EFFECT OF FRESH CHICORY (*CICHORIUM INTYIBUM L.*) INCLUSION ON RABBIT MEAT QUALITY

L. Basso*[1], M.E. Cossu[1], G. Graziotti[2], C. Ríos[2], C. Gauna[3], C. Castellini[4] and A. Dal Bosco[4]

[1] Producción Animal, Facultad Agronomía, Universidad de Buenos Aires, Av. San Martín 4453, (1417), Argentina. [2] Facultad Ciencias Veterinarias, Univ. de Buenos Aires, Av. Chorroarín 280, (1417), Argentina. [3] Fac. Ciencias Veterinarias de La Pampa, La Pampa, Argentina. [4] Dip. Biologia Vegetale e Biotecnologie Agroambientali e Zootecniche. Univ. di Perugia, Borgo 20 Giugno, 74. Italia. Email: lbasso@agro.uba.ar

Keywords: rabbit, chicory, meat quality

Introduction

The energy level of the rabbit fattening diet is a direct way to modify the growth performance and meat characteristics. In order to satisfy most rabbit meat consumers, diet fatty acid composition and manipulation has been well investigated (Gondret *et al.*, 1998). Rabbit meat possesses a relatively high content of polyunsaturated fatty acids (Ouhayoun *et al.*, 1987) and low FA-n6/FA-n3 ratio (Bernardini *et al.*, 1999) but forage addition increases FA-n3 (Facchin, 2001). Chicory plant is a concentrated source of fructo-oligosaccharides and inulin. Fresh chicory addition might influence growth performance and consequently meat quality traits of rabbits. The purpose of the study was to assess the effect of feeding fresh chicory (Cichorium intyibum L.) on the chemical, nutritional properties and muscle fibre type of rabbit meat.

Materials and Methods

A trial was conducted at an experimental station belonging to the Faculty of Agronomy, Buenos Aires University. From weaning to 52days of age, all NZW young rabbits were fed a standard feed (DE: 2463kcal/kg, CP:15,5%), from 53d to slaughter a finishing diet was used (DE:2571 kcal/kg, CP:16.01%). Litters of 26 NZW does (13 per group) were used. After weaning a total of 156 rabbits were allocated in collective cages until 53 days of age, then redistributed in bi-cellular cages until 80days of age. Animals were fed either a commercial (Control) or commercial diet plus *Cichorium intyibum L.* (chicory) (100g chicory dry matter/d/rabbit; 9.34%DM, CP: 28.8%DM, DE:2558 kcal/kgDM). Twenty six (13/group) 53d-of age rabbits were slaughtered to determine fatty acid (FA) composition in early age; the rest were slaughtered at 80 days. Samples of hindleg were obtained to determine composition in FA extracted according to Folch *et al.* (1957) and analysed by gas chromatography (Shimadzu GC-14B; capillary column: Ulbon HR-SS-10; 0,32 I.D.x 50 mL) and using Helium as carrier gas. Chemical analysis followed AOAC (1985). Ten minutes *post mortem* a sample of *Longissimus dorsi* from the left side of the carcass was obtained and histochemical treatment (freeezing in isopentane cooled by liquid nitrogen). Six serial cross-sections (10µm thick) from each muscle sample were obtained with a cryostat at 20°C. One was stained with azorubine (reference staining), four were processed according to the myofibrillar ATPase (Guth and Samaha, 1970) and one was stained for succino-dehydrogenase activity (Nachlas *et al.*, 1957). Fibres were classified as I, IIA y IIB (Brooke and Kaiser, 1970). Mean cross-sectional area was determined with a computerised image analysis system (Buche, 1990). For the variables, analysis was carried out using GLM procedure of SAS and mean values were compared using Tukey test (5%).

Results and Discussion

The fibre type distribution (Table 1) was slightly but significantly influenced by diet. Chicory rabbits presented a high level of I type fibres. Only IIA fibre cross-sectional area varied between diets ($P<0.01$), with less area for chicory fed . However, when all fibre type were analysed, the Chicory group presented the thinner fibres of all types (N.S.). It is known, that dietary energy level represents a tool to modify carcass composition, to a lesser degree, this factor influences muscle biology (fibre cross-sectional area); the major energy level determined the increase in anaerobic glycolytic energy metabolism. Chicory rabbits were significantly leaner at slaughter than control, presented less intramuscular fat and more protein content ($P<0.01$; Table 2). At 53 days of age, hindleg fatty acid composition differed slightly between treatments: only for C18:3, and n-6/n-3 ratio with a better value for the chicory group (more linolenic acid content and less n-6/n-3 ratio). At slaughter, fatty acid composition differed significantly. The level of C18:3 increased with age but, although difference between treatments was not significant, chicory group showed higher levels than control group. The high level of chicory saturated fatty acid was due to differences in C16:0 and C18:0 concentration. The lower content of polyunsatured fatty acids was due to the C18:2 level (32.8 and 26.8 %Agtot for control and chicory group respectively) and explains the lower n-6/n-3 ratio for the chicory group, closest to the recommendation of the U.S. Department of Health.

Conclusions

The results of this study show a good response to the inclusion of chicory on carcass quality and meat traits. Carcasses were leaner and meat presented less intramuscular fat and more protein content. The chicory group showed high linolenic acid content and a better n-6/n-3 ratio.

Table 1: Effect of diet on histochemical traits of *Longissimus dorsi* muscle.

	Control	Chicory	Probability	Rsd[1]
Fibre type distribution (% of the total number of fibres)				
I	14,2[b]	17,1[a]	P=0,0220	6,2
IIA	11,8	12,0	P=0,1267	4,5
IIB	74,0	70,9	P=0,1528	21,7
Fibre cross-sectional area (μm^2)				
I	2179	1868	P=0,0875	453
IIA	1868[A]	1435[B]	P=0,0100	403
IIB	4397	4126	P=0,3776	781

(1)Rsd= residual standard deviation a, b= P<0,05; A, B=<0,01

Table 2: Effect of diet on **hindleg** chemical and **fatty** acid **composition.**

	Control	Chicory	Probability	Rsd[1]
Final weight (g)	2232	2268	P=0,3760	105
Total fat (% RC[2])	3,67[A]	2,70[B]	P=0,007	0,88
Humidity (%)	72,5[b]	73,6[a]	P=0,0471	1,5
Protein (%)	19,5[B]	20,9[A]	P=0,0018	1,1
Ether extract (%)	3,20[A]	2,03[B]	P=0,0012	0,85
Fatty acid composition (%Agtot) of 53d-of age rabbits				
C18:3	2,50[b]	3,03[a]	P=0,0109	0,35
SFA[3]	36,6	37,6	P=0,4621	2,58
MUFA[4]	23,2	24,5	P=0,3636	2,64
PUFA[5]	40,2	37,9	P=0,2888	4,03
n-6/n-3	13,8[A]	10,2[B]	P=0,0022	1,82
Fatty acid composition (%Agtot) of 80d-of age rabbits				
C18:3	2,81	3,24	P=0,1817	0,61
SFA[3]	33,7[B]	39,4[A]	P<0,0001	1,79
MUFA[4]	25,4	25,9	P=0,6775	2,10
PUFA[5]	40,9[A]	34,7[B]	P<0,0001	1,68
n-6/n-3	12,5[A]	8,78[B]	P=0,0010	1,77

(1)Rsd= residual standard deviation; (2) RC= chilled carcass – (liver, kidneys, organs of chest and neck); (3) saturated fatty acids; (4) monounsaturated fatty acids; (5) polyunsaturated fatty acids;

References

A.O.A.C. (1985). *Official Methods of Analysis*. Ed.XXX AOAC Publ., Washington, DC. USA.

Bernardini, M., Castellini, C.and Dal Bosco, A. (1997). Livello di ω-3 nella carne di coniglio in relazione al contenuto della dieta. Atti XII Congresso Nazionale ASPA, Pisa 23-26 Giugno, 381-382.

Buche, P. (1990). RACINE: Un système d'analyse multi-images de coupes sériées. Application à la caractérisation de fibres musculaires. Ph.D.thesis, Université RennesI. France.

Brooke, M. and Kaiser, K. (1970). Muscle fiber types:how many and what kind?. Arch. Neurol., 23: 369

Folch, J., Lees, M. and Stanley, G.H.S. (1957). A simple method for the isolation and purification of lipids from animal tissues. J. of Biological Chemistry, 226: 497-509.

Facchin, E. (2001). Resultados preliminares de crianza rural en Brasil. Seminario Internacional para el desarrollo sostenible de cunicultura en América Latina. 6-10 agosto . Santa Rosa, La Pampa. Argentina

Gondret, F., Mourot, J., Lebas, F. and Bonneau, M. (1998). Effects of dietary fatty acids on lipogenesis and lipid traits in muscle, adipose tissue and liver of growing rabbits. Anim. Sci., 66: 483-489

Guth, L. and Samaha, F.J. (1970). Procedure for the histochemical demonstration of actomyosin ATPase. Research Note. Experimental Neurology, 28: 365-367.

Nachlas, M.M., Tsou, K., De Souza, E., Chang, C. and Seligman, A.M. (1957). Cytochemical demonstration of succinic dehydrogenase by the use of a new p-nitrophenyl substitued ditetrazole. J. of Histochemistry and Cytochemistry, 41: 1151-1162.

Ouhayoun, J., Kopp, J., Bonnet, M., Demarne, Y. and Delmas, D. (1987). Influence de la composition des graisses alimentaires sur les propriétés des lipides périrénaux et la qualité de la viande du lapin. Sci. Aliments, 7, 521-534.