THE EFFECT OF ADDING WOOL KERATIN HYDROLYSATE TO RECONSTITUTED MILK ON THE QUALITY OF LAMB CARCASSES AND MEAT

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Introduction

The utilization of protein lysates as supplementation in the diet arise a great interest since they are responsible of promoting, through different mechanisms, remarkable productive performances (Celi *et. al.* 1997; Mordenti, 1989). These are substances that the feedstuff industry prepares and generally sells with commercial names without indicating the primary raw material. This research aims at evaluating the quanti-qualitative characters of carcass and meat from lambs fed on milk replacer supplemented with wool keratin lysate.

Materials and Methods

24 three-crossbred ewe lambs were subdivided in two groups (Control (C) and Lysate (L)) and fed ad libitum reconstituted milk. For group L the milk was supplemented with 20 g/l wool keratin lysate. The lambs were slaughtered at 6 weeks of the age and the carcasses, after 24 h chilling at 4 °C, were divided into two half sides. The right side was evaluated and dissected into quality cuts (neck, shoulder, rib, loin, breast, flank and leg) and subsequently the lean, fat and bone fractions of the single cuts were detected (Borghese *et al.* 1991). Samples of longissimus thoracis (LT) and semimembranosus (SM) muscles were collected from all animals 4h after slaughter (from the 10th rib for the first, from the middle point for the second muscle) for the histochemical characterization of the muscular fibres, whereas a part of LT muscle was preserved at -80 °C up to the moment of analysis to determine the myofibrillar degradation due to cathepsin D (Nicastro *et al.*, 1996). Duplicate muscle samples were immersed into liquid nitrogen and mounted on spindles before sectioning 12 mm thich using a Reichert-Jung freezing microtome. Serial sections mounted on glass microscope slides were stained with NADH-Tr and myofibrillar ATPase reacted at alkaline pH to differentiate muscle fibre type according to their oxidative and glycolitic capability (Nicastro 1989). Fibres were classified into βRed, αRed and αWhite according to Ashmore and Doerr (1971). Sections were analysed using a Image Analyzer Vidas by Zeiss to determine fiber diameter and fiber percentage type for each fiber type. The data were subjected to the analysis of variance according to GLM procedure by SAS(1990).

Results and discussion

The results concerning the quality cuts are reported in tables 1 and 2. The utilization of the lysate determined a certain difference in the half side cuts. In fact, in the animals of the control group the incidence of the fore cuts (neck, breast and shoulder) and rear cuts (loin and leg) is on an average higher. Statistical significative levels are found only for the flank (4.4 vs 5.1%; $P<0.01$) and loin (7.5 vs 6.2%; $P< 0.05$). From the table 1 it is evident that the first quality cuts are generally heavier. The most significative changes in lean. fat and bone fractions are found in cuts from L group (table 2). In fact this group evidences for shoulder and flank a significative higher percentage of lean than the control ($P < 0.05$); the flank, moreover presents lowest fat fraction ($P<0.05$). The morphometric values of the fibres and their percent distribution il LT and SM muscles are reported in table 3. In both muscles it is immediately clear that the animals in group L present fibres with a greater diameter even though the statistical significance ($P< 0.05$)is shown only for the white fibres of LT muscle (28.41 vs 24.74 μm). The histo-enzymatic typization of muscular fibres is basic for the increase of the muscular tissue and subsequent biochemical evolution of the same in meat after slaughter (Nicastro. 1992). In literature, the comparison data of carcasses from artificially nursed animals slaughtered at 12 kg live weight are poor, for this reason the results here discussed may are be indicative of a particular Italian productive technique, that is the milk lamb. The percent distribution of the fibres evidences a lower presence of the red ones in SM muscle of controls ($P<0.05$). This result is found even though not in a significative manner in LD muscle. These differences confirm what Nicastro and Moody (1992) found out, and this depends on the different functionality and physiology of the considered muscles. From the morphometric and percent data of the fibres of L animals a trophic potential can be found, that is to be interpreted as a phase in full evolution in the theory of fibre "mutations" (Nicastro 1992). The values of myofibrillar degradation and subsequent activity of proteolytic complex of cathepsin D in LT muscle (table 5) resulted more evident in the "lysate" subjects, even though not supported by a statistical significance. The activity expressed in μg tyrosin released for 60 m at 45 °C, the total activity and the specific one as well as the absorbance increase at 700 nm resulted lower in controls evidencing an exalting of cathepsin D in the process of proteolysis of L carcasses. Even though for these data comparisons cannot be made in literature, some results evidence the proteolytic activity of lysosomial cathepsins (Ouali, 1990) as well as their action on actyn and myosin in different lamb muscles (Whipple and Koohmaraie, 1992).

Conclusions

The overall evaluation of the data concerning the quality of lamb meat fully justifies the utilization of wool keratin lysate as supplement of the ration. The lysate determined a higher incidence of both the main quality cuts and the red fibres of the oxidative type that constitute an evaluation index of meat tenderness.

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Table 1 - Least squares means for half side carcass characteristics (%) on lamb influenced by feeding system.

	Control	Lysate
Neck	8.03	8.65
Breast	7.99	8.19
Shoulder	18.75	18.98
Rib	14.06	12.88
Loin	6.18^{a}	7.55^{b}
Flank	5.10^{A}	4.36^{B}
Leg	32.07	33.06

a.b $P < 0.05$; A. B $P < 0.01$

Table 2 - Least-square means of physical composition of cuts (%) on lamb influenced by feeding system.

	Lean	Fat	Bone
Neck			
Control	49.48	26.19	24.33
Lysate	43.21	27.19	29.60
Breast			
Control	41.43	21.42	37.15
Lysate	39.92	21.23	38.85
Shoulder			
Control	60.39^{a}	14.21	25.40
Lysate	63.02^{b}	13.22	23.76
Rib			
Control	47.92	15.36	36.72
Lysate	51.16	14.17	34.67
Loin			
Control	59.44	11.60	28.96
Lysate	53.58	14.59	31.83
Flank			
Control	63.27^{a}	36.73^{a}	
Lysate	70.87^{b}	29.13^{b}	
Leg			
Control	65.68	10.17	24.15
Lysate	65.69	10.17	24.14

a.b $P < 0.05$;

Table 3 - Least-square means for size and population of muscle fibers in longissimus thoracis and semimembranosus muscles as influenced by feeding system.

	Longissimus thoracis		
	Diameter (μm)		
Item	βR	αR	αW
Control	23.72	19.04	24.74^{a}
Lysate	25.12	22.01	28.41^{b}
	Population (%)		
Control	12.62	43.72^{A}	43.66^{a}
Lysate	14.97	38.22^{B}	46.81^{b}
	Semimembranosus		
	Diameter (μm)		
Control	28.60	23.67	27.51
Lysate	31.02	28.94	29.58
	Population (%)		
Control	12.57^{a}	42.73	44.70^{a}
Lysate	15.58^{b}	42.49	41.93^{b}

a.b $P < 0.05$; A. B $P < 0.01$.

Table 4 - Least-square means on lamb carcass traits as influenced by feeding system.

	Control	Lysate
Slauther weitht g	12566	12137
Cold carcass g	6666	6566
Dressing %	64.90	65.11
Weight skin g	1450	1450
Kidney and pelvic fat. g	138^{a}	129^{b}
Metatarsal length. cm	57	57
Metacarpal length. cm	42	42

a.b $P < 0.05$;

Table 5 - Least -square means and standard error (S.E.) on proteolytic activity of cathepsin D on LT muscle.

	Control	Lysate	S. E.
Specific activity	1.42	1.81	.23
Total activity	3.20	4.08	.48
Enzyme activity*	18.33	18.75	3.32