

TEXTURAL AND SENSORY PROPERTIES OF MEAT FROM PODOLIAN CATTLE

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Introduction

Production factors including breed, age, sex, feeding, rearing system and technological factors, such as refrigeration or ageing time, can affect a number of meat characteristics. Research has shown evidence that concentrate-fed animals produce more tender meat and with better flavour than forage-fed animals. Inadequate tenderness is the most frequent motivation of consumer dissatisfaction, so any improvement in this parameter would increase the value of the final product. Prolonged ageing time may improve meat tenderness (Campo *et al.*, 1999; Marino *et al.*, 2006). During ageing, muscles undergo a series of physical and biochemical changes which are responsible of their conversion to meat. The present research aims to evaluate the effects of rearing system (indoor vs outdoor), protein level (high and low protein supplementation) and ageing time on the textural and sensory properties of meat from Podolian young bulls.

Materials and Methods

Twenty-four Podolian young bulls were divided into 3 groups (8 subjects each): indoor (IND), pasture with high protein level supplementation (PHP-16% D.M.) and pasture with low protein level supplementation (PLP-12% D.M.). Diet was composed of oat hay as forage plus durum wheat flour shorts and field beans as concentrate, the amount in each group was calculated according to INRA (1988) to satisfy the growth requirement. Longissimus dorsi lumborum (LD) was removed from the right carcass side and aged in vacuum-packaging at 4°C until 11 and 18 days post-mortem. Rheological properties were tested on ten parallel pipes for each raw sample (1 cm² in cross-section) using two different instrumental measurements (Instron 4301 universal testing machine). The shear force (WBSF) was assessed using a Warner-Bratzler device (100 mm/min crosshead speed using 100 kg load cell). Texture profile was analysed using a modified compression device that avoids transversal elongation of the samples. Each sample underwent two cycles of 80% compression, force by time data were used to calculate the following parameters: hardness, cohesiveness, springiness, chewiness. The sensory properties were evaluated on steaks grilled at an internal temperature of 75°C by a panel of 10 assessors, previously trained to develop a communal sensory vocabulary and to evaluate the intensity of attributes (odour, savoury, acidic, bitter, sweet, flavour, tenderness, juiciness, chewiness, fatness). Attributes were rated on the basis of 100 mm unstructured lines with anchor points at each end (0: absent and 100: very strong). Data were subjected to an analysis of variance, using the GLM procedure of the SAS statistical software (1999).

Results and Discussion

Rearing system and protein level did not account for WBSF and texture profile (Table 1) in agreement with Keane and Allen *et al.* (1998). The specific effects of dietary constituents on meat quality are not easy to evaluate. The feeding regime can have an influence on animal growth and it is difficult to establish whether the meat characteristics are due to dietary components for their intrinsic properties or to diet effects on animal growth rate and body composition (Muir *et al.*, 1998). Nevertheless, significant effects of protein level was found in relation to the sensory properties (Figure 1), where meat from grazing animals supplemented with high protein level showed lower flavour intensity ($P < 0.01$), tenderness ($P < 0.001$) and juiciness ($P < 0.05$) than grazing animals supplemented with low protein level and outdoor animals. Berge *et al.* (1993) observed lower meat tenderness with increased amounts of muscle production in steers fed a high level of protein rich soybean-rapeseed meal compared with a low level of soybean-rapeseed meal. Ageing time significantly improved, WBSF and texture profile of Podolian meat (Table 1); after 18 days lower WBSF, hardness, chewiness ($P < 0.001$), cohesiveness ($P < 0.01$) and springness ($P < 0.05$) was found when compared to those after 11 days of ageing.

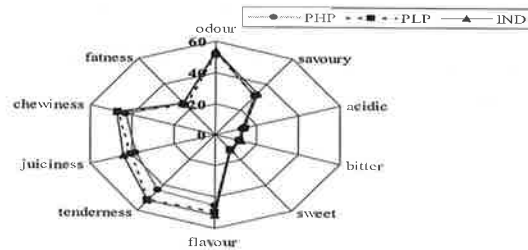


Figure 1: Sensory properties of Podolian meat as affected by rearing system.

Table 1: Rheological properties of Podolian meat as affected by rearing system and ageing (means \pm SE).

		Ageing	Rearing system			mean	Effects, P		
			PHP	PLP	IND		Rearing system	Ageing	Ag. x Rearing system
WBSF	kg	11	6.39 \pm 0.46	6.72 \pm 0.44	7.64 \pm 0.50	6.92 \pm 0.27	NS	***	NS
		18	5.9 \pm 0.46	5.69 \pm 0.44	6.09 \pm 0.50	5.89 \pm 0.27			
Hardness	kg	11	9.45 \pm 0.53	8.97 \pm 0.58	9.74 \pm 0.60	9.39 \pm 0.44	NS	***	NS
		18	7.79 \pm 0.53	7.94 \pm 0.58	8.18 \pm 0.60	7.97 \pm 0.44			
Cohesiveness		11	0.16 \pm 0.01	0.16 \pm 0.008	0.17 \pm 0.009	0.17 \pm 0.01	NS	**	NS
		18	0.12 \pm 0.01	0.12 \pm 0.008	0.13 \pm 0.009	0.13 \pm 0.01			
Springiness	cm	11	0.71 \pm 0.025	0.66 \pm 0.027	0.69 \pm 0.028	0.69 \pm 0.02	NS	*	NS
		18	0.64 \pm 0.025	0.61 \pm 0.029	0.61 \pm 0.029	0.62 \pm 0.02			
Chewiness	kg*cm	11	1.04 \pm 0.075	0.96 \pm 0.081	1.09 \pm 0.084	1.03 \pm 0.08	NS	***	NS
		18	0.70 \pm 0.075	0.69 \pm 0.089	0.73 \pm 0.087	0.71 \pm 0.08			

NS= not significant. * = P<0.05; ** = P<0.01; *** = P<0.001 Means followed by different letters differ significantly at P < 0.05.

During ageing meat is subjected to gradual softening processes. Indeed, muscle undergo a series of physical and biochemical changes which are responsible for their conversion to meat; in particular, these modifications may be due to the action of endogenous proteolytic enzymes (Koochmariaie, 1996). Extending the ageing time from 11 to 18 days improved flavour intensity, tenderness, juiciness and chewiness (P<0.001) of meat (data not shown). Some authors (Campo *et al.*, 1999; Monson *et al.*, 2005) found that flavour intensity increased after a longer ageing time, probably due to post-mortem processes, such as proteolysis and lipolysis, which result in the development of flavour precursors. Indeed, over 1000 volatile compounds responsible for meat flavour have been identified (Mottram, 1998).

Conclusions

Our results suggest that extending ageing time from 11 to 18 days results in increased meat tenderness and improved chewing texture and flavour intensity. High level of protein supplementation did not change meat texture profile and impaired some sensory properties. This result reveals that, in formulating finishing diets, good meat eating quality could be achieved optimising feed availability (pasture) and reducing the protein level of diet supplementation.

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