Crimson Publishers
Wings to the Research

Mini Review

Effect of Different Stages of Biological DevelopmentGoats Fed Diets Detoxified Castor Cake on the Function Hepatic and Renal

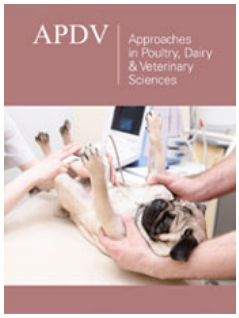
Ricardo Alves de Araújo[1]*, Roberto Cláudio Fernandes Franco Pompeu[2], Luiza de Nazaré Carneiro da Silva[3] and José Neuman Miranda Neiva[3]

[1]State University of Maranhão, Itapecuru Mirim, Maranhão, Brazil

[2]Brazilian Agricultural Research Corporation, Sobral, Ceará, Brazil

[3]Federal University of Tocantins, Araguaina, Tocantins, Brazil

ISSN: 2576-9162



***Corresponding author:** Ricardo Alves de Araújo, State University of Maranhão, Itapecuru Mirim, Maranhão, Brazil

Submission: January 05, 2021

Published: February 05, 2021

Volume 8 - Issue 2

How to cite this article: Ricardo Alves de Araújo, Roberto Cláudio Fernandes Franco Pompeu, Luiza de Nazaré Carneiro da Silva, José Neuman Miranda Neiva. Effect of Different Stages of Biological DevelopmentGoats Fed Diets Detoxified Castor Cake on the Function Hepatic and Renal. Appro Poult Dairy & Vet Sci 8(2). APDV. 000681. 2021.
DOI: 10.31031/APDV.2021.08.000681

Copyright@: Ricardo Alves de Araújo, This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use and redistribution provided that the original author and source are credited.

Abstract

We evaluated the influence of the substitution of soybean meal (SM) by detoxified castor cake (DCC) on the function hepatic and renal of goats fed with diets containing DCC by alkaline solutions in confinement regime during different stages of biological development (growth, pregnancy and lactation). The treatments consisted of three diets, a formulated with corn and soybean meal (SM) and the others were formulated with detoxified castor cake by calcium hydroxide (Ca(OH)2 DCC) and another composed by detoxified castor by DCC of sodium hydroxide (NaOH). In relation to renal and hepatic parameters showed that there was interaction between the diets and biological stages on the levels of total proteins, direct bilirubin, albumin, alanine aminotransferase, aspartate aminotransferase, gamma glutamyl transferase. In a general way, the goats fed with both castor cake, regardless of the stage evaluated had higher levels. The detoxified castor cake by alkaline solutions in replacement of soybean meal proved to be a viable alternative in the feeding of goats in the three-stage biological, because it does not affect the functionality of the liver and kidney function.

Keywords: Growth;Nitrogen;Pregnancy;Lactation

Introduction

Among the biological stages of ruminants there is a great variation in each phase, marked mainly by the variation of the intake of dry matter and nutrients [1]. In each stage occurs an intense cascade of hormonal variations which influence directly the consumption of foods for these animals. Another factor, in addition to the hormonal action is the activation of receptors of tension due to the ruminal compression exerted by the increase in size of the organs. In dairy goats, for example, in order for the lactation phase to be efficiently productive, there is a need for physiologically well-developed goats. Therefore, the rearing phase is of paramount importance, since the formation of healthy, well-nourished and physiologically developed matrices will later reflect healthy pregnancies and lactations. Based on this, the use of these by-products can make this phase more efficient and reflect on the others, as the rearing determines the productive potential of the future dairy goat. The recent increase in the inclusion of biodiesel in the world energy matrix has led to the production of ruminant feeds from by-products or cakes obtained after extraction of oil from oilseeds, which constitute the main by-products of the biodiesel production chain. Thus, a possibility of integrating the agroenergy and agricultural chains, and generating employment and income has emerged, in addition to possibly minimizing the environmental problems caused by these residues. Thus, considering the possibility of using by-products from the biodiesel chain in diets for ruminants, giving these by-products an efficient destination and incorporating them into the dairy goat production chain, the objective was to evaluate the influence of detoxified castor cake by alkaline solutions on renal and hepatic metabolic profile of Saanen and Anglo Nubian goats during different biological stages (growth, pregnancy and lactation).

Material and Methods

Experimental area and trial period

The study was conducted at the Technological Center of production of goat milk from Embrapa Goats and Sheep (3º44'57.42" south and 40°20'43.50" West) located in the city of Sobral-CE, Brazil, in the period from June 2015 to May 2017. All procedures involving animals were carried out in accordance with the regulations of the Commission of Ethics in the use of animals in the Empresa Brasileira de Pesquisa Agropecuária, Centro Nacional de Pesquisa with goats, protocol no. 005/2015.

Animals, experimental design and diets

Eighteen goats were evaluated in each stage, being 9 Saanen and 9 Anglo Nubian. The same goats were evaluated in each stage biological. In the growth phase (270 days), they had the following characteristics: goats with 43±2.97 kg body weight and body condition scores of 2.5±0.5 were used. In pregnancy (160 days): goats with body weight of 42.08±5.33kg of body condition score of 3.6±0.3 according to the classification of [2]. All tests were performed on two occasions, the first when the goats were with 30 to 100 days of gestation (first and second third) and the second from 110 to 140 days of pregnancy, representing the final third of pregnancy and performed the averages to represent this stage. In lactation (150 days): goats with 43±2.97kg body weight and body condition scores of 2.5±0.5. In this way, the experiment had a duration of 580 days without interruption.

The goats were placed in individual stalls, suspended and with floor ripped of 5.06m^2, being 2.87m^2 solarium area composed of beaten floor, provided with drinkers, feeders and saltshakers. The measurement of live weight was performed fortnightly in proper balance. The animals were weighed always at the same time and in fasting. The treatments consisted of three diets, a formulated with corn and soybean meal (SM) and the others were formulated with detoxified castor cake by calcium hydroxide ($Ca(OH)_2$ DCC) and another composed by detoxified castor by DCC of sodium hydroxide (NaOH), having the same levels of protein and energy and was used as roughage hay tifton-85.

Detoxification and ricin measurement

Castor cakes used in this study were obtained after collecting oil, by mechanically pressing castor bean seeds at temperatures between 90 and 100 °C. After mixing the cakes with reagents and water for 3 hours (mixing for 10 min and resting for 30 min, alternately), the cakes were placed outdoors on a plastic canvas for 48 hours and constantly rolled with a squeegee adapted for homogeneous drying. After drying, the cakes were chopped using a forage machine to reduce the material size and to facilitate its homogenization with the other ingredients.

The concentrations of alkaline products (calcium hydroxide and sodium hydroxide) used for 100% detoxification of ricin in crude castor cakes were 90g $Ca(OH)_2$ and 60g NaOH per kilogram, respectively, which were diluted in 2L of water using a stationary mixer (Fischer® MOB 400G2) equipped with a three-phase motor. No hemagglutinating activity was observed at those concentrations, i.e., ricinus agglutinin was no longer active (Figure 1), therefore, these two concentrations were used to formulate the diets.

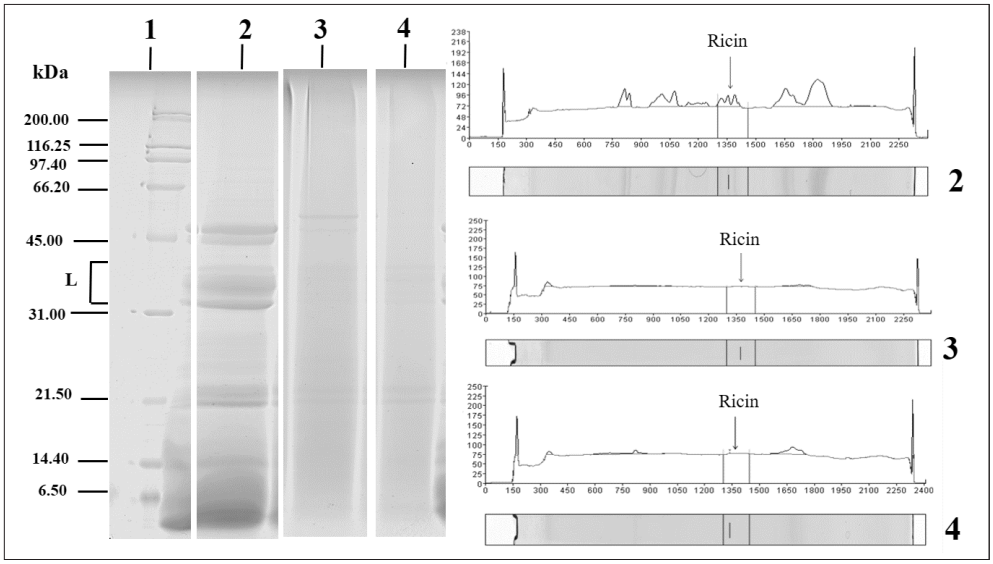


Figure 1: Electrophoretic characterization of castor cake proteins treated with different chemical products. 1: Molecular weight marker (kDa); L: Lectins;

2: Crude castor cake;

3: Detoxified castor cake $Ca(OH)_2$;

4: Detoxified castor cake NaOH.

Copyright © : Ricardo Alves de Araújo

Data management and collection

Blood samples were collected using 9.0mL vacutainer tubes (Grainer Bio-One, Vacuette® Americana, SP, BRA), by puncturing the jugular vein, five days before the end of the rearing phase, and 4h after the morning feed. Two blood samples were collected from each animal; one in a tube containing an anticoagulant (EDTA) and another in a tube without the anticoagulant. The tubes with the anticoagulant were used for analyzing urea and total protein concentration, while samples without the anticoagulant were used for analyzing creatinine, total and direct bilirubin, albumin, alkaline phosphatase, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and gamma-glutamyltransferase (GGT) levels. To determine urea and total protein concentration, serum was obtained by centrifuging the tubes at 3,293×*g* for 15 min, identified and stored in Eppendorf® mini-tubes, and frozen for analysis. Blood parameters and urine creatinine were analyzed with commercial Labtest® kits using colorimetric procedures.

Statistical analysis

Data were initially subjected to normality tests (Shapiro–Wilk) and homoscedasticity tests (Levene), and were also submitted to analysis of variance by the F test when the presuppositions were met, by using the following model:

$$Y_{ijk} = \mu + \propto_i + \beta_j + (\propto\beta)_{ij} + e_{ijk},$$

where Y_{ijk} is the dependent variable corresponding to the experimental observation; μ is the overall mean; αi is the fixed effect of the diets; β_j is the fixed effect different stages biological; $(\alpha\beta)_{ij}$ is the interaction effect; and e_{ijk} is the random error, assuming an independent normal distribution. Interaction between diet and at different stages biological was only considered when significant at 5% probability. A comparison of means was carried out by Tukey test at 5% probability to evaluate the effects of breed, diet and different stages biological. Statistical analyses were performed using the GLM procedure of the SAS software version 9.3 [3].

Result

In relation to renal and hepatic parameters (Table 1) showed that there was interaction between the diets and biological stages on the levels of total proteins, direct bilirubin, albumin, alanine aminotransferase, aspartate aminotransferase, gamma glutamyl transferase.

Table 1: Total proteins (TP), direct bilirubin (DB), albumin (ALB), urea (URE), alkaline phosphatase (AP), alanine amino-transferase (ALT), aspartate aminotransferase (AST) and gamma-glutamyltransferase (GGT) of goats fed with detoxified castor cake during the biological stage.

Stages Biological	Diets			Mean	MSE	P-Value		
	SM	$Ca(OH)_2$ DCC	NaOH DCC			D	S	D X S
	TP (g dL^{-1})							
Growth	5.50Bb	6.27Aa	6.95Ba	6.24				
Pregnancy	5.42Bb	6.49Aab	6.72Ba	6.21	1.25	*	*	*
Lactation	8.93Ab	10.84Aa	10.50Aa	10.09				
Mean	6.62	7.87	8.06					
	DB (mg dL^{-1})							
Growth	0.14Ba	0.08Bb	0.10Bb	0.11				
Pregnancy	0.91Aa	1.02Aa	0.92Aa	0.95	0.09	*	*	*
Lactation	1.18Aa	1.29Aa	1.22Aa	1.23				
Mean	0.74	0.8	0.75					
	ALB (g dL^{-1})							
Growth	2.05Ba	1.97Ba	2.21Ba	2.08				
Pregnancy	2.14Bb	2.32Bab	2.44Ba	2.3	0.12	*	*	*
Lactation	4.34Ab	5.42Aa	5.00Aa	4.92				
Mean	2.84	3.24	3.22					
	URE (mg dL^{-1})							
Growth	21.67Ca	19.52Cab	17.06Cb	19.42				
Pregnancy	31.16Ba	28.81Bab	27.70Bb	29.22	3.65	*	*	*
Lactation	40.67Aa	39.29Aab	36.60Ab	38.85				
Mean	31.17	29.21	27.12					
	AP (UI L^{-1})							

Copyright © : Ricardo Alves de Araújo

Growth	4.65	5.33	4.74	4.91C				
Pregnancy	6.71	6.26	6.62	6.53B	1.23	0.236	*	0.154
Lactation	11.18	10.61	11.15	10.98A				
Mean	7.51	7.4	7.5					
	ALT (UI L^{-1})							
Growth	19.75Ba	13.62Bb	11.57Bb	14.98				
Pregnancy	15.49Ba	11.71Bb	11.79Bb	13	2.43	*	*	*
Lactation	102.63Aa	76.22Ac	92.55Ab	90.47				
Mean	45.96	33.85	38.64					
	AST (UI L^{-1})							
Growth	112.09Aa	67.66Bb	67.03Bb	82.26				
Pregnancy	96.98Ba	71.59Ac	87.06Ab	85.21	8.76	*	*	*
Lactation	19.18Ca	15.06Bb	15.06Cb	16.43				
Mean	76.08	51.44	56.38					
	GGT (UI L^{-1})							
Growth	70.71Aa	62.65Bab	55.57Bb	62.98				
Pregnancy	55.79Bb	65.78Ba	57.13Bb	59.57	11.54	*	*	*
Lactation	64.19Bb	77.73Aa	64.40Ab	68.77				
Mean	63.56	68.72	59.03					

MSE: Mean standard error. Averages followed by common lowercase letters in the lines and by uppercase letters in the columns do not differ from one another according to the Tukey test at 5% significance.

In a general way, the goats fed with both castor cake, regardless of the stage evaluated had higher levels of total proteins in the bloodstream (7.87g dL^{-1} and 8.06g dL^{-1} to $Ca(OH)_2$ DCC and NaOH DCC, respectively). In relation to the content of direct bilirubin can be observed higher levels during gestation and lactation (0.95 and 1.23mg dL^{-1}, respectively). The blood urea was higher during the stage of lactation (38.85mg dL^{-1}), being twice the growth stage (19.42mg dL^{-1}) as well as the alkaline phosphatase, which was 10.98UI L^{-1} during lactation of goats. In relation to ALT, AST and GGT, one can observe a wide variation, both in terms of diets, much of the biological stage. The ALT was greater for the goats fed with the diet during the three stages, being that during lactation did not differ from goats fed with diet based $Ca(OH)_2$ DCC. On the other hand, AST was lower during lactation of goats, already the GGT was higher during the shew of lactation for the goats fed with both diets the basis of DCC.

Discussion

The average levels of enzymes for hepatic and renal functions are within the standards for species, according to [4] on the three biological stages evaluated [5] found similar values to this work, to evaluate the response of the liver-kidney in Saanen goats fed with castor bean meal. The reduction of AST during lactation is common, because [6], says that all the enzymes related to liver function are generally reduced during the lactation period, due to the expansion of the extracellular fluid. Despite this, the values were within the reference range for the species [7], thus discarding a possible deficit in protein metabolism in three stages of development, which is not common due during pregnancy, because the greater metabolic demand during pregnancy [8] could decrease the concentration of some enzymes in blood, but the quantity of nontoxic metabolites decreased biological at this stage.

In relation to the higher concentration of urea in goats fed with SM and $Ca(OH)_2$ DCC may be related the highest levels to lower filtration of nitrogen after detoxification of ammonia in the liver, considering that the goats fed with SM and $Ca(OH)_2$ DCC had a higher consumption of protein [9]. In relation to the effect of the biological stages on the urea, [10] asserts that it is common for the decrease of the concentration of urea during growth, because this reduction is not only a result of increased glomerular filtration, but also due to a reduction in the hepatic synthesis. With the increase of progesterone and estrogen concentrations, the activity of the enzymes decreases the urea cycle [11].

Conclusion

The detoxified castor cake by alkaline solutions in replacement of soybean meal proved to be a viable alternative in the feeding of goats during the three-stage biological, because it does not affect the functionality of the liver and kidney function.

References

1. Forbes JM (2007) Voluntary food intake diet selection in farm animals. (2nd edn), CAB International, Cambridge, United Kingdom, p. 453.

Copyright © : Ricardo Alves de Araújo

2. Morand Fehr P (2005) Recent developments in goat nutrition and application: A review. Small Rum Research 60(1-2): 25-43.

3. SAS Institute (2005) SAS system for Windows: versão 9.4. SAS Institute, Cary.

4. Smith MC, Sherman DM (2009) Goat medicine. (2nd edn), Lea and Febiger, Philadelphia, Pennsylvania, USA, p. 871.

5. Menezes DR, Costa RG, Araújo GGL, Pereira LGR, Oliveira PTL, et al. (2012) Blood, liver and rumen parameters of sheep fed diets containing detoxified castor bean meal. Pesquisa Agropecuária Bras 47(1): 103-110.

6. Huy A (2005) Biochemical tests in pregnancy. Australian Prescriber 28: 98-101.

7. Contreras P, Wittwer F, Böhmwald H (2000) Indicadores sanguíneos do metabolismo mineral em ruminantes. In: Perfil metabólico em ruminantes: seu uso em nutrição e doenças nutricionais. Porto Alegre, Gráfica da Universidade Federal do Rio Grande do Sul, Brasil, pp. 75-88.

8. Radin L, Šimpraga M, Vince S, Kortelíc A, Milinkovic Tur S (2015) Metabolic and oxidative status of Saanen goats of different parity during the peripartum period. Journal of Dairy Research 82(4): 426-433.

9. Araújo RA, Neiva JNM, Pompeu RCFF, Cândido MJD, Rogério MCP (2020) Detoxified castor in the diets of dairy goats: I. Effects on intake, digestibility, renal and hepatic parameters, and milk yield. Revista Bras de Zootec 49: 1-10.

10. Kalhan SC (2000) Protein metabolism in pregnancy. American Journal of Clinical Nutrition 71(5 Suppl): 1249-1255S.

11. Ismail ZA, Al Majali AM, Amireh F, Al Rawashde OF (2008) Metabolic profiles in goat does in late pregnancy with and without subclinical pregnancy toxemia. Veterinary Clinic and Pathology 37(4): 434-437.

For possible submissions Click below:

Submit Article

Copyright © : Ricardo Alves de Araújo