EFFECT OF SEX CONDITION AND TIME ON FEED ON THE MEAT FATTY ACID PROFILE OF CROSSBREED HAIR LAMBS

M. R. Mazon[1], L. S. Oliveira[1], R. F. Carvalho1, D. M. C. Pesce[2], D. P. D. Lanna[3], S. L. Silva[1] and P. R. Leme[1]

1Faculdade de Zootecnia e Engenharia de Alimentos,Universidade de São Paulo Pirassununga, Brasil

[2]Faculdade de Medicina Veterinária, Pontifícia Universidade Católica de Minas Gerais, Poços de Caldas, Brasil

[3]Departamento de Zootecnia, Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo, Piracicaba,SP,Brasil

Abstract – The concern for human health has increased in recent years and consumers are more demanding of quality of the product and its beneficial effect. Therefore, the aim of this study was to evaluate the fatty acid composition of the meat from castrated or intact lambs, slaughtered at different time on feed. Forty eight Dorper x Santa Inês males allotted in pens according to initial BW (block) and fed a diet high concentrate. After 14 days of adaptation period 24 animals were Burdizzo castrated. The animals were slaughtered after 36 or 78 days of feeding (half of each sex) and the *m. Longissimus dorsis* sampled for analysis of the fatty acid profile.There was an interaction between sexual condition and time on feed (P<0.05) in the C12: 0 (lauric), C14: 1C9 (myristoleic), C18: C9C12 (linoleic), monounsaturated fatty acids, total polyunsaturated and omega 6.

Key Word – Castration, Lipid composition, Meat quality

- INTRODUCTION

The Brazilian market for sheep meat has expanded in recent years (FAO, 2013), but there is still a large gap to be filled in product quality. The requirement of the consumer for a healthier product is growing, and to meet this new demand new technologies have been developed.

In Brazil the most part of sheep production is based on crossbreeding of a local hair breed called Santa Inês - that shows a great tolerance to hot environments, low nutritional requirements and high prolificacy - with Dorper that result in a product with good carcass conformation and meat production. Additionally, the use of non-castrated males finished under feedlot with high concentrate diets is another increasing practice, looking to improve lean meat production and net return. On the other hand, depending on the age and sex condition of animals the meat composition can vary affecting body and fatty acid composition, which is a very important aspect of red meat because it is related to consumer health. There is a lack of information about the fatty acid profile of Santa Inês x Dorper crossbreed according to sex condition and time on feed. Therefore, this work was developed to evaluate the effects of sex condition and time on feed and fatty acid composition of meat from lambs fed high concentrate diets on finishing phase.

- MATERIALS AND METHODS

Forty eight crossbred Dorper x Santa Inês non-castrated (NC) males averaging 32.4 ± 5.0 kg of live weight (LW) and 3.5 months old were housed according to LW (block) in 24 pens

with two animals per pen, and fed diets containing 75% whole grain corn, 20% protein-mineral pellet and 5% of coast cross hay. After adaptation period half animals of each sex were randomly selected (within each block) and castrated (CA) using the emasculation technique. After that animals were kept in feedlot for 36 or 78 days when they were slaughtered.

After 24h of chilling carcasses were ribbed between 12th and 13th ribs and a sample of LM (2.5 cm thick) was taken vacuum packaged and frozen at -18 ^{o}C for further fatty acid profile analysis. The extraction of fat and methylation was made according to the method of Hara and Radin (1978) and Christie (1982) and determined by a gas cromatograph and compared with a known standard CRM-14. Statistical analyses were conducted using the GLM procedure of SAS (SAS Institute Inc.,Cary, NC) accounting for block, sex condition, time on feed and sex condition *vs* time on feed interaction as fixed effects.

- RESULTS AND DISCUSSION

Results for fatty acids that showed no significant sex condition *vs* time on feed interaction are presented in Table 1 and those where interaction was significant are presented in Table 2. The backfat thickness at slaughter was 3.7 and 3.1mm for CA and NC and 2.8 and 3.9mm for animals fed 36 or 78 days (P=0.0357), respectively.

There was no effect of sex condition for the most fatty acids analyzed, except for palmitic (C16:0) that was greater for NC when compared to CA males (Table 1).

In the same way, days on feed did not affect the most of fatty acids analyzed, except for C20:0 that was greater for animals fed 78 days. Percentage of Conjugated Linoleic acid (CLA; C18:2c9t11) was greater in Longissimus of animals fed 36 days than those fed 78 days.

There was no difference between sex condition or time on feed for percentages of saturated fatty acids (SFA), ω-3, as well as for ω-6:ω-3, unsaturated:saturated, polyunsaturated:saturated ratios.

Castrated males fed for 36 days showed higher percentage of C12:0, C14:1c9, C15:1, C18:2c9t12, ω-6 and PUFA but smaller percentages of C18:1c9 and MUFA when compared to CA fed 78 days (Table 2). On the other hand, the fatty acid profile of NC animals fed for 36 or 78 days was not different. When comparing animals fed for 36 days, castrated showed higher percentage of C12:0, C14:1c9 but there was no difference for other fatty acids. For animals fed 78 days, CA showed high percentage of C18:1c9 but there was no difference for the rest of fatty acids.

Table 1 Fatty acid composition (% of total fatty acids) of *Longissimus* muscle from castrated (CA) or non-castrated (NC) males with different days on feed, for traits with significant sex condition x time on feed interaction

	Sex condition[2]		Days on feed[2]	
Fatty acid[1]	CA	NC	36	78
C14:0	2.32^{a}	2.40 ^{a}	2.45^{A}	2.27^{A}
C15:0	0.50 ^{a}	0.53 ^{a}	0.53 ^{A}	0.50^{A}
C16:0	23.02^{b}	24.15^{a}	23.26^{A}	23.91^{A}
C18:0	11.93^{a}	11.02^{a}	11.66^{A}	11.30^{A}
C20:0	0.06^{a}	0.05^{a}	0.06^{B}	0.05 ^{A}
C18:2T10C12	0.02 ^{a}	0.02 ^{a}	0.02^{A}	0.01^{A}
C18:2C9T11	0.24^{a}	0.22^{a}	0.26^{A}	0.19^{B}
SFA	40.41^{a}	40.77^{a}	40.65^{A}	40.52^{A}
ω-3	0.12^{a}	0.12^{a}	0.13^{A}	0.11^{A}

ω-6:ω-3	25.90[a]	24.53[a]	26.55[A]	23.88[A]
UFA:SFA	1.49[a]	1.46 [a]	1.47[A]	1.485[A]
PUFA:SFA	0.22 [a]	0.21 [a]	0.23[A]	0.19[A]

[1] SFA – saturated fatty acids; UFA–unsaturated fatty acids; PUFA – poliunsaturated fatty acids.
[a,b,A,B] Columns with different letters within sex condition (lowercase) or days on feed (uppercase) differ (P<0.05).

Table 2 Fatty acid composition (% of total fatty acids) of Longissimus muscle from castrated (CA) or non-castrated (NC) males with different days on feed for traits with significant sex condition x time on feed interaction

Fatty acid	CA36	CA78	NC36	NC78
C12:0	0.14 [a]	0.08[b]	0.09[b]	0.10[ab]
C14:1C9	0.12 [a]	0.09[b]	0.11[ab]	0.11[ab]
C18:1C9	40.32[b]	44.79[a]	41.76[b]	41.61[b]
C18:2C9C12	6.49[a]	4.73[b]	5.65[ab]	5.92[ab]
ω-6	6.92[a]	5.04[b]	5.60[ab]	6.28[ab]
MUFA	49.04[b]	53.04[ac]	50.86[bc]	50.84[bc]
PUFA	10.46 [a]	6.65[bc]	8.33[ac]	8.44[bc]

CA36- castrated males slaughtered with 36 days on feed; CA78 – castrated males slaughtered with 78 days on feed; NC36- Non -castrated males slaughtered with 36 days on feed; NC78 –Non-castrated males slaughtered with 78 days on feed; MUFA– monounsaturated fatty acids;
PUFA – poliunsaturated fatty acids
[a,b,c] Columns with different letters differ (P<0.05).

The fatty acids found in greater concentration in meat were C18:1, C16:0 and C18:0 (42%, 24% and 11% respectively) and the total fatty acids were 40% saturated, 42% monounsaturated and 23% polyunsaturated. These results are in agreement with those reported by Zapata et al. (2001) and Madruga et al. (2006). The concentration of monounsaturated fatty acids is greater when animals are fed for longer periods which cause greater fat deposition, in contrast to polyunsaturated that show higher concentrations in young animals fed for short periods (DUCKETT, 1993; DE SMET et al., 2004). On the other hand, Leao et al. (2011) reported higher concentrations of saturated (51.3%) and smaller concentrations of monounsaturated (40%) and polyunsaturated (8%) fatty acids in Ile de France lambs, then observed in our work.

- CONCLUSION

Castration and time on feed had a small impact on fatty acid composition of Longissimus muscle from Santa Ines x Dorper crossbreed when they are slaughtered at low levels of backfat thickness.

ACKNOWLEDGEMENTS

At FIP (Foundation research incentive) for financial support, the Veterinary Department of the Pontifical Catholic University of Minas Gerais, in Poços de Caldas, the Department of Animal Science, Faculty of Animal Science and Food Engineering, University of São Paulo, in Pirassununga and CAPES (Coordination of Improvement of Higher Education Personnel) scholarship to the first author.

REFERENCES

- FAO. (2013). Food and Agriculture Organization of United Nations. Statistical Databases FAOSTATS. Agriculture.
- Christie, W. W. (1982). A simple procedure for rapid transmethilation of glycerolipids and cholesterol esters. Journal of Lipid Research 23: 1072-1982.
- De Smet, S., Raes, K. & Demeyer, D. (2004). Meat fatty acid composition as affected by fatness and genetic factors: a review. Animal Research, Les Ulis Cedex 53: 81-98.
- Duckett, S. K. (1993). Effects of time on feed on beef nutrient composition. Journal ofAnimal Science 71: 2079-2088.

- Hara, A. & Radin, N. S. (1978). Lipid extraciton of tissues with low-toxicity solvent. Analitical Biochemistry 90: 420-426.
- Leão, A. G., Sobrinho, A. G. S., Moreno, G. M. B., Souza, H. B. A., Perez, H. L. & Loureiro, C. M. B. (2011). Características nutricionais da carne de cordeiros terminados com dietas contendo cana-de-açúcar ou silagem de milho e dois níveis de concentrado. Revista Brasileira de Zootecnia 40(5):1072-1079.
- Madruga, M. S., Araújo, W. O., Sousa, W. H., Cézar, M. F., Galvão, M. S. & Cunha, M. G. G. (2006). Efeito do genótipo e do sexo sobre a composição química e o perfil de ácidos graxos da carne de cordeiros. Revista Brasileira de Zootecnia 35(4): 1838-1844.
- Zapata, J. F. F., Nogueira, C. M. & Seabra, L. M. J. (2001). Composição centesimal e lipídica da carne de ovinos do Nordeste brasileiro. Ciência Rural, 31(4): 691-695.