Quality characteristics of meats of podolian bulls slaughtered at different ages.

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ABSTRACT

Podolian cattle, autochthonous breed of south Italy, is reared prevalently with a wild system or a semi-wild one, systems that permit a big utilization of natural grazing to produce quality and genuine meats.

The aim of this study was to evaluate the quality of meat from *Longissimus dorsi* and for this reason we analyzed the physical parameters, the chemical and the fatty acid compositions of sample cuts of Podolian bulls slaughtered at three different ages.

This trial was carried out on 18 Podolian steers, reared in wild system and divided into 3 homogeneous groups of 6 animals each one. During the trial period, the animals were fed ad libitum with graze. The steers were slaughtered at the age of 14 months (A group), 16 months (B group) and 18 months (C group), according to veterinary police rules.

The determination of meat physical and chemical characteristics was effected according to ASPA official methodologies. After that, the carcasses were refrigerated for 72 hours at 4°C. The data was analyzed for variance (ANOVA) using the GLM procedure of SAS.

The meats of B group show, even if with different levels of statistical significance, the highest pH at 1, 24 and 72 hours and the lowest shear force of cooked meats. On the other hand, the A group presents the highest value of L* and b* index and the major cooking loss.

The chemical composition of raw meats from C group demonstrates that these meats have the lowest incidence of moisture and indeterminate ($P<0,01$) and they have a high value of fat ($P<0,01$); instead, the cooked meat from the same group shows the major incidences of moisture and fat, while the incidences of proteins and indeterminate are the lowest ($P<0,01$).

Fatty acid composition of raw meat of B group demonstrates that these meats have the highest quantity of SFA and the lower of PUFA and UFA, ω3, ω6 and the highest value of A.I. and T.I ($P<0,01$ and $P<0,05$). The same trend is showed on cooked meat of B group.

The B group meat has, in the complex, better physical and chemical characteristics, even if acidic quality of fat is not particularly useful for human feeding.

KEY WORDS: Meat quality, Acid composition, Podolian meat, Free range.

INTRODUCTION

As it is noticed, the quanto- qualitative aspects of meat depend by the animal genotype (specie and/or breed), the age of slaughtering, the sex, the rearing system, the breeding system, the slaughtering condition and the manufacturing of carcasses, the time of ageing and the type of conservation and domestic preparation (Giorgetti and Poli, 1990). As far as the different quanto-qualitative aspects of meat productions of bulls with special genotypes is concerned, the available literature is rich in general when, on the other hand, the one found concerning podolian is limited, although there is no lack of interesting surveys (Ragni et al., 2006; Marsico et al., 2007; Marsico et al., 2007; Braghieri et al., 2007, Marsico et al., 2008; Ragni et al., 2008; Marsico et al., 2008; Braghieri et al., 2009; Tarricone et al., 2009; Braghieri et al., 2009; Tarricone et al., 2009).

Remembering that the podolian is a rural genotype, thrifty, well adapted in difficult environments of the inside areas of south Italy, reared in free range system because of its capability to use better the pasture of the territory. This system provides acceptable quantitative productions, but furnished with a secure imagine of genuineness, appropriate to the rearing system on which are deriving meats whose quality depends by the pasture that is being used. The literature on the influence of the age of slaughtering of the podolian bulls reared with free range system is very few and for this

reason we decided to take the opportunity to investigate on some qualitative aspects of podolian bulls' meat reared with free range system and slaughtered in different ages.

MATERIALS AND METHODS

In order to evaluate the influence of the age of slaughtering on some chemico- physical characteristics of podolian bulls' meat reared in open sky (free range), there have been used 18 subjects, subdivided in 3 groups of 6 heads each one. The steers were slaughtered at the age of 14 months (A group), 16 months (B group) and 18 months (C group), according to veterinary police rules. From the right half side of each carcass has been taken a sample of Longissimus dorsi on which there have been evaluated the parameters described in the following tables, both those of raw and cooked ones.
Particularly, the pH has been measured with the pHmeter; the colorimetric indexes "L", "a" and "b" with the HunterLab; the shear force with the W.B.S. system; the cooking loss is determined with the cooking of the samples in a ventilated electric oven at 180°C up to the temperature of 75°C (ASPA, 1996).
For the general chemical analysis made on a part of the Longissimus dorsi, both raw and cooked, have been followed the indicated methodologies by ASPA (1996) and on the extracted fat (Folch, 1957) have been measured the gas chromatography-silica analysis in glass with the stationary phase of bis-cyanopropyl-siloxane polisililfenilen 70% (60m x 0,25 mm ID x 0,25 µm). All data collected were subjected to analysis of variance and differences between the estimated average, evaluated with the "t" Student.

RESULTS

The physical parameters of bulls' meat seem to be significantly depended ($P<0, 01$ and $P<0, 05$) by the age of slaughtering (Tab. 1). Particularly, the meat of 16 months animals have the higher values of pH (6,84 vs 5,82 e 5,57), while, those of younger subjects (14 months) point out meat with higher and significant values of colorimetric indexes. But, the same ones, present raw meat less tough (1,43 kg/cm^2) and more resistant (3,10 cm), that, after being cooked, becomes harder (6,74 kg/cm^2) and has a bigger loss of weigh (28,90%).
Moreover, the chemical composition of the L.D. raw and cooked, even if with a different statistic significant ($P<0,01$ and $P<0,05$), seems to be depended by the age of slaughtering. This of the younger subjects (Tab. 2) is richer in water (74,83%), is less protein (21,67%) and less fatty (1,23%). After cooking (Tab. 2) are the meat of 18 months subjects that are more watery (66,62%), poorer in proteins (28,81%) and more fatty (2,30%).
The acid composition, also, of the extracted fat of raw meat depends in a significant way ($P<0,01$ and $P<0,05$) by the age of animals (Tab. 3). As a matter of fact, this extracted by the meat of subjects of 14 months is richer in $C_{12:0}$ (0,16%), $C_{15:0}$ (0.71%), $C_{17:0}$ (1,15%), $C_{18:0}$ (18,29%), $C_{20:0}$ (0,16%), $C_{15:1}$ (0,24%), $C_{18:1\omega7}$ (1,42%), $C_{18:1\omega9t}$ (3,45%), $C_{18:2\omega6t}$ (0,29%), CLA $_{(9Z,\ 11E)}$ (0,93%), CLA $_{(10E,\ 12Z)}$ (0,16%), $C_{18:3\omega3}$ (1,20%), $C_{18:3\omega6}$ (0,10%), $C_{20:1\omega9}$ (0,20%), $C_{20:3\omega3}$ (0,56%), $C_{20:3\omega6}$ (0,12%), $C_{20:4\omega3}$ (0,12%), EPA (0,35%), $C_{22:5\omega3}$ (0,35%), $C_{22:5\omega3}$ (0,44%), PUFA (7,65%), ω3 (3,45%) and ω6 (3,68%) and poorer in $C_{18:1\omega9c}$ (30,37%).
The bulls of 16 months present a higher quantitative percentage of saturated fatty acids (50,53%) and this fact brings a higher value of ratio between saturated fatty acids and polyunsaturated fatty acids (12,67) and of the thrombogenic index (0,81).On the contrary, the older bulls present lower values of saturated fatty acids (47,26%) and higher of monounsaturated (43,69%) and unsaturated fatty acids (48,32%).
Similar trend of fat extracted from cooked meat, the bulls of 14 months present higher levels of $C_{12:0}$ (0,15%), of $C_{14:1}$ (0,67%), $C_{15:1}$ (0,25%), $C_{17:1}$ (0,72%), $C_{18:1\omega9t}$ (3,34%),CLA $_{(9Z,\ 11E)}$ (0,90%),

CLA $_{(10E, 12Z)}$ (0,14%), $C_{18:3\omega3}$ (1,27%), $C_{20:3\omega3}$ (0,65%), EPA (0,28%), $C_{22:5\omega3}$ (0,45%), ω3 (3,50%) and the lowest % of $C_{16:0}$ (30,61%), of $C_{18:1\omega9c}$ (30,61%). The bulls of 16 months register the highest level of saturated fatty acids (49,55%) and of thrombogenic index (0,83%). On the contrary, the bulls of 18 months register the highest level of unsaturated fatty acids (49,76%) and the highest level of ratio between unsaturated and saturated (1,08).

CONCLUSIONS

Even if more watery, for the small quantity of fat and for the superior concentrations of ω3, ω6 and CLA, the meat of 14 months bulls seems to be nutritionally of the highest quality.

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- TAB. 1: PHYSICAL PARAMETERS OF LD

	A	B	C	DSE
pH 1	6,18 B	6,84 A	6,44	0,368
pH 24	5,53 b	5,82 a	5,75	0,209
pH 72	5,31 B	5,67 Aa	5,45 b	0,163
L	41,44 A	38,75 B	38,53 B	2,091
a	14,40	14,35	14,76	1,411
b	13,90 A	12,34 B	12,13 B	1,178
Raw WBS				
Peak force (kg/cm^2)	1,43 B	2,37 A	2,14 A	0,526
Peak elongation (cm)	3,10 a	2,93 b	2,94 b	0,215
Cooked WBS				
Peak force (kg/cm^2)	6,74 Aa	4,41 B	5,41 b	1,608
Peak elongation (cm)	1,79 AB	1,53 B	1,99 A	0,217
Cooking loss (%)	28,90 Aa	25,56 ab	21,64 Bb	4,970

TAB. 2: CHEMICAL COMPOSITION OF LD

	RAW					COOKED			
	A	B	C	DSE		A	B	C	DSE
Moisture	74,83 a	74,01 b	73,97 b	0,986		64,26 B	63,46 B	66,62 A	2,060
Proteins	21,67	24,01	22,12	4,291		31,34 Aa	29,91 b	28,81 B	2,044
Fats	1,13 B	1,40 B	2,10 A	0,681		1,97	1,51 B	2,30 A	0,694
Ashes	1,25	1,21	1,26	0,205		1,41	1,64	1,54	0,317
Undeterm.	1,12 A	1,03 a	0,55 Bb	0,578		1,03 B	3,67 A	0,69 B	1,409

TAB. 3: ACID COMPOSITION OF LD (%)

	RAW					COOKED			
	A	B	C	DSE		A	B	C	DSE
C 10:0	0,01 B	0,12 Aa	0,07 Ab	0,057		0,00	0,08 A	0,05 B	0,017
C 12:0	0,16 a	0,12	0,10 b	0,07		0,15 A	0,09 B	0,08 B	0,053
C 14:0	3,59	3,72	3,52	1,042		3,55 A	2,89 B	3,13	0,728
C 15:0	0,71 A	0,50 B	0,44 B	0,165		0,74 A	0,43 B	0,41 B	0,137
C 16:0	24,28 Bb	27,94 A	26,77 a	3,069		24,46 a	25,64	26,29 b	2,044
C 17:0	1,15 A	0,91 B	0,87 B	0,119		1,15 A	0,95 Ba	0,86 Bb	0,125
C 18:0	18,29 A	17,12	15,39 B	2,971		17,91 A	19,34 A	15,10 B	2,285
C 20:0	0,16 a	0,11	0,09 b	0,086		0,15 a	0,12	0,09 b	0,068
C 14:1	0,59	0,47	0,58	0,185		0,67 A	0,34 B	0,56 A	0,186
C 15:1	0,24 A	0,22	0,21 B	0,046		0,25 A	0,20 B	0,20 B	0,045
C 16:1w7	2,51 b	2,99	3,33 a	0,822		2,70 B	2,64 B	3,46 A	0,655
C 17:1	0,64	0,57	0,65	0,137		0,72 A	0,57 Bb	0,67 a	0,119
C 18:1w7	1,42 a	1,05 b	1,22	0,507		1,19	1,09 B	1,32 A	0,235
C 18:1w9t	3,45 A	1,98 AB	0,42 B	0,56		3,34 A	0,61 B	0,44 B	0,577
C 18:1w9c	30,37 B	34,16 Ab	37,11 Aa	3,49		30,61 b	35,08 a	35,74 a	5,721
C 18:2w6t	0,29 A	0,14 B	0,20	0,13		0,26	0,14	2,20	4,914
C 18:2w6c	3,07	2,76	2,93	0,682		3,12	2,97	3,05	0,884
CLA (9Z, 11E)	0,93 A	0,42 B	0,48 B	0,327		0,90 a	0,47 b	0,63	0,566
CLA (10E, 12Z)	0,16 A	0,07 B	0,12	0,078		0,14 a	0,09 b	0,13	0,065
C 18:3w3	1,20 A	0,21 B	0,26 B	0,497		1,27 A	0,04 B	0,24 B	0,403
C 18:3w6	0,10 A	0,07 Bb	0,09 a	0,028		0,10	0,09	0,10	0,038
C 20:1w9	0,20 A	0,10 B	0,12 B	0,068		0,13	0,13	0,14	0,06
C 20:2w6	0,03	0,03	0,02	0,027		0,04	0,03	0,04	0,03
C 20:3w3	0,56 A	0,27 B	0,27 B	0,249		0,65 A	0,40 B	0,36 B	0,263
C 20:3w6	0,12 a	0,08 b	0,11 a	0,057		0,13 B	0,12 B	0,18 A	0,071
C 20:4w3	0,12 A	0,01 B	0,01 B	0,083		0,04	0,00	0,03	0,044
EPA	0,35 A	0,02 B	0,02 B	0,178		0,28 A	0,03 B	0,05 B	0,101
C 22:5w3	0,44 A	0,04 B	0,07 B	0,218		0,45 A	0,11 B	0,08 B	0,169
C 22:5w6	0,01 b	0,03 a	0,02	0,026		0,00	0,05	0,05	0,034
DHA	0,17 A	0,00 B	0,00 B	0,099		0,03	0,00	0,03	0,028
SFA	48,35 b	50,53 Aa	47,26 B	3,027		48,14 Ab	49,55 Aa	46,01 B	1,919
MUFA	39,42 B	41,54	43,69 A	4,041		39,61	40,66	42,56	5,904
PUFA	7,65 A	4,15 B	4,63 B	2,109		7,48	4,80	7,21	5,237
ω3	3,45 A	1,03 B	1,24 B	1,236		3,50 A	1,38 B	1,50 B	1,033
ω6	3,68 a	3,10 b	3,37	0,781		3,67	3,40	5,63	4,614
UFA	47,07	45,69 b	48,32 a	3,025		47,09 Ba	45,46 Bb	49,76 A	2,26
Other acids	4,57 a	3,80 b	4,42	1,008		4,78	4,99	4,22	1,349
ω6/ω3	1,06	3,00	2,72	0,017		1,04	2,46	3,75	0,094
SFA/PUFA	7,84 B	12,67 A	10,44 A	3,135		7,50 B	10,97 Aa	8,84 b	2,856
UFA/SFA	0,98	0,91 B	1,03 A	0,115		0,98 Ba	0,92 Bb	1,08 A	0,082
A.I.	0,83	0,96	0,85	0,206		0,83	0,82	0,79	0,115
T.I.	0,65 B	0,81 A	0,68 B	0,085		0,63 B	0,83 A	0,62 B	0,074