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EVALUATION OF *Acacia macracantha* PODS IN BALANCED RATION FOR GROWING RABBITS

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Palabras clave: *Acacia macracantha* vainas; conejos; consumo; digestibilidad; atenuación de compuestos secundarios.
Keywords: *Acacia macracantha* pods; intake; rabbits; digestibility; attenuation of secondary compounds.

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RESUMEN

Evaluación de vainas de *Acacia macracantha* en ración balanceada para conejos en crecimiento. Se evaluó la atenuación de compuestos secundarios en vainas de Uveda (*Acacia macracantha, Am*) para su uso potencial en ración para conejos (*Oryctolagus cuniculus* mestizos California x Nueva Zelanda). Ensayo 1: arreglo factorial completamente al azar, factor temperatura de remojo (25, 45 y 65°C) y factor tiempo de remojo en agua (0, 6, 12, 24 y 48 h). Ensayo 2: se determinó consumo, digestibilidad y ganancia de peso evaluando ración basal (proteína cruda 183 $g.kg^{-1}$ y NDF 467 $g.kg^{-1}$, mezcla de harina de maíz y soya, heno de bermuda, aceite de soya, minerales y aminoácidos) y ración que contenía 30% de *Am* atenuada y cantidades variables de materias primas de basal (proteína cruda 184 $g.kg^{-1}$ y NDF 511 $g.kg^{-1}$). Se utilizaron 12 conejos por tratamiento (peso vivo 969±48,7 g y edad de 55 d). Después del período de adaptación de 7 días, se registró consumo de alimento y se recogieron heces de 62 a 89

ABSTRACT

The attenuation of secondary compounds in Uveda pods (*Acacia macracantha*, Am) were evaluated for potential use in ration for rabbits (*Oryctolagus cuniculus* mestizos California x Nueva Zelanda). Test 1: a completely random factorial arrangement, soaking temperature factor (25, 45 and 65°C) and water soaking time factor (0, 6, 12, 24 and 48 h). Test 2: consumption, digestibility and weight gain were determined by evaluating baseline ration (crude protein 183 $g.kg^{-1}$ and NDF 467 $g.kg^{-1}$, cornmeal and soybean mixture, Bermuda hay, soybean oil, minerals and amino acids) and serving containing 30% attenuated Am and varying amounts of basal raw materials (crude protein 184 $g.kg^{-1}$ and NDF 511 $g.kg^{-1}$). Twelve rabbits were used per treatment (live weight 969±48.7 g and age of 55 d). After the 7-day adaptation period, food intake was recorded and feces collected from 62 to 89 days of age. From the first trial, most effective secondary compound reduction was soaking of Am pods for 48 hours at 65°C. The

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días de edad. Del primer ensayo, la reducción de compuestos secundarios más efectiva fue con el remojo de vainas de *Am* durante 48 horas a 65°C. Las reducciones del contenido inicial fueron: 72,4% para polifenoles totales, 82,1% para fenoles simples, 63,3% para taninos totales, 90,8% para taninos condensados y 74,5% para taninos que precipitan proteínas. En el ensayo 2, la ingesta de alimento fue mayor para ración de *Am* (128 vs 107 g.d^{-1}, p<0,01), con energía bruta (11,0 vs 11,7 Mj.kg^{-1}, p<0,001) y digestibilidad de proteína bruta (66,9 vs 76,4, p<0,001) más bajas en comparación con conejos alimentados con ración basal. Por el contrario, digestibilidad de fibra fue mayor en conejos alimentados con ración *Am* (p<0,01). En conclusión, es factible incluir 30% de vainas *Am* atenuadas para conejos, sin embargo se requieren más experimentos para confirmar su efecto sobre la producción.

initial content reductions were: 72.4% for total polyphenols, 82.1% for simple phenols, 63.3% for total tannins, 90.8% for condensed tannins and 74.5% for tannins that precipitate proteins. In trial 2: food intake was higher for Am ration (128 vs 107 g.d^{-1}, p<0.01), with gross energy (11.0 vs. 11.7 Mj.kg^{-1}, p<0.001) and digestibility of Crude protein (66.9 vs 76.4, p<0.001) lower compared to rabbits fed basal ration. On the contrary, fiber digestibility was higher in rabbits fed Am ration (p<0.01). In conclusion, it is feasible to include 30% of attenuated Am pods for rabbits, however more experiments are required to confirm their effect on production.

INTRODUCTION

Global warming is a reality that reaches the entire population. Every day it is necessary to look for crop alternatives that can be a source of nutrients (protein and / or energy) to raise animals that are fed sustainably, shrubby and shrub legumes that grow in adverse dry climates can be an alternative to achieve this task. *Acacia macracantha* (Uveda, cují negro, cují yaque, cují hediondo, tusca, faique, taque, guarango, wild tamarind, stink casha, cambrón, carambomba, guatapana, steel acacia, acacia piquant, french cacha) is a tropical legume (*Mimosoideae*, tribe *Acacieae*) that grows in semi-arid areas of Venezuela; *A. macracantha* pods is consumed by grazing goats, using its foliage and mature pods (Nouel-Borges 2015, Nouel-Borges and Rincon 2005). Accordingly, it is a potentially fibrous ingredient to be included in rabbit rations. *A. macracantha* pods contain 13.4-13.7% crude protein, 46.1-71.7% neutral detergent insoluble fiber, 29.9-46.7% acid detergent insoluble fiber, 16.1-25.0% hemicellulose and 4.3-6.5 ask, 9.8% total polyphenols, 0.02% simple phenols and 9.7% total tannins (Nouel-Borges 2015, Nouel-Borges and Rincon 2005). However, the pods contain secondary compounds that may impair the digestibility, liver health and reproduction, but they can be neutralized or mitigated by various techniques (Romero *et al*. 2010). Ingestion of plant secondary metabolites present a physiological and behavioral challenge for mammalian herbivores. Herbivores must not only detoxify plant secondary metabolites. They may also deal with energetic constraints such as reduced food intake, mass loss, increased excretion of energy, and increased metabolic demands (Sorensen *et al*. 2005). In a study with different soaking methods varying different temperatures were evaluated to reduce the presence of secondary compounds as reports Makkar (2003).

Espejo-Díaz and Nouel-Borges (2014) report a significant reduction of secondary compounds in *A. macracantha* leaves with soaking processes at different temperatures; with a favorable effect on the incorporation of the leaves treated in a ration for rabbits improving their digestion and use. This research aims to identify and select from soaking temperatures and soaking in water the best alternative to mitigate the effects of secondary compounds in *A. macracantha* pods for potential use in ration for rabbits. Determinate the effect of incorporating attenuated pod in rabbit (*Oryctolagus cuniculus* mestizos California x Nueva Zelanda) rations on the intake, feed digestibility and rabbit blood plasma components associated with the use of energy metabolism and health of the rabbit's liver; were determinate the individual rabbit weight gain and dress out percentage.

MATERIALS AND METHODS

Trial one. For secondary compounds attenuation in pods. An experimental design was performed in a completely random factorial arrangement (Kuehl 2001). The mean and standard error of different treatments for each trait was determinate using Statistix for Windows (2003) from recorded experimental data. A completely randomized design was used a 3 x 5 factorial arrangement, two factors were combined: factor one, water immersion time (0, 6, 12, 24 and 48 h) and factor 2, water temperature (25, 45 and 65°C), resulting in 15 different treatments. Six repetitions were performed for each treatment, with a total of 90 experimental units. the means between treatments were separated by Tukey HSD All-Pairwise Comparisons Test. *A. macracantha* pods were harvested at physiological maturity (brown to black in its entirety) in a total of 10 plants with 10 to 12 years of age located in the field of forage introductions of the Agronomy Faculty from the Lisandro Alvarado University Tarabana, Cabudare, Lara state, Venezuela. The average annual climatic data of the area are temperature of 25ºC, precipitation of 812.6 mm, relative humidity of 74.6%, solar radiation of 371 cal cm^{-2} and evaporation of 2,084.9 mm and a height of 550 meters above sea level (Ortiz *et al*. 2015). All pods were dried at room temperature on a concrete floor protected with a steel roof. The *A. macracantha* pods were finely ground (1 mm sieve), then a 10 g sample was placed in a ruminal nylon bag for digestibility (50 µm mesh, 6 bags per treatment). These bags were immersed in the water bath (50 l capacity) for temperature control (166.67 $ml.g^{-1}$ sample). After the application of treatments, the samples were dried at room temperature in a forced air oven for 24 hours and later for 48 hours at 60°C. The chemical analyzes pre and post treatment of secondary compounds were performed on a sample composed of pairs of replicates, for a total of three samples analyzed for each treatment. Were determined total polyphenols, simple polyphenols, total tannins, condensed tannins and tannins that precipitate proteins, using methodologies described by Makkar (2000) and developed by Porter *et al*. (1986), Makkar *et al.* (1988), Makkar *et al.* (1993) and Hagerman *et al*. (1998). Gross energy with a calorimetric pump, model Parr-1261, crude protein (total nitrogen x 6.25 by the Kjeldahl method) using method no. 976.06 of the AOAC (1995) and cell wall components contained in the samples were determined using the methodology of Van Soest *et al*. (1991), with the use of heat-stable amylase, sodium sulfite and Fritted-disk Gooch crucible (coarse porosity, pore size 50 µm).

Trial two. Design of completely randomized experiments (Kuehl 2001) was applied for two treatments (basal/control and with *A. macracantha* attenuated pods) in order to assess their effect on food intake, digestibility and individual weight gain. *A. macracantha* pods of the same harvested for the attenuation in Trial 1 were ground to be used in the experimental ration. The *A. macracantha* flour was submitted to the most effective treatment for polyphenols attenuation obtained in experiment 1 (48 h of soaking at 65°C, performed in a water bath of 150 L capacity). A basal ration and ration containing 30% *A. macracantha* pods in replacement of 17% Bermuda hay, 8.2% corn flour, 4% soy meal and 0.8% minerals in isoproteic and isoenergetic rabbit ration (Table 1), ingredients and chemical composition was formulated to meet the requirements of growing rabbits (De Blas and Mateos 1998) and both were pelleted (4 mm diameter). The granules remained firm and hard but were shorter than those of the basal ration. Twenty-four crossbred rabbits New Zealand x Californians (12/treatment), weighing 969.15±48 g and 55 d old, were housed in individual metabolic cages. The rabbits remained healthy, without diarrhea and without contamination with coccidia, no animals died during the test, until the sacrifice. Intake and digestibility determinations were performed according to the methodology described by Perez *et al*. (1995) with 4 observations for individual rabbit (digestibility determination). The animals were kept in metabolic cages for 34 d, feed intake was recorded daily. Following a 20 d period of adaptation to each diet, feed intake was recorded daily by 14 d, and total fecal output collected during last 4 consecutive days (Perez *et al*.1995). Rabbits were weighed every 7 d. Daily weight gain was estimated by simple regression on 4 individual consecutive weightings for each rabbit. In order to determine the effect of incorporating *A. macracantha* pods in the ration on blood chemistry, energy metabolism and health of rabbits; blood collection for heart puncture was performed (with 18 x 1½ and hypodermic needles 6 ml) on days 0, 7, and 14 of the trial. While for the determination of metabolites in blood plasma separation took place by centrifugal blood serum and cells. The blood glucose measurement was performed the same day of collection, while the rest of the metabolites were determined within less than five days after the extraction (the samples were frozen at -40°C and stored in a freezer). The food and biological samples analysis laboratory is 100 meters away from the rabbit breeding and evaluation laboratory. The plasma was analyzed in the laboratory to determine the metabolic lipid profile (cholesterol, LDL, HDL, triglycerides), urea and glucose. Using the total enzyme cholesterol CHOP-PAP, LDL and HDL method by colorimetric according to Trinder (Phenol / 4-AF), triglycerides TG enzyme AA method Color GPO (McGowan *et al*. 1983), Trinder glucose glycemia according to Trinder (Lott and Turner 1975) and uremia as proposed by Wiener Lab (2000), transaminases by GOT / AST method (Bergmeyer and Bernst 1963). At the end of the experimental period (after 34 d of the beginning of the trial, and 89 d old), the rabbit was weighed and slaughtered to determine to dress out percentage. Experimental animals were managed under the ethics and laboratory management standards proposed by Aller *et al*. (2000) trying to maintain the maximum possible animal welfare during the experiment.

Table 1. Chemical Composition of Ingredients.

	Ingredients										
$Gr.kg^{-1}$	*A. macracantha* pod	Cornmeal	Soybean meal	Bermuda hay	Osmolar AA*	Mineral premix	Calcium carbonate	Salt	Calcium monophosphate	Soy oil	Meat and bone meal
Dry matter	932.4	863.3	882.7	910.3	48.5	1000	998.2	981.8	949.6	1000	964.3
Ash	65.3	15.8	78.7	50.9	-	-	-	-	-	-	30.8
Crude Protein	136.9	78.6	525.5	85.7	602.5	-	-	-	-	-	61.7
Neutral detergent fiber	717.0	381.4	231.5	719.5	-	-	-	-	-	-	-
Acid detergent fiber**	467.1	45.2	119.9	411.6	-	-	-	-	-	-	-
Gross energy ($MJ.kg^{-1}$)	18.9	17.7	19.4	18.0	-	-	-	-	-	38.8	27.6
			$Gr.kg^{-1}$ of inclusion of the ingredients in the ration								
Basal ration I											
	0.0	342.5	200.0	370.0	2.50	10.0	10.0	2.5	7.5	40	20
300 $gr.kg^{-1}$ *A. macracantha* pod ration	300.0	260.5	160.0	200.0	2.50	10.0	0.0	2.5	7.0	40	20

*vitamin and amino acid mix by Reveex laboratory. **aNDF-NDF.

RESULTS AND DISCUSSION

With 25°C temperature, the values of compounds varied without regular trend over time, whereas for the soaking temperature of 45 to 65°C a clear trend to reduce the values of compounds tested is observed (Table 2). Longer the time elapsed, higher the level of attenuation. The lower value is obtained soaking 48 h and at 65°C and this treatment was selected to test its effect in rabbits. The feed intake was higher in rabbits fed the ration containing *A. macracantha* due to its higher fiber content that led to a lower gross energy digestibility (Table 3). Rabbits fed a basal ration showed higher crude protein digestibility probably due to the higher soybean meal content of the ration, but lower fiber digestibility. The ration with 30% *A. macracantha* pods had 4.4 percentage units more cell wall than the basal diet. An increase in the cell wall digestibility of 13.6%, of the fiber insoluble in 6% acid detergent and of 23.8% hemicellulose could be achieved when compared with the digests of these components in the basal ration.

Table 2. Effect of temperature and soaking time on secondary compounds in evaluated treatments in *Acacia macracantha* pods.

Temperature °C	Secondary compounds ($gr.kg^{-1}$)	*Acacia macracantha* Fresh pods Soaking time (h)					Probability Interaction Temperature x Soaking time
		0	6	12	24	48	
25	Total polyphenols	34	50	38	28	34	<0.001
	Simple phenols	18	21	16	14	16	<0.001
	Total tannins	16	29	22	13	18	<0.001
	Condensed tannins	124	35	40	51	13	<0.001
	Tannins that precipitate CP	0.046	0.036	0.029	0.026	0.018	0.912
45	Total polyphenols	58	39	33	26	23	<0.001
	Simple phenols	28	18	12	9	9	<0.001
	Total tannins	30	21	21	16	14	<0.001
	Condensed tannins	129	44	124	64	71	<0.001
	Tannins that precipitate CP	0.046	0.023	0.029	0.028	0.011	0.912
65	Total polyphenols	58	46	33	29	16	<0.001
	Simple phenols	28	20	14	11	5	<0.001
	Total tannins	30	26	19	17	11	<0.001
	Condensed tannins	129	112	81	80	21	<0.001
	Tannins that precipitate CP	0.047	0.022	0.023	0.018	0.012	0.912

Table 3. Chemical composition of rations, basal and ration with 300 $gr.kg^{-1}$ *A. macracantha* pod inclusion.

	Rations	
$g.kg^{-1}$	Basal ration	300 $gr.kg^{-1}$ *A. macracantha* pod ration
Dry matter	964	962
Ash	63.7±1.3	59-3±1.3
Crude Protein	183±3.4	184±3.2
Neutral detergent insoluble fiber	467±4.7	511±15.0
Acid detergent insoluble fiber	182±8.5	240±5.3
Gross energy ($MJ.kg^{-1}$)	19.3±0.12	19.4±0.04

When these results are compared with those of Salas-Araujo *et al*. (2008) and Romero *et al*. (2010) shows that under similar conditions (place, weather, rabbit's age and crossbreeding) using non-attenuated *A. macracantha* pods, less than half % of the attenuated could be incorporated into the ration. Respect to Romero *et al*. (2010) CP digestibility was only 36% at the same level of incorporation of unattenuated pods vs. 66.89% in this experiment (0 % soybean meal), showing that the process of attenuation may significantly facilitate digestion thereof. When compared with attenuated pods with dolomite lime to the same level of incorporation, as reported by Carrero *et al*. (2013), is that the dry matter intake, digestibility of CP (41.3%) and NDF (39.6%) were lower than those achieved by soaking for 48 h at 65°C.

A healthy rabbit normally occurs: 35-76 $mg.dl^{-1}$ total cholesterol <10 $mg.dl^{-1}$ of LDL, <5 $mg.dl^{-1}$ of HDL, 124-156 $mg.dl^{-1}$ of triglycerides, 57-150 $mg.dl^{-1}$ of serum glucose and from 15.0 to 50.0 $mg.dl^{-1}$ of blood urea nitrogen as reported by Harkness and Wagner (1989), Zhang *et al*. (2009) Hsu and Culley (2006), and Carpenter (2013). On trial 2 (Table 4), using *A. macracantha* pods in the ration, the total cholesterol, HDL, triglycerides, glucose and urea were normal for rabbits. LDL values in plasma was slightly raised for both rations. Without changes in blood chemistry that could affect adversely the health and energy use of rabbits. The preliminary incorporation of 30% of attenuated pods in iso-proteic and iso-energetic rabbit ration seemed to allow greater daily gain and total weight (Table 5) than in the basal ration (It should have a greater number of test animals to definitively determine this statement), with similar values of final weight, carcass yield and carcass weight, although the efficiency of feed utilization was higher in rabbits fed the basal ration. A food intake 19.6% (individual daily, or 12.5% total accumulated intake) of greater than that of the basal ration together with a better digestion of the cell wall components could favor a greater release of energy in the caecum (Gidenne and Perez 2000, Debray *et al*. 2003) and with it a possibility of greater weight gain in rabbits than received 30% of *A. macracantha*. A lower transaminase activity and a lower amount of plasma urea in the rabbits consuming ration with 30% attenuated pods seems to indicate that there was less degradation of amino acids to obtain energy, which could favor a greater total gain of live weight.

Table 4. Effect of type of ration on feed intake, faecal digestibility and plasma fractions.

	Basal	300 gr.kg^{-1} attenuated pods	Probability
Dry matter intake (g.d^{-1})*	107	128	<0.001
Faecal apparent digestibility (g.kg^{-1})*			
Dry matter	589	548	<0.001
Organic matter	588	551	<0.001
Crude protein	764	669	<0.001
Neutral detergent fiber	352	400	<0.001
Acid detergent fiber	182	193	0.034
Hemicellulose	453	582	<0.001
Gross energy	603	564	<0.001
Digestible energy (MJ.kg^{-1})	11.7	11.0	<0.001
Glucose (mg.dl^{-1})**	115.8	123.6	0.273
Cholesterol (mg.dl^{-1})**	64.7	66.4	0.127
HDL (mg.dl^{-1})**	2.31	1.98	0.028
LDL (mg.dl^{-1})**	12.3	12,1	0.056
Triglycerides (mg.dl^{-1})**	115	128	0.321
Úrea (mg.dl^{-1})**	42.7	36.3	0.018
Transamsaminases (UI.l^{-1})**	23.9	18.6	0.003

* 12rabbit/treatment and 4 samples for rabbit (individual cages).
** 12rabbit/treatment and 3 samples for rabbit (individual cages).

Table 5. Preliminary effect on productive variables assessed using the rations offered to rabbits.

Variable	Basal ration	30% attenuated pods	Probability.
Initial weight (g)*	969.4±54.2	968.9±43.3	1.0000
Final weight (g)*	2015.0±65.2	2074.5±55.6	0.1450
Daily weight gain (g.d^{-1})**	31.96±1.5	35.7±1.5	0.0196
Total gain weight (g)**	1086.6±50.8	1213.8±51.0	0.0196
Total Intake (g)*	3358.1±110.2	3776.6±105.1	0.0001
Carcass weight (g)*	1293.7±46.2	1323.7±37.6	0.1157
Carcass yield (%)*	63.4±0.5	62.41±0.5	0.2083
Feed efficiency*	3.13±0.1	3.15±0.1	0.0000

* 12rabbit/treatment (individual cages).
** 12rabbit/treatment and 4 samples for rabbit (individual cages) determinate by simple linear regression.

In healthy rabbits to be used as a model to study liver health and circulating lipids in plasma, Dontas *et al*. (2011) determined that rabbits can have in plasma from 18.62 to 25.87 IU / l of ALT, and that these values may vary due to animal handling, environmental changes and sampling times. These values are very similar to those obtained in the present trial, indicating normal hepatic values both for those who consumed the basal ration and with attenuated *A. macracantha* pods.

Compared with the results of Salas-Araujo *et al*. (2008) using a similar level of pods not attenuated in similar environmental conditions and handling, the animals lost weight during the experiment (-0.098 g.d^{-1}), demonstrating that the attenuation process significantly improves feed utilization. Moreover, Hernández (2003) is using *Prosopis juliflora* pods are preserved in sugar cane molasses with a similar degree of incorporation in this experiment achieved a dry matter intake of 135 g.d^{-1}, weight gain of 9.83 g.d^{-1}, feed conversion and live weight of 12.8 kg of feed per kg of body weight. Both are native plant species in the semiarid, an important advantage in the incorporation of 30% of pods seen attenuated as to gain weight and feed utilization, presenting itself as an alternative to making feed for rabbits under the conditions where the experiments were performed.

An experiment conducted in similar conditions (management, place, and identical weather) but using rations with 30% attenuated leaves of *A. macracantha* in secondary compounds, found no effect on dry matter intake. However, dry matter digestibility was slightly higher than in our experiment (54.8 *vs* 46.9%; Espejo-Diaz and Nouel-Borges 2014).

Palma and Hurtado (2010) evaluated commercial balanced feed consumption in post-weaning rabbits, with 14.9% crude protein, 17% crude fiber and 7.9% ethereal extract, finding a dry matter intake of 118, 2 g.d^{-1}, a weight gain of 26.7 g.d^{-1} and a conversion of 4.47 kg.kg^{-1} LW. These values are slightly lower in consumption and weight gain, but much lower in conversion to the basal ration evaluated in this experience, possibly due to its lower protein content.

Sánchez *et al*. (2018) evaluated several types of commercial pelletized balanced feed in post-weaning rabbits (5 weeks of age and 770.1 g.rabbit^{-1}), with 19.5% crude protein and 16.5 Mj.kg^{-1} of raw energy in the best performing food, achieving 29.5 g.d^{-1} of weight gain, a food consumption of 93.6 g.d^{-1} and a conversion of 3.2 kg of DM of food per kg of live weight. When compared with the basal ration of this experiment, the energy level was lower and the protein slightly higher, allowing a similar consumption, a slightly lower weight gain and conversion; the baseline ration evaluated in this experiment being a good reference for commercial comparisons.

Akande (2015) evaluated rabbits of 5 to 7 weeks of age and 725 grams of live weight, received balanced rations with up to 30% inclusion of *Cajanus cajan* grains (legume of grain that grows in semi-dry environments) heat treated at 80°C by 3 to 5 minutes, the ration with 16.6% of crude protein and with 8.61% of raw fiber was consumed at a rate of 42 g.d^{-1} of dry matter, 12 grams per day of daily weight gain and achieved a conversion 3 kg DM of food per kg of live weight gain. When comparing this experience with that of attenuated *A. macracantha* pods, it is appreciated that the intake and weight gain achieved by them is a third of that achieved by this experiment, despite having similar feed conversions. Make it clear that neutralizing trypsin inhibitors or other high temperature compounds is not enough to improve animal performance that receives legumes as part of their diet.

Shaahu *et al*. (2014) evaluated boiled in water for 40 minutes *Lablab purpureus* seeds, incorporating them into rations for rabbits of 5 weeks age (354 g live weight) at a concentration of 23.43% of the total dry matter, with a content of 13.44% of crude protein and 11.89% of crude fiber, achieved 24.3 g.d^{-1} of dry matter intake, a gain of live weight of 7 g.day^{-1} and a conversion of 3.53 kg of DM per kg of live weight gain. The aforementioned experience, despite the lower incorporation of heat-treated seed, shows a worse performance in consumption, weight gain and food conversion. It can be seen that soaking and temperature exert an attenuating effect on the presence or action of secondary compounds better than boiling in water. This positive effect could be associated with possible leaching and more attenuation by interacting longer with the water at the best temperature evaluated.

The incorporation of 30% *of A. macracantha* pods attenuated into secondary compounds in rations for growing rabbit increases food consumption and the digestibility of cell wall components. This treatment has a lower apparent digestibility of dry matter, organic matter, crude protein and energy than that of the basal ration. Preliminarily, the 30% attenuation of attenuated pods could improve the daily weight gain in growing rabbits.

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