SP 6971
2015
SP-PP-SP 6971

52ª Reunião Anual da Sociedade Brasileira de Zootecnia

Zootecnia: Otimizando Recursos e Potencialidades

Belo Horizonte - MG, 19 a 23 de Julho de 2015

Chemical Composition and Fatty Acid Profile of the *Longissimus dorsi* of Goats Fed Bakery Waste

Danilo Antonio Morenz[1], Carlos Elysio Moreira da Fonseca[2], Aline Barros da Silva[3], Mirton José Frota Morenz[4]

[1]Doutorando do Programa de Pós-Graduação em Zootecnia – UFRRJ, Bolsista CAPES. e-mail: danilo.morenz@gmail.com
[2]Professor Adjunto. Instituto de Zootecnia – UFRRJ
[3]Mestranda do Programa de Pós-Graduação em Zootecnia – UFRRJ, Bolsista CAPES
[4]Pesquisador Embrapa Gado de Leite, Juiz de Fora – MG

Abstract: This work was conducted to evaluate the effect of replacing corn by bakery waste in goats diet on chemical composition and profile of fatty acids in *Longissimus dorsi* muscle. We analysed four levels of inclusion of bakery waste replacing corn (0, 33, 66, 100%) on dry matter basis, and used 16 goats arranged in a completely randomized design. The diets were composed of concentrate and Tifton 85 hay (*Cynodon dactylon*) with forage: concentrate ratio of 40:60. The animals were slaughtered with an average weight of 26.9 kg. There was no difference in the chemical composition of *Longissimus dorsi* muscle between groups of animals fed diets with increasing levels of bakery waste replacing corn, characterized by mean 74.21% moisture, 22.82% protein, 2.05% of total lipids and 1.07% ash. The elaidic acid content (C 18: 1 trans-9) increased with the addition of bakery waste.

Keywords: byproduct, corn, thin meat

Composição Química e Perfil dos Ácidos Graxos do Músculo *longissimus dorsi* de Caprinos Alimentados com Resíduo de Panificação

Resumo: Objetivou-se avaliar o efeito da substituição do milho pelo resíduo de panificação na dieta de cabritos sobre a composição química e o perfil dos ácidos graxos do músculo *Longissimus dorsi*. Foram analisados quatro níveis de inclusão do resíduo de panificação em substituição ao milho (0, 33, 66, 100%) na base da matéria seca, e utilizados 16 cabritos dispostos em delineamento inteiramente casualizado. As dietas foram compostas de concentrado e feno de Capim-Tifton 85 (*Cynodon dactylon*), com relação volumoso:concentrado de 40:60. Os animais foram abatidos com peso médio de 26,9 kg. Não houve diferença para a composição química do músculo *Longissimus dorsi* entre os grupos de animais alimentados com dietas contendo níveis crescentes de resíduo de panificação em substituição ao milho, caracterizada pelas médias de 74,21% de umidade, 22,82% de proteína, 2,05% de lipídios totais e 1,07% de cinzas. O teor de ácido elaídico (C 18:1 trans-9) aumentou com a inclusão do resíduo de panificação.

Palavras–chave: carne magra, milho, subproduto

Introduction

The elevation and the concentrates price fluctuations such as corn and soybeans, stimulate the use of alternative foods such as bakery waste which has important nutritional qualities, being characterized as concentrated energy food. It can be a good alternative for obtaining good quality carcasses. The bakery waste (BW) may be composed of leftover cakes, breads debris, sweet and biscuits, not marketed products or overdue, losses breaks, deformed products or who have suffered excess or lack of cooking during processing. Considerable quantities of such waste are available for use in animal feed. In this context, it is important to evaluate the effect of using this residue in the diet on goat meat characteristics. Thus, the objective was to evaluate the effect of replacing corn by bakery waste on the chemical composition and fatty acid profile of the *Longissimus dorsi* muscle of goat kids.

Material e Methods

The experiment was conducted at the Technical College of the Federal Rural University of Rio de Janeiro (CTUR) in Seropédica - RJ, from January 20 to March 14, 2010. We evaluated four levels of bakery waste (BW) replacing corn: 0; 33; 66 and 100% (DM basis), using 16 male goats with a mean weight of 17.0 kg in a completely randomized experimental design. The animals were kept in individual stalls with food and water. The experimental diets were composed of Tifton 85 hay (*Cynodon dactylon*) and concentrate (corn meal, soybean meal and bakery waste) (Table 1) in the ratio of 40:60 based on dry matter (DM), and provided twice daily (7:00 and 17:00). The diets were prepared weekly and concentrated formulated to be isonitrogenous (Table 2) and the BW added to the concentrate at the time of delivery due to the ease of fermentation. The experimental period lasted 77 days, with a

SP 6971

week of animals to adapt to experimental conditions. The animals were weighed weekly until the average weight of 27.7 kilograms when they were submitted to solid fasting for 18 hours and slaughtered with an average weight of 26.9 kg. The sections between the 9th and 11th ribs were packed in polyethylene bags and stored at -18°C until analysis begins. Then it were ground in a food processor and properly homogenized in porcelain mortar. The moisture analysis, ash, protein were performed in duplicate using the *Longissimus dorsi* in nature. The total lipid extraction was performed using the cold technique with petroleum ether solution, after passing through the acid hydrolysis treatment due to the high protein content that hinders the extraction. The profile of fatty acids was determined by gas chromatography using a INTECROM G 8000 chromatograph, FID detector (280°C) and manual injection, with gun at 250°C. The lipids were esterified (and not extracted because there is no such step, the esterification was direct) according to the technique used in the Food and Beverage Analysis Laboratory (LAAB) Institute of Technology of the Federal Rural University of Rio de Janeiro, The technique proposed by Huang et al. (2006). The variance and regression analyzes were performed using the program SAEG (UFV, 2005).

Table 1 - Chemical composition of feeds used in experimental diets (DM basis)

Feed	DM	OM	CP	NDF	EE	MM	TC	NFC
Tifton-85 hay	85.00	93.94	3.24	79.02	1.15	5.71	89.55	10.53
Bakery waste	74.00	97.06	11.46	1.48	3.26	2.33	82.34	80.86
Corn meal	96.06	98.60	9.94	14.71	4.87	1.32	83.80	69.10
Soybean meal	96.42	93.45	54.54	11.30	2.46	6.17	36.45	25.15

DM = dry matter; OM = organic matter; CP = crude protein; NDF = neutral detergent fiber; EE = ether extract; MM = mineral matter; TC = total carbohydrate; NFC = non-fibrous carbohydrate.

Table 2 - Feed and chemical composition of experimental diets (DM basis)

Feed	Replacement levels[1] (%)			
	0%	33%	66%	100%
Corn meal	71.8	48.6	25.0	0.0
Bakery waste	0.0	24.0	48.5	74.4
Soybean meal	28.2	27.4	26.5	25.6
Chemical composition (%)				
Dry matter	91.27	88.20	85.08	81.80
Organic matter [1]	95.45	95.67	95.47	95.27
Crude protein [1]	14.80	14.79	14.79	14.78
Neutral detergent fiber [1]	39.85	37.89	35.90	33.80
Ether extract [1]	2.97	2.75	2.53	2.30
Total carbohydrate [1]	78.33	78.45	78.52	78.66
Non-fibrous carbohydrate [1]	38.48	40.56	42.62	44.86

[1] % of dry matter.

Results and Discussion

The chemical composition of *Longissimus dorsi* muscle was not influenced (P> 0.05) by replacing corn with residue bakery, and averaged 74.2% for moisture, 22.8% for protein, 2.1% for lipids and to 1.1% total ash (Table 3). The values of moisture, protein and ash vary from 74.04 to 74.33%, from 22.50 to 23.16% and from 1.03 to 1.10%. The lipid content in the flesh is related to the dietary energy levels, so higher energy levels increase meat lipid levels. The distribution of the fat in goat is different from other ruminant species such as sheep, for example. Subcutaneous fat in goat is thin, the fat is deposited mostly in the abdominal cavity, and approximately 60% of total fat are located between the abdomen and the guts. The ether extract content ranged from 1.87 to 2.24%, which shows that the goat meat has little fat marbling. When comparing the goat meat with other species, we note that goat meat is more lean. The concentration of saturated fatty acids C14:0, C16:0, C17:0 and C18:0 were not influenced (P> 0.05) by replacing corn with BW in the diet. The content of fatty acids in goat meat followed the same proportional order reported by Madruga et al. (2013), that the oleic acid (C18:1) is the main, followed in descending order by palmitic acid (C16:0), stearic (C18:0) and linoleic (C18:2). Thus, the oleic acid (C18: 1) and isomer were unsaturated fatty acids which contributed most to the profile of fatty acids, which is admittedly appointed as cholesterol-lowering and low-density lipoprotein (LDL) (Arruda et al., 2012). The goat meat had high content of monounsaturated fatty acids (MUFA) (44.56%), followed by saturated (SFA) (40.06%) and polyunsaturated (PUFA) (3.18%), which did not differ (P > 0.05) between the meat of animals undergoing to the treatments. A higher concentration of long chain saturated fatty acids increase the serum cholesterol levels, whereas the concentrations of monounsaturated and polyunsaturated fatty acids have the opposite effect on serum cholesterol. AGI / SFA ratio is indicative of the quality of the lipid fraction, i.e., the higher the AGI index / AGS indicate better quality of the lipid fraction. Thus, relations PUFA / SFA and UFA / SFA are indicators for the quality of meat (Wood et al., 2003). The values from 1.32 to 1.57 found for the relationship AGI / SFA were similar to those reported in the literature for goat meat. However, the values from 0.06 to 0.11 (PUFA / SFA) were lower than a minimum threshold of 0.40 recommended by the Department of Healt - UK (Wood et al., 2003). It was found increased elaidic acid content of C18:1 trans-9 increased as the BW replaced corn. Mushi et al. (2010) had lower values of elaidic acid in the *Longissimus dorsi* muscle east African goats.

Table 3 - Centesimal composition and profile of the *Longissimus dorsi* muscle of kids fed increasing levels of bakery waste (RP) replacing corn the diet.

Items	Replacement levels (%)				CV(%)	Rgression equation
	0	33	66	100		
Moisture (%)	74.1	74.3	74.0	74.3	1.0	Ŷ=74.2
Crude Protein (%)	22.9	22.5	23.2	22.8	2.3	Ŷ=22.8
Ether extract (%)	2.2	2.2	1.9	1.9	14.0	Ŷ=2.1
Ash (%)	1.0	1.1	1.1	1.1	3.7	Ŷ=1.1
Fatty acids (%)						
C14:0 (miristic)	2.22	1.23	1.62	1.20	38.20	Ŷ=1.56
C16:0 (palmitic)	22.20	17.51	20.02	20.74	11.69	Ŷ=20.12
C16:1 (palmitoleic)	2.05	1.49	1.89	2.11	23.09	Ŷ=1.88
C17:0 (margaric)	0.70	0.52	0.73	0.29	123.34	Ŷ=0.55
C17:1 (heptadecenoic)	0.38	0.52	0.83	0.30	138.12	Ŷ=0.49
C18:0 (estearic)	15.87	14.46	14.09	15.15	11.54	Ŷ=14.95
C18:1n9t (elaidic)	1.71	1.54	1.70	3.60	32.74	Ŷ=1.2586-0.0176X
C18:1n9c (oleic)	46.50	41.08	41.91	39.22	12.31	Ŷ=42.18
C18:2n6c (linoleic)	5.21	7.69	7.73	7.75	32.95	Ŷ=7.03
C20:2 (eicosadienoic)	0	0.56	0.41	0.27	176.33	Ŷ=0.30
C23:0 (tricosanoic)	2.61	1.65	2.96	4.30	83.83	Ŷ=2.87
SFA	43.60	35.38	39.42	41.68	12.27	Ŷ=40.06
MFA	48.89	43.10	44.64	41.63	13.37	Ŷ=44.57
MUFA	2.61	2.21	3.38	4.57	75.32	Ŷ=3.18
PUFA/SFA	0.06	0.06	0.08	0.11	72.94	Ŷ=0.08
UFA/AGS	1.35	1.57	1.46	1.32	10.88	Ŷ=1.42

SFA = saturated fatty acid, MUFA = monounsaturated fatty acid, PUFA = polyunsaturated fatty acid, UFA = unsaturated fatty acid.

Conclusions

The bakery waste can replace corn in diets for goats without compromising the quality of the meat.

References

Arruda, P. C. L.; Pereira, E. S.; Pimentel, P. G.; Bomfim, M. A. D.; Mizubuti, I. Y.; Ribeiro, E. L. A.; Fontenele, R. M.; Filho, J. G. L. 2012. Perfil de ácidos graxos no *Longissimus dorsi* de cordeiros Santa Inês alimentados com diferentes níveis energéticos. Ciencias Agrárias 33:1229-1240.

Huang, Z.; Wang, B.; Crenshaw, A. A. 2006. A simple method for the analysis of trans fatty acid with GC–MS and ATe-Silar-90 capillary column. Food Chemistry 98:593-598.

Madruga, M. S.; Dantas, I.; Queiroz, A.; Brasil, L.; Ishihara, Y. 2013. Volatiles and water- and fat-soluble precursors of Saanen goat and cross Suffolk lamb flavor. Molecules 18:2150-2165.

Mushi, D. E.; Thomassen, M. S.; Kifaro, G. C.; Eik, L. O. 2010. Fatty acid composition of minced meat, longissimus muscle and omental fat from Small East African goats finished on different levels of concentrate supplementation. Meat Science 86:337-342.

UFV. SAEG: sistema para análises estatísticas. Versão 9.0. Viçosa, 2005. 1 CD-ROM.

Wood, J. D.; Richardson, R. I.; Nute, G. R.; Fisher, A. V.; Campo, M. M.; Kasapidou, E.; Sheard, P. R.; Enser, M. 2003. Effects of fatty acids on meat quality; a review. Meat Science 66:21-32.