

Effects of rearing system on meat quality of Podolian bulls

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Abstract

The study analysed meat of Podolian bulls slaughtered at the age of 14 months. The animals were weaned at the age of 8 months and then reared in 2 different breeding systems: stall feeding (ST) and grazing with supplementary feeding (PA). The anatomical dissection of the lumbar region showed a significantly higher ($P<0.01$) fat deposition in the subjects reared in stalls (ST); this higher adipo-genesis produced a reduced lean synthesis (55.14% vs 60.34%; $P<0.05$). No significant difference was assessed in the dissecting data concerning the pelvic limb cut. The animals subjected to stall feeding produced meats with a significantly higher lightness (L^*), reduced toughness ($P<0.01$) and with a lower WBS value ($P<0.05$). The chemical analyses carried out on *Longissimus lumborum* samples did not show differences between the rearing systems.

Introduction

The Podolian is an autochthonous breed of southern Italy, and is reared prevalently using an extensive or semi-extensive system, which permits a good use of natural grazing to produce meat of high quality.

But in the last few years a complete stall system has gained popularity with many breeders who focus on the production of light and heavy calves, because with a balanced feeding system these animals can obtain good productive performances (Di Trana *et al.*, 1993; Cifuni *et al.*, 2004; Cocca *et al.*, 2005; Marino *et al.*, 2006).

Quantitative and qualitative aspects of Podolian beef, connected with the breeding system and type of feed have been the subject of many studies (Cosentino *et al.*, 2005; Maiorano *et al.*, 2005; Ragni *et al.*, 2006 a,b; Marsico *et al.*, 2007; Vicenti *et al.*, 2007).

The present study was planned in order to assess the influence of breeding system on meat quality.

Materials and methods

Twelve carcasses were analyzed in order to evaluate the influence of breeding system on some parameters of meat quality. These carcasses were from Podolian steers aged 14 months, reared in the experimental system from the age of 8 months. 6 of the animals were reared with a stall feeding system (ST), while the other 6 (PA) were grazed and also given supplementary feed in an outdoor corral of 20 hectares.

Stall-reared animals were fed *ad libitum* with a mixture of barley, oats, fava beans, mineral and vitamin supplements and straw; while animals in the corral received a supplement of fava beans in the evening in addition to grazing, but only if necessary.

After slaughtering, the lumbar region of each right half-carcass was been dissected into lean, fat and bone (Table 1). On each sample of muscle *Longissimus lumborum* (Ll), physical (Table 2) and chemical (Table 3, 4) parameters were analyzed according to the A.S.P.A. methodologies (1996).

The data obtained were then subjected to ANOVA analysis using the GLM procedure (SAS, 1999).

Results and discussion

The results show that the lumbar region of PA (Table 1), with different levels of statistical significance, are richer in lean (60.34 % vs 55.14 %; $P<0.05$) and poorer in fat (4.30 % vs 12.01%; $P<0.01$) than ST.

Table 1. Anatomical dissection of lumbar region (%)

Group	PA	ST	S.E.D. F.D. = 10
Weight (kg)	7.63 B	11.77 A	1.483
Lean	60.34 a	55.14 b	4.059
Fat	4.30 B	12.01 A	2.946
Bone	35.78	32.86	4.754

Different letters (A, B) after values on a line indicate significant differences among ages: A, B: $P<0.01$; a, b: $P<0.05$.

Moreover the meat of the PA group (Table 2), even if with different level of statistic significance, presents a less acid pH (5.81 vs 5.57; $P<0.05$), is less luminous (36.15 vs 40.64; $P<0.01$) and more resistant (3.12 vs 2.21; $P<0.01$) than ST.

Table 2. Physical parameters of meats (Ll)

Group	PA	ST	S.E.D. F.D. = 10
L*	36.15B	40.64A	3.752
a*	14.97	15.14	2.104
b*	12.05	13.42	2.606
pH	5.81a	5.57b	0.311
W.B.S. raw:			
Shear force (kg/cm ²)	1.78	1.92	0.823
Resistance (cm)	3.12A	2.21B	0.452
W.B.S. cooked:			
Shear force (kg/cm ²)	3.41A	1.60B	0.675
Resistance (cm)	1.73a	1.50b	0.299
Cooking loss (%)	24.09	24.66	3.767

Different letters (A, B, a, b) after values on a line indicate significant differences among ages: A, B: $P<0.01$; a, b: $P<0.05$.

The cooked meat of the ST group (Table 2) has a lower shear force value (1.60 vs 3.41; $P<0.01$) and resistance (1.50 vs 1.73; $P<0.05$) than the meat of animals reared in the grazing system.

The chemical composition of raw meat (Table 3) does not seem to depend on the breeding system, in fact no statistically significant differences were observed.

Table 3. Chemical composition of raw meats (Ll) (%)

Group	PA	ST	S.E.D. F.D. = 10
Moisture	73.54	73.92	1.212
Protein	21.94	21.34	1.170
Lipid	1.88	2.23	0.911
Ash	1.80	1.43	0.885
Indet.	0.84	1.08	0.423

Instead the cooked meat (Table 4) of stalled animals (ST) is richer in lipid (3.83 vs 2.25; $P<0.05$) and ash (2.43 vs 1.66; $P<0.01$) but contains less moisture (61.63 vs 64.10; $P<0.01$) than the grazed animals (PA).

Table 4. Chemical composition of cooked meats (Ll) (%)

Group	PA	ST	S.E.D. F.D. = 10
Moisture	64.10A	61.63B	2.335
Protein	30.97	30.99	1.881
Lipid	2.26b	3.83a	1.903
Ash	1.66B	2.43A	0.222
Indet.	1.02	1.12	0.582

Different letters (A, B, a, b) after values on a line indicate significant differences among ages: A, B: $P<0.01$; a, b: $P<0.05$.

Conclusions

The semi-extensive system of breeding favorably influences the presence of lean meat in the lumbar region. The PA meat was less luminous, because these animals had higher myoglobin levels than the ST animals, due to differences in physical activity (Shorthose & Harris, 1991); PA meat was also less acid and more resistant, and the chemical composition of cooked meat presented higher levels of moisture and lower levels of fat.

References

- A.S.P.A. (1980) – Valutazione degli alimenti di interesse zootecnico. I. Analisi chimica. *Zoot. Nutr. Anim.*, vol. 6, 19-34.
- A.S.P.A. (1989) – Metodologie relative alla macellazione, alla valutazione e dissezione della carcassa di animali di interesse zootecnico. *Agr. Ric.*, 11, (99-100), 39-45.
- Cifuni G.F., Napoletano F., Riviezzì A.M., Brughieri A., Girolami A. (2004) – Fatty acid profile, cholesterol content and tenderness of meat from Podolian young bulls. *Meat Science*, 67:289-297.
- Cocca C., Ragni M., Dimatteo S., Di Turi L., Vicenti A. (2005) – Prestazioni produttive di vitelloni Podolici allevati con differenti regimi alimentari. *Atti Proceedings 4° convegno Mondiale delle Razze Bovine Italiane da Carne* (Gubbio, 29 aprile-1 maggio), 463-468
- Cosentino E., Perna A., Cosentino C., Santarsiere L.A., Marsico D., Gambacorta E. (2005) - Vitelloni podolici in allevamento brado e semibrado: II. Resa alla macellazione e alla sezionatura in carcassa. *Atti Proceedings 4° convegno Mondiale delle Razze Bovine Italiane da Carne* (Gubbio, 29 aprile-1 maggio).
- Di Trana A., Marsico G., Muscio A. (1993) - Variazioni quanti-qualitative del latte di bovine di razza “podolica”: influenza del sottosistema di allevamento. *Atti XXVIII simposio internazionale di zootecnia*, Milano, 14 maggio, 269-276.
- Maiorano G., Gambacorta E., Cavone C., Ciarlariello A., Di Cesare C., Manchisi A. (2005) - Caratteristiche sensoriali e nutrizionali della carne di bovini Podolici. *Atti Proceedings 4° convegno Mondiale delle Razze Bovine Italiane da Carne*, Gubbio, 29 aprile-1 maggio.
- Marino R., Albenzio M., Girolami A., Muscio A., Sevi A., Brughieri A. (2006) – Effect of forage to concentrate ratio on growth performance, and on carcass and meat quality of Podolian young bulls. *Meat Science*, 72:415-424.
- Marsico G., Ragni M., Vicenti A., Melodia L., Cocca C., Perrucci M. (2007) – Effect of different diets on fatty acid profile of podolian young bulls meat. *Proceedings of 53rd International Congress of Meat Science and Technology*, 369-370. August 5 – 10, Beijing, China.
- Ragni M., Cocca C., Di Turi L., Vicenti A. (2006) – Aspetti qualitativi della carne di vitelli Podolici allevati con differenti regimi alimentari. *Taurus*, Anno XVIII, 7:79-85.
- Ragni M., Cocca C., Melodia L., Di Turi L., Marsico G., Vicenti A. (2006) – Caratteristiche qualitative e dietetiche delle carni di vitelloni Podolici in relazione ai diversi sistemi di allevamento. *Taurus*, Atti I Congresso Nazionale ARNA, Bologna 23-25 marzo, 120.
- S.A.S. (1999) - S.A.S. Institute Inc., Ed. Cary (N.C.) U.S.A.
- Shorthose, R. W., & Harris, P. V. (1991). Effects of growth and composition on meat quality. In A. M. Pearson & T. R. Dutson (Eds.), *Advances in meat research* (7th ed., p. 515). London, UK: Elsevier.
- Vicenti A., Ragni M., Di Turi L., Marsico G., Totada F., Facciolongo A.M., Lastilla M. (2007) – Effects of different diet and ageing time on meat physical quality traits of podolian young bulls. *Proceedings of 53rd International Congress of Meat Science and Technology*, 275-276. August 5 – 10, Beijing, China.
- <http://www.anabic.it>
- <http://www.politicheagricole.it/PRODUZIONE/ZOOTECNICA/Razze/podolica.htm>