World
Rabbit
Science
Association

PROCEEDINGS OF THE 12th WORLD RABBIT CONGRESS

Nantes (France) - November 3-5, 2021

ISSN 2308-1910

This communication was accepted by the scientific committee of the Congress

**but was not presented during the Congress itself,
neither face-to-face nor remotely via Internet.**

NUTRITIVE CONTRIBUTION OF GROWING RABBITS CAECOTROPHY, SUPPLIED WITH DEGRASSED COCONUT FLOUR.

Acosta Acosta Y.[1*], La O Michel A L.[1], Valdivé Navarro M[2], Jay Herrera O[1], Betancourt Santos NN.[3], Villalón Moracen Y[1], Frómeta Tonzón D[1].

[1]Department Agronomy, Faculty Agroforestry, Guantánamo University, Aven Che Guevara Km 1½. PC 85100.Guantánamo. Cuba
[2]Department of monogastric animals, Institute of Animal Science, Mayabeque. Cuba.
3National State Inspection Office road Jamaica. Guantánamo. Cuba.
[*]Corresponding author: yanixi@cug.co.cu

ABSTRACT

The research was carried out with the purpose of evaluating the effect of the inclusion of increasing levels (0, 10, 20, 30 and 40%) of defatted coconut flour in the nutritional contribution of cecotrophagy to the nutrient balance of growing rabbits. 35 rabbits of the Chinchilla breed were used, distributed in a completely randomized design, with seven repetitions per treatment, the production of cecotrofo was controlled in 24 hours as well as the contents of MS, PB, FB, ashes and MO of the cecotrophs. The diets were supplied at a rate of 150 g.animal.día-1. Circular wooden necklaces were placed on rabbits to prevent the consumption of cecotrophs. Cecotrophic collection was performed every two hours uninterrupted for a 24-hour period. The first cecotrophs were collected at 9 am and the last at 7 am the next day. The composition of the diets influenced the total production of cecotrophs, with the lowest productions for the inclusions of 30 and 40% of coconut flour defatted in the same way in the curves of cecotrophic production for 24 hours. The contribution of MS and PB were high, with a tendency to decrease in the diet, which included 40% of defatted coconut flour in the diet.

Keywords: cecotrophagy, rabbits, defatted coconut flour

INTRODUCTION

There is a large amount of waste caused by agricultural activity that is currently a subject of study, in order to use them as alternative sources that generate profitability in rabbit feeding, these studies should be aimed at knowing their specific qualities for this species, including digestibility, palatability, nutritional content and the effects on intestinal functioning and enteric diseases (Valverde, 2010). There are few studies on the nutritional contribution of cecotrophs in animals fed with that of defatted coconut flour, due to food shortages worldwide and the competition of food for animals with human food, food strategies must be established for rabbits, based on the resources available in the tropics, with an adequate use of them to promote the sustainability of production systems (Nieves *et al*., 2011). The possibilities of using defatted coconut flour in rabbit feeding systems are based on the fact that it is a non-ruminant herbivorous animal with a functional and practicing cecotrophy, uses fibrous foods with relative efficiency and manages to adjust consumption in function of the energy concentration of the diet (Arruda, *et al.,* 2005), in addition the activity of the microorganisms of the blind have an important role in the nutrition and health of rabbits.

The objective of the present work was to evaluate the effect of the inclusion of defatted coconut flour on the chemical composition and the nutritional contribution of cecotrophs in the rabbit.

MATERIALS AND METHODS

Animals and experimental design

The research was carried out in the metabolism and bromatology laboratory of the Center for Agricultural Technology Studies (CETA), belonging to the Agroforestry Faculty of the University of Guantanamo, located at km 5½ of the Guantanamo-El Salvador highway. Cuba. 35 rabbits of the Chinchilla breed were used, distributed in a completely randomized design, with seven repetitions per treatment, which were: inclusions in the diet of 0, 10, 20, 30 and 40% of defatted coconut flour (Table 1), the variables Controlled were: production of cecotrofo in 24 hours, the contents of MS, PB, FB, ashes and MO of the cecotrophs and the contribution of MS and PB of the cecotrophs to the nutrient balance to the diet.

Table 1: Percentage composition of the ingredients in the evaluated diets

	Inclusive levels of Cuban coconut flour				
Ingredients	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**
Cornmeal	24,72	23,99	23,05	16,65	7,8
Alfalfa meal,	55,33	50,04	45,84	46,33	47,96
Soybean meal	12,87	10,11	6,85	2,85	0
Defatted coconut flour Cuban	0,00	10,00	20	30	40
Dicalcium phosphate	1,06	0,90	0,73	0,58	0,45
Common salt	0,30	0,30	0,30	0,30	0,30
Calcium carbonate	0,00	0,00	0,00	0,00	0,17
DL-Methionine	0,12	0,12	0,12	0,12	0,12
L-Lysine	0,00	0,04	0,11	0,17	0,20
Premix	2,00	2,00	2,00	2,00	2,00
Zeolite	1,50	1,00	1,00	1,00	1,00
Coconut oil	2,10	1,50	0	0	0

Five experimental diets were formulated in response to the treatments declared for the experiment. They were supplied at a rate of 150 g per animal in two schedules; 8:00 a.m. and 4:00 p.m., food scraps were collected and weighed in the morning, water was freely supplied in previously cleaned drinking fountains.
Circular wooden necklaces (25 cm in diameter) were constructed to prevent the consumption of cecotrophs, the necklaces were placed on the animals at 7:00 a.m. and removed at 8:00 a.m. the next day. Cecotrophs were collected every two hours for 24 hours. The first cecotrophs were collected at 9 am and the last at 7 am the next day.
At the end of the collection, the cecotrophs were weighed and frozen for later chemical analysis. For each treatment the caecotrophycurve was performed according to the weight of the dry matter of the cecotrophs.

Chemical Analyses

Samples of defatted coconut flour, diets and faeces were analyzed in the CETA bromatology laboratory, where% DM, PB, Ash, MO and FB were determined. In the cecotrophs the laboratory analyzes performed were MS, PB, Ashes and MO. The analyzes were performed according to the methodology suggested by the AOAC (2006).

Calculation methodology

To obtain the nutritional contribution values of the cecotrophs, the formula suggested by Carabaño (1989).

CN MS % = (A x 100) / (A + B)

CN PB % = (C x 100) / (C + D)

Where:

CN MS = Nutritional contribution of cecotrophs in MS%;

A = Excretion of cecotrophs (g MS / d);

B = Average food intake during the experimental period (g MS / d);

CN PB = Nutritional contribution of PB (%) of cecotrophs

C = Crude protein excreted in the cecotrophs (g / d);

D = Crude protein ingested in the food (g / d).

Statistical Analysis

Simple variance analyzes were performed and the comparison of means was performed through the Duncan test. For the analysis of the results of soft stool production (PHB), the curves were modeled using the Gompertz derivative model using nonlinear regression analysis adjusting the parameters by the Levenberg-Marcquardt method with the SPSS program 15.0. The coefficient of determination and significance of the adjustment and the parameters were taken into account as statistical criteria of goodness of fit of the model:

PHB (a, b, c, t) = abc exp (-ct) exp (-be-ct)

RESULTS AND DISCUSSION

The diets formulated in Table 2, showed adequate composition of PB and FB, nutrients with marked effects on the digestive physiology of the rabbit, the mean crude protein values were around 16%, which is in the range (15.4-16.2) proposed by De Blas and Mateos (2010), while the FB ranged between 13.97 and 14.69, with the lowest values for the diets that included 30 and 40% of defatted coconut flour in the diets that were slightly below those 14.5–15% required by rabbits suggested by De Blas and Mateos (2010).

Table 2: Chemical composition (%) of the diets with increasing levels of coconut flour defatted in the diets.

	Nutrients Levels of inclusion of defatted coconut flour				
Nutrients	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**
Dry matter	92.08	91.13	90.57	91.3	91.61
Crude protein	16.04	16.02	16.00	16.03	16.00
Crude fiber	14.68	14.43	14.69	14.09	13.97
Ashes	12.45	12.99	11.3	11.03	12.61
Organic matter	87.55	87.01	88.7	88.97	87.39

The total production of cecotrofo for 24 hours by rabbits fed with increasing levels of coconut flour defatted in the diets are presented in Figure 1, the results of the statistical analysis reflect that the production of cecotrofo at levels of 10 and 20% of Inclusion of defatted coconut flour showed no differences with the animals that consumed the referential diet. Which could be related to the consumption of DM, in this regard Gidenne and Lebas, (1987) pointed out that the consumption of food slightly increases the excretion of soft stools and subsequently stabilizes.
In this same order, Meredith and Prebble (2017) evaluated the impact of the production and consumption of cecotrophs using three diets in the feeding of growing rabbits with a nutritional composition similar to those used in this study and demonstrated that there is a positive linear relationship between consumption, weight and the amount of cecotrophs produced in 24 hours; These results coincide with those obtained, which in the same way the production of cecotrophs was higher in the animals that showed greater food consumption.
The average productions were around 25 g of DM / day, which confirms what was reported by Gidenne and Lebas (1987) and coincide with the values reported by Alves *et al.* (2014) who obtained average values of 26.17; 21.93 e 22.27g DM / day, evaluating the inclusion of sugarcane bagasse enriched with vinegar in diets for growing rabbits.

On the other hand, the caecotrophycan be influenced by various factors within which is the composition of the diets especially in regard to their fibrous fraction. In diets with a low percentage of fiber, caecotrophyis reduced due to low intestinal motility and longer cecal retention time (Ferreira *et al.*, 2008).
Because of the importance of cecotrophagy in rabbits, it is good to highlight that the reduction in cecotrophic consumption is not only related to the composition of diets, in particular several studies are reported that reflect that various factors are involved: gastrointestinal diseases (Mullan and Main, 2006; Meredith, 2012; RSPCA, 2013), perineal dermatitis and skeletal muscle-related diseases (Harcourt-Brown, 2014), obesity (Prebble *et al.*, 2015a), dental diseases (Meredith *et al.*, 2015) and behavioral changes (Prebble *et al.*, 2015b).

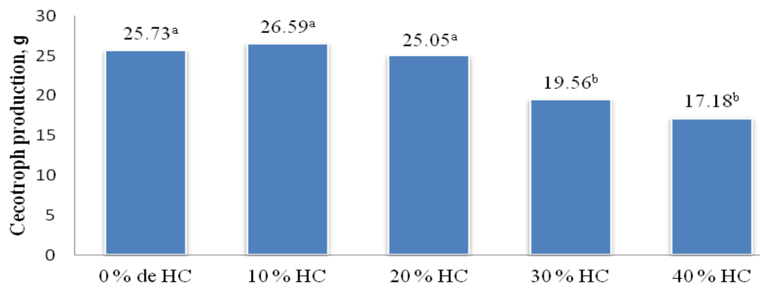
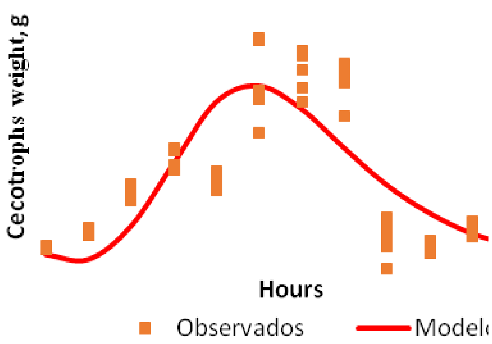


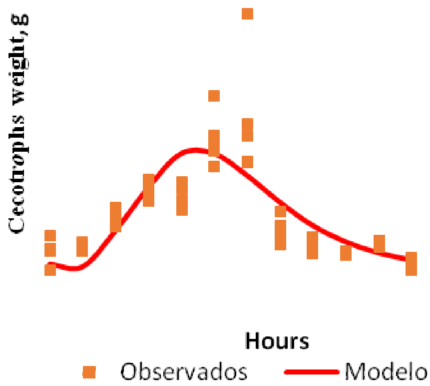
Figure 1: Total production of cecotrophs for 24 hours by rabbits fed with increasing levels of defatted coconut flour

The cecotrofo production patterns experienced by rabbits during the 24 hours evaluated are presented in figures 2A, 2B, 2C, 2D and 2E, it is perceived that the composition of the diets promotes variations in the cecotrofo production pattern, being more marked from the inclusion of 30% defatted coconut flour. These variations seem to be related to the fiber content of the 30 and 40% portions of coconut flour inclusion, which confirms that cecotrophagy can be influenced by the composition of the diets, especially with regard to the fibrous fraction. In this regard Ferreira et al. (2008) report that in diets with low fiber content, cecotrophagy is reduced, based on low intestinal motility and longer cecal retention time.

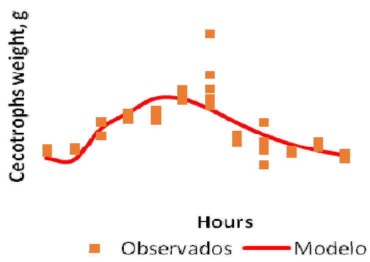
The figures illustrate for all treatments that the maximum production of cecotrophs occurs during the morning period, it is important to note that the animals maintained cecotrophic production during the 24 hours of evaluation, with peak production between 9:00 and 13:00 h in the treatments of 0, 10 and 20% inclusion of Cuban coconut flour, similar to that reported by Gidenne and Lapanouse (2004) and Alves et al. (2014) who reported production of cecotrophs between 8:00 am and 4:00 pm and from 6:00 am to 10:00 am respectively.
On the other hand, it was found that the groups that consumed 30%, the cecotrofo production peak reach it in two moments at 7:00 and 17:00 h and the 40% group obtained its peak between 19:00 and 9:00 p.m.
Similarly, Coelho (2010) found differences in the caecotrophycurves using tifton-85 hay enriched with vinegar for growing rabbits, and says that the inclusion of the vinegar that converts diets rich in soluble carbohydrates may have caused the modification of the productive cycle of cecotrophs. The cecotrofo production curves obtained with the use of Cuban coconut flour in the 24 hours evaluated is similar to that achieved by Alves *et al.* (2014) evaluating cane bagasse enriched with vinasse, who found a modification in the cecotrofo production curve with an advance in the production peak towards 2:00 to 4:00 h, although in general the maximum cecotrofo production occurred in the morning period more specifically between 6:00 and 10:00 a.m
García *et al.* (1995), meanwhile, obtained 20.46 g DM / d of average production of cecotrophs from experimental diets based on Leucaena hay. Similar results reported Herrera (2003) who presented an average of 20.98 g DM / d, and Coelho (2010) that found an average production of 22.82 g DM / d. The average production of cecotrophs observed in this trial when 30 and 40% of Cuban coconut flour was incorporated were similar to the reported values Gidenne and Lebas (1987) (20 g MS / d), probably due to low food consumption. The production of various soft stools with age, physiological status, diet and collection method (Fraga, 1998). According to this author, the values can vary from 15 to 30 g MS / d.



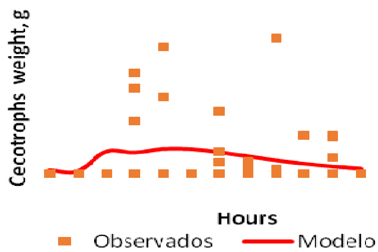
A: 0% inclusion of defatted coconut flour



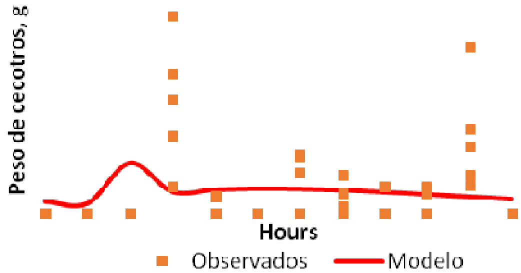
B: 10% inclusion of defatted coconut flour



C: 20% inclusion of defatted coconut flour



D: 30% inclusion of defatted coconut flour



E: 40% inclusion of defatted coconut flour

Figure 2: Cecotroph production patterns of rabbits fed with increasing levels of defatted coconut flour for 24 hours.

The chemical composition of the cecotrophs with the inclusion of increasing levels of defatted coconut flour is presented in Table 3, little variation was observed in the nutrient content of the cecotrophs showing influence only in their mineral composition. Similar trend was reported by Nogeria (2003) who did not observe the effect of different citrus pulp tenors in the diet on the composition of MS, PB and MO of the cecotrophs. The results confirm that cited by De Blas and Wiseman (1998) who state that the chemical composition of cecotrophs is relatively constant, although the material ingested varies in chemical composition.

Gomes and Ferreira (1999) evaluating the chemical composition of cecotrophs of rabbits fed different diets, found lower DM values for diets containing dry white corn straw (27.44%), coast cross hay (27.54%) Alfalfa (25.08%), Guandú Hay (26.69%) and Bean Straw (26.39%), Herrera (2003) found lower values for DM for alfalfa hay (24.55%) , as for hay from the upper third of the cassava branch (23.30%), however, Coelho (2010) found near DM value of cecotrophs for diets based on fortified tifton-85 hay (31.66%) and unenriched (31.46%) by vinasse results lower than those in this study. The MS values found by Arruda *et al.* (2003) resemble those of this work, where they evaluated diets with high and low starch content associated with different sources of fiber (alfalfa hay and soybean husk) obtained an average of MS 35.09%.

While the mean PB values of the cecotrophs in this study were high without differences between treatments and ranged between 30.1 and 32.20%, they are similar to those reported by Herrera (2003) in diets based on alfalfa hay (32.53%) and hay from the upper third of the cassava branch (29.34%). Coelho (2010), on the other hand, reports lower PB values of cecotrophs from diets based on tifton-85 hay enriched (23.76%) and unenriched (25.08%), and those of Gomes and Ferreira (1999) with diets containing dry white corn straw (25.30%), coast cross hay (25.34%), and close to treatments containing alfalfa hay (29.66%), guandú hay (26, 78%) and bean straw (28.40%).

On the other hand, the PB values found by Alves *et al*. (2014) using cane bagasse enriched with vinegar in growing rabbits were lower than those in this study (23.76 and 25.08%).

With respect to the content of mineral material represented by the cecotroph ash values, significant effects were observed among treatments with a tendency to de-growth in the highest% of inclusion of Cuban coconut flour in the diet with average valuesof 8.49 and 8.99% for the 30 and 40% inclusion of Cuban coconut flour, Alves *et al*. (2014), reported a similar behavior of the mineral content, finding that the inclusion of vinasse altered the amount of mineral material which was reduced when the cane bagasse was incorporated into the diet.

Table 3: Content of MS, PB, ashes and MO of rabbits cecotrophs fed with increasing levels of defatted coconut flour.

	Diets					
Indicators	**0 %**	**10 %**	**20 %**	**30 %**	**40 %**	**EE, Sig**
Dry matter	35.82	36.36	35.44	34.78	34.56	0.92
Crude protein	30.1	31.85	32.03	32.00	32.20	0.75
Organic matter	90.50	90.50	90.00	91.50	91.00	0.85
Ashes	9.50^{b}	9.50^{b}	10.00^{a}	8.49^{d}	8.99^{c}	0.35**

^{abcde} Different letters in the same row indicates significant differences, ** p≤0.001

The estimation of the contribution of MS and PB promoted by the possible ingestion of the cecotrophs is presented in Figure 3 , the average contribution values of MS varied between 13.23 and 18.62%, there was an effect of

Composition of diets in the contribution of DM decreasing with the inclusion of Cuban coconut flour from 30%.

The average values cited by the literature for the contribution of protein to the diet vary from 10 to 28%, Fraga (1998) points out that this value can be modified by diets, Gomes and Ferreira (1999) reported values for PB using straw of 28.55% beans similar to the average reached in this work, while the contribution values of the MS were 18.48%.

The contribution of the PB maintained a similar trend with average values between 21.7 and 29.8%, only that in this indicator no differences were found between the 40% inclusion of Cuban coconut flour with the reference diet and diets with 10 and 20% inclusion of Cuban coconut flour. Coelho (2010) did not find differences between the CNPB and CNMS values when evaluating semi-simplified diets based on tifton-85 hay enriched or not with vinegar, the average values of CNMS were 16.48% and the CNPB 18.66 In terms of treatments containing hay without enrichment, the CNMS and CNPB values were 15.53% and 17.68% respectively.

The practice of caecotrophyprovides important protein levels to the diet. The protein contained in the cecotrophs contributes 15 to 30% of the total ingested nitrogen reaching levels of approximately 28% of PB (Irlbeck 2001). A considerable fraction (70 to 80%) of this nitrogen is in the form of microbial protein, another (20%) as non-protein nitrogen and the nitrogen contained in the mucoid layer that surrounds them (8%) that probably comes from indigestible nitrogen of endogenous metabolism food and nitrogen. The reingested protein is characterized by high digestibility and a high content of essential amino acids.

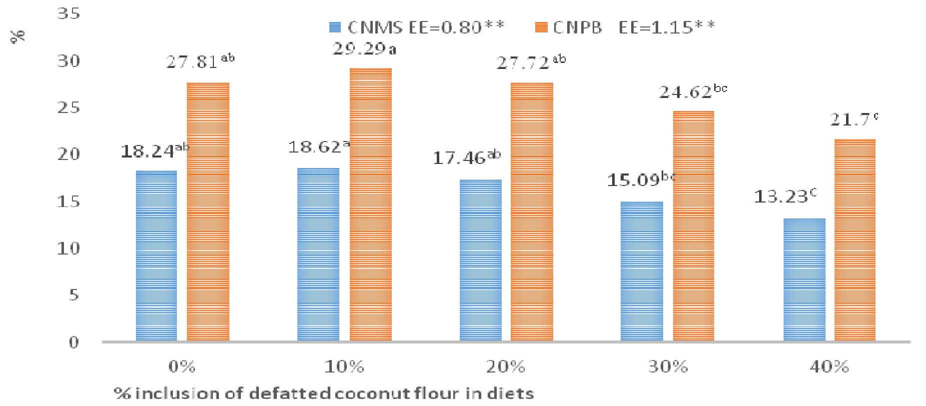


Figure 3. Contribution of MS and PB of the rabbit diet with increasing levels of defatted...

It has been shown that adult rabbits can maintain a positive nitrogen balance when fed with a poor quality protein; but if rabbits are prevented from practicing caecotrophyunder experimental conditions, the nitrogen balance with the same diet becomes negative (García *et al*., 2000).

CONCLUSIONS

1. Cecotroph production of rabbits that consume diets with 0, 10, and 20% Cuban coconut flour is high with values of 25.73; 26.59 and 25.05 g / animal in 24 h respectively and low for those who feed with 30 and 40% (19.56 and 17.18 g / animal in 24 h).

2. The cecotrophs produced by rabbits fed with Cuban coconut flour, show a high nutrient content with MS of 34.56 to 36.36%, PB between 30.1 and 32.03% and ashes between 8.49 and 9.50% making considerable contributions of MS, PB and other nutrients to the rabbit.

3. The lower digestibility coefficients of the PB found in the diets with 30 and 40% of Cuban coconut flour, are associated with the high concentration of lignin in those diets and the lower contribution of MS and PB made by their cecotrophs.

REFERENCES

Arruda A. M. V., López D. C., Ferreira W. M. *et al.* 2003. Desempenho e características de carcaça de coelhos alimentados com rações contendo diferentes níveis de amido e fontes de fibra. Revista Brasileira de Zootecnia, v. 32, n. 6, p.1311-1320.

Arruda A. M. V., Sales E., Yurika V., Clementino D. & Da Silva J. F. 2005. Digestibilidade de nutrientes em coelhos alimentados com rami (Bohemeria nivea) Nutrients digestibility in rabbits fed with rami (Bohemeria nivea) Ciências Agrárias, Londrina, v. 26, n. 4, p. 581-590.

Alves F. F.N. 2014. Avaliação nutricional do bagaço de cana-de açúcar enriquecido com vinhaça em dietas para coelhos em crescimento. Dissertação (Mestrado em Zootecnia)- Escola de Veterinária da Universidade Federal de Minas Gerais, Belo Horizonte

Coelho C. C. G. M .2010.Utilização digestiva de dietas semi-simplificadas com fenos enriquecidos com vinhaça para coelhos em crescimento. 66f. Dissertação (Mestrado em Zootecnia) – Escola de Veterinária , Universidade Federal de Minas Gerais, Belo Horizonte,MG.

De Blas C. & Mateos G. G. 2010. Feed formulation. De Blas C., WIiseman J. In: Nutrition of the rabbit. Cambridge: CAB International, p. 222-232.

Ferreira M., Melo R. S., Machado L. C., Ferreira W. M., Geraldo A., Sousa L. F., Mauricio R. M., Dutra R. M. 2008. Avaliação da energia digestível e degradabilidade cecal in vitro das frações obtidas no processamento da rama da mandioca para coelhos. In: i jornada científica e vi fipa do cefet, Bambuí. Anais...Bambuí.

Fraga M. J. 1998. de nutrientes. In: De Blas, C.; Wiseman, J. 1998. Journal of the Nutrition of the rabbit. Cambridge: University Press, p. 39 – 53.

García J., Carabano R., Pérz-Alaba L., De Blas J.C. 2000. Effect of fiber source on cecal fermentation and nitrogen recycled through caecotrophyin rabbits**.** Journal Animal Science**,** 78: 638-646.

García J., De Blas J.C., Carabano, R., García P. 1995. Effect of type of lucerne on caecal fermentation and nitrogen contribution through caecotrophy in rabbits. Reproduction Nutrition Developme**nt,** v.35, p.267–275,

Gidenne T., Lapanouse. 2004. A. Impact of caecotrophy on rate of passage, intake and faecal excretion pattern in the growing rabbit. World Rabbit Scien**ce**, v.12, n.2, p.81-94.

Gidenne T. Lebas F. (1987) Estimation quantitative de la caecotrophie chez le lapin en croissance: variations en fonction de l'âge. Annales de Zootechnie 36, pp 225–236.

Gomes A. V. C. & Ferreira W. M. 1999. Composição química e contribuição nutritiva de cecotrofos de diferentes dietas. Revista Brasileira de Zootecnia, v.28, n.6, p.1297-1301.

Herrera A. P. N. 2003. Eficiência produtiva e avaliação nutricional de dietas simplificadas a base de forragens para coelhos em crescimento. 104 f. Tese (Doutorado em ciencia animal) – Escola de Veterinária, Universidade Federal de Minas gerais, Belo Horizonte, MG.

Harcourt-Brown F., 2014 Digestive system disease. In : BSAVA Manual of Rabbit Medicine. Eds A. Meredith and B. Lord. BSAVA, Gloucester. pp 168-190

Irlbeck N.A. 2001. How to feed the rabbit (*Oryctolagus cuniculus*) gastrointestinal tract. Journal animal science 79:343-346.

Meredith A., 2012 Is obesity a problem in pet rabbits? Veterinary Record, 1718, 192–193

Meredith A. L., Prebble J. L.., and Shaw D. J., 2015 Impact of diet on incisor growth and attrition and the development of dental disease in pet rabbits. Journal of Small Animal Practice 566:37-82

Meredith A & Prebble, J. 2017. 'Impact of diet on faecal output and caecotroph consumption in rabbits'. Journal of Small Animal Practice, vol 58, no. 3, pp. 139-145. DOI: 10.1111/jsap.12620

Mullan S.M. and Main, D.C.J., 2006 Survey of the husbandry, health and welfare of 102 pet rabbits. Veterinary Record, 1594, 103–109.

Nieves D., Terán O., Cruz L., Mena M., Gutiérrez F., LY, J. 2011. Digestibilidad de nutrientes en follaje de árnica (*Tithonia diversifolia*) en conejos de engorde. Tropical and Subtropical Agroecosystems, v.14, n.1, p.309-314.

Nogueira R. A. 2003. Estratégias de avaliação nutricional da polpa cítrica seca em dietas para coelhos em crescimento. Tese apresentada à Universidade Federal de Lavras como parte das exigências do Programa de Pós-graduação em Zootecnia, área de concentração em Nutrição de Não Ruminantes, para a obtenção do título de "Doutor"

Official methods of analysis of AOAC International. AOAC. 2016. 20th ed., Rockville, MD: AOAC International, ISBN: 978-0-935584-87-5, Available: Available: http://www.directtextbook.com/ isbn/9780935584875 , [Consulted: September 22, 2016]. [Links]

Pérez P. M. A. Utilization de destintos tipos de fibra por los conejos en cebo. 1989. 115f. Tese (Doutorado em Engenharia Agronómica) – Universidade Politécnica de Madrid, Madrid.

Prebble J., Shaw D. and Meredith A., 2015a. Bodyweight and body condition score in rabbits on four different feeding regimes. Journal of Small Animal Practice. 563, 207-12.

Prebble *et al*., 2015b. The effect of four different feeding regimes on rabbit behaviour. Applied Animal Behaviour Science. 169, 86–92

RSPCA 2013. http://www.rspca.org.uk/adviceandwelfare/pets/rabbits [Accessed June 28, 2015].

Valverde D. M. 2010. Usos de la morera (*Morus alba L.*) en la alimentación del conejo: El rol de la fibra y la proteína en el Tracto digestivo. Agronomía Mesoamericana, Vol. 21 No. 2, p. 357-366.