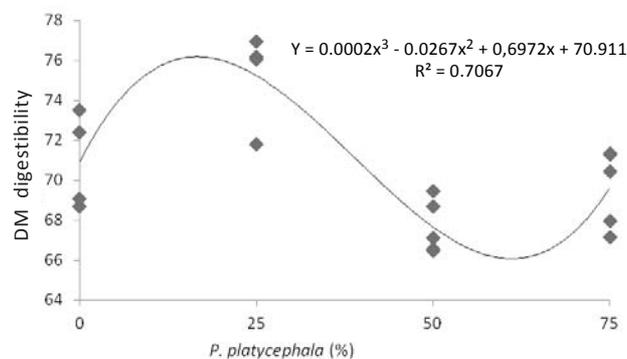
There was effect for NDF intake in percentage of body weight with better results (16.4 and 15.2 g/kg) for more elevated percentages of pods. One explanation for the more elevated NDF intake when levels of pods are increased is the higher content of NDF in these diets.

Although forages represented 40% of the total diet, carbohydrates of ammoniated brachiaria hay were well used by animals, with good performances (Table 3), stressing the mean consumption of total digestible nutrients (TDN) of 68.84 ± 5.57 g/MW/day, superior to the recommended by NRC (2007), of 43.68 g/MW, considering the animal category and the performance.

The inclusion of faveira pods replacing corn grains in the diets did not change ($P > 0.05$) weight gain (217.20 ± 36.36 g/day) or feed conversion (5.3 ± 0.35 kg of DM/kg BW) by sheep. Feed conversion results were compatible to NRC (2007), which is of 5.2 for sheep of this category.

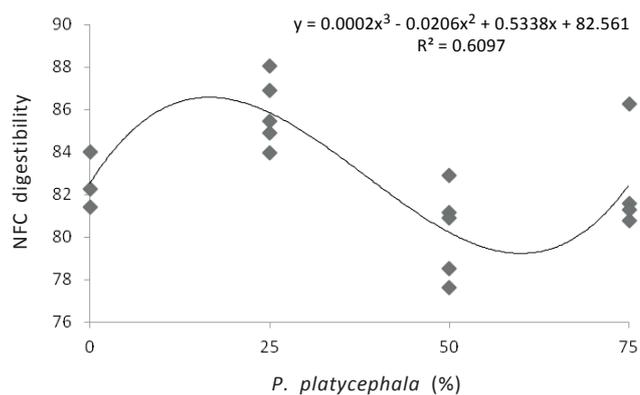
Apparent digestibility of DM, CP, EE, NDF and TDN was not influenced ($P > 0.05$) by inclusion of faveira pods in the diets, with means of 88.76 ± 1.37 ; 70.07 ± 1.66 ; 80.50 ± 7.10 ; 66.34 ± 3.26 and 72.31 ± 3.63 g/100 g DM, respectively.

The highest digestibility for DM and NFC was estimated at 76.1 and 86.7 g/100 g of DM, when only 15.9 and 17.3% of pods were included in replacement to corn grains, respectively (Figures 2 and 3). This result could be related to higher intake of NFC than that of fiber components (NDF and ADF) when smaller amounts of pods were included in the diets. The qualitative difference between corn and faveira ADF (Table 1) and the possible association of the fiber fraction with phenolics must also be emphasized. In a previous study with diets based on faveira pods for confined sheep, Alves (2004) verified that consumption of



DM - dry matter.

Figure 2 - Digestibility of dry matter in diets containing faveira pods.



NFC - non-fiber carbohydrates.

Figure 3 - Digestibility of non-fiber carbohydrates in diets containing faveira pods.

tannins negatively influences the digestibility of pods fiber fraction, which could be due to the inhibitory effect of condensed tannins.

Conclusions

The inclusion of up to 75% of faveira pods in substitution to corn grains in the diets for finishing animals does not influence weight gain or feed conversion, although the replacement of more than 50% compromises the digestibility of dry matter.

References

- ALVES, A.A. **Valor nutritivo da vagem de faveira (*Parkia platycephala* Benth.) para ruminantes.** 2004. 198f. Tese (Doutorado em Zootecnia) – Universidade Federal do Ceará, Fortaleza.
- ALVES, A.A.; SALES R.O.; NEIVA, J.N.M. et al. Degradabilidade ruminal in situ de vagens de faveira (*Parkia platycephala* Benth.) em diferentes tamanhos de partículas. **Revista Brasileira de Medicina Veterinária e Zootecnia**, v.59, n.4, p.1045-1051, 2007.
- CUNHA M.G.G.; CARVALHO, F.F.R.; VERAS, A.S.C. et al. Desempenho e digestibilidade aparente em ovinos confinados alimentados com dietas contendo níveis crescentes de caroço de algodão integral. **Revista Brasileira de Zootecnia**, v.37, n.6, p.1103-1111, 2008.
- HALL, M.B. **Neutral detergent-soluble carbohydrates nutritional relevance and analysis: a laboratory manual.** Florida: University of Florida. Institute of Food and Agricultural Sciences, 2000. 76p. (Bulletin, 339).
- MACHADO, F.A.; ALVES, A.A.; MOURA, J.W.S. et al. Valor nutritivo da vagem de faveira (*Parkia platycephala* Benth.). **Revista Científica de Produção Animal**, v.1, n.1, p.39-43, 1999.
- MORAIS, D.A.E.F.; VASCONCELOS, A.M. Alternativas para incrementar a oferta de nutrientes no semi-árido brasileiro. **Revista Verde**, v.2, n.1, p.1-24, 2007.
- NATIONAL RESEARCH COUNCIL - NRC. **Nutrient requirements of small ruminants: sheep, goats, cervides and new world camelids.** 6.ed. Washington, D.C.: National Academy Press, 2007. 362p.
- SILVA, D.J.; QUEIROZ, A.C. **Análise de alimentos: métodos químicos e biológicos.** 3.ed. Viçosa, MG: UFV, 2002. 235p.
- SOUZA, G.B.; NOGUEIRA, A.R.A.; SUMI, L.M. et al. **Método alternativo para determinação de fibra em detergente neutro e detergente ácido.** São Carlos: Embrapa Pecuária Sudeste, 1999. 21p. (Boletim de Pesquisa, 4).
- WEISS, W.P.; CONRAD, H.R.; PIERRE, N.R.S. A theoretically-based model for predicting total digestible nutrient values of forages and concentrates. **Animal Feed Science and Technology**, v.39, n.1-2, p.95-110, 1992.