# Meat quality of Podolian bulls slaughtered at different ages

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**Abstract**

The objective of this study was to evaluate the tissue composition of some sample cuts and the meat quality of Podolian bulls slaughtered at different ages. The bulls were reared in stalls and received the same diet. Twelve samples of meat cuts were analyzed. Six of these were from 14-month-old bulls (Group *A*) while the other six were from 18-month-old (Group *B*) bulls. Group *B* presented a significantly higher incidence of lumbar region meat (P<0,01) and a lower incidence of external fat (P<0.05). However, the leg region of Group *B* presented a lower incidence of lean (65.31% *vs* 71.03%; P<0.01) and a higher incidence of fat (14.99% *vs* 11.30%; P<0.01), so that we obtained two contrasting results. The meat of Group *B* was less bright (L*), redder (a*) and had a lower pH than *A* group. The meat was tougher, especially when cooked (P<0.01). Finally the chemical composition of the *Longissimus lumborum* muscle presented a higher incidence of protein (P<0.01) and fat, and a lower moisture content in *B* group.

## Introduction

Podolian cattle are one of the most important native Italian breeds. Many other more famous breeds (Chianina, Marchigiana, Romagnola and Maremmana) have the Podolian as ancestor. These animals were once reared in many different Italian regions, whereas in recent years a dramatic reduction of the number of heads has relegated this breed to some marginal areas of southern Italy. Traditionally, Podolian grazes natural pasture in family herds throughout the year. For meat production, calves are dam-reared on pasture for about 10 months and are then fed a finishing diet in loose housing conditions with external paddock. The steers are slaughtered at the age of 14 to 18 months.

Little is known about nutrient composition, tenderness and colour of meat produced by Podolian cattle. This breed is genetically lean and produces meat with low levels of marbling, and the meat is often characterised by reduced tenderness and is dark in colour due to the extensive rearing system.

Consumer perception of product quality is based above all on the physical characteristics of the product, communication about the product (Issanchou, 1996) and nutritional information. One of the most important aspects of meat quality that determines overall acceptability is texture. In particular, tenderness play a central role in orienting consumer preference (Risvick, 1994) with consumers willing to pay higher prices for more tender meat (Boleman et al., 1997). Grunert (1997) found that the most important considerations for European consumers when buying meat are taste, tenderness and juiciness.

The aim of this study was to evaluate the tissue composition of some sample cuts and the meat quality of Podolian bulls slaughtered at different ages.

## Materials and methods

This trial was carried out on 12 Podolian steers, from the same farm in the Basilicata region, of southern Italy. At the age of about 10 months, the animals were moved to a stall for fattening and divided into 2 homogeneous groups of 6 animals each. During the trial period, the animals were fed *ad libitum* on hard wheat straw and a complete pellet feed, containing field bean, oats and a vitamin-mineral integrator. The steers were slaughtered at the age of 14 months (Group *A*) and 18 months (Group *B*), according to veterinary police regulations.

The carcasses were divided into two half sides. The right half carcasses were then divided into two quarters and dissected according to ASPA (1996) methodologies. The pelvic limb and the lumbar region were separated, and then dissected into their tissue components: lean, fat and bone. Samples of the *Longissimus lumborum (Ll)* muscle were taken in order to evaluate the meat quality characteristics.

Meat physical characteristics were determined according to ASPA official methodologies (1996). The pH values were measured on the *Ll* muscle, after the carcasses had been refrigerated for 24 hours at 4°C. The colorimetric indexes (L* = Lightness, a* = red index, b* = yellow index) were assessed on *Ll* samples using the Hunter Lab system (Colourmeter Miniscan XE, D65) with five readings taken for each sample. Four samples of raw and cooked meat (1 inch diameter) were taken from *Ll* muscle and subjected to the shear force, according to the Warner Bratzler Shear (WBS) system using an Instron 5544 Instrument. In order to determine cooking loss percentage, meat samples were obtained from each *Ll* muscle which were homogeneous in dimension (about 5 cm thick). These were weighed before and after cooking in a ventilated

electric oven at 165°C, until an internal temperature of 75°C was reached in the core of the meat sample (ASPA, 1996), measured by a thermocouple (Hanna Instruments).

Chemical analysis was performed on raw meat from the *Ll* muscle, using 250 g samples, devoid of external fat, epimysium and parts in which metamyoglobin was formed. The chemical composition (ASPA, 1996) was determined on cubed samples which were homogenized using a homogenizer with double rotating blade.

The data were analysed for variance (ANOVA) using the GLM procedure of SAS (2000).

**Results and discussion**

Group *B* (Table 1) presented a significantly higher incidence of lean in the lumbar region (63.99% *vs* 61.13%; P<0.01), a higher incidence of external fat (8.85% *vs* 7.67%; P<0.05) and a lower incidence of bone (27.15% *vs* 31.35%; P<0.01), than Group *A*. Group *B* also presented a higher weight of the pelvic limb (60.81 *vs* 38.15; P<0.01) with a lower incidence of lean (65.31% *vs* 71.03%; P<0.01) and a higher incidence of fat (14.99% *vs* 11.30%; P<0.01) and bone (19.69% *vs* 17.65%; P<0.05). This is in contrast with Gullett et al. (1995), who found no statistically significant difference for percent fat as affected by age of steers. On the contrary, Sargentini *et al*. (1999) reported that the percentage of fat tissue increases with age, and the incidence of bone decreases in half carcasses of Maremmana young bulls.

**Table 1.** Anatomical dissection of main cuts (%)

| | Lumbar region | | S.E.D. |
|---|---|---|---|
| Group | *A* | *B* | F.D. = 10 |
| Weight(kg) | 11.77 | 11.92 | 1.174 |
| Lean | 61.13B | 63.99A | 1.830 |
| Fat | 7.67b | 8.85a | 1.187 |
| Bone | 31.35A | 27.15B | 1.866 |
| | Pelvic limb | | S.E.D. |
| Group | *A* | *B* | F.D. = 10 |
| Weight(kg) | 38.15B | 60.81A | 4.273 |
| Lean | 71.03A | 65.31B | 1.862 |
| Fat | 11.30B | 14.99A | 1.231 |
| Bone | 17.65b | 19.69a | 1.482 |

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 *Ll* meat (Table 2) in Group *B* was less bright (L*) (38.12 *vs* 40.64; P<0.01), redder (a*) (16.34 *vs* 15.14; P<0.05) and presented a reduced pH when compared with Group *A* (5.44 *vs* 5.57; P<0.05).

The meat produced by 18 months old bulls was tougher, especially when cooked (3.29 kg/cm$^2$ *vs* 1.60 kg/cm$^2$; P<0.01). These results agree with Gullett *et al*. (1995), whose trials showed that samples from 12-month-old animals were significantly more tender then those from 17-month-old animals. However, Sargentini *et al*. (1999) showed that physical characteristics of meat do not change significantly with subjects' age. In our study, the effect of age on cooking losses is not significant, according to Gullett *et al*. (1995).

**Table 2.** Physical parameters of meats (*Ll*)

| Group | *A* | *B* | S.E.D. F.D = 10 |
|---|---|---|---|
| L* | 40.64A | 38.12B | 1.476 |
| a* | 15.14b | 16.34a | 1.536 |
| b* | 13.42 | 13.57 | 1.529 |
| pH | 5.57a | 5,44b | 0.187 |
| W.B.S. raw: | | | |
| Shear force (kg/cm$^2$) | 1.92 | 2.34 | 0.884 |
| Resistance (cm) | 2.21B | 2.93A | 0.460 |
| W.B.S. cooked: | | | |
| Shear force (kg/cm$^2$) | 1.60B | 3.29A | 0.863 |
| Resistance (cm) | 1.50 | 1.54 | 0.286 |
| Cooking loss (%) | 23.14 | 24.61 | 4.963 |

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.

Finally the chemical composition of Group *B Ll* (Table 3) presented a higher incidence of protein (22.25% *vs* 21.34; P<0.01) and fat - although the difference was not significant - and a lower value of moisture (72.29% *vs* 73.92%; P<001).

**Table 3.** Chemical composition of meats (%)

| Group | *A* | *B* | S.E.D. F.D = 10 |
|---|---|---|---|
| Moisture | 73.92A | 72.29B | 1.604 |
| Protein | 21.34B | 22.25A | 0.738 |
| Lipid | 2.23 | 2.40 | 0.849 |
| Ash | 1.43B | 1.54A | 0.095 |

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 *Longissimus lumborum* of steers slaughtered at the age of 18 months showed an increasing incidence of subcutaneous fat in connection with chronological deposition of tissues; a typical behaviour of the breed showing fat tissue deposition later than bone and muscular tissue (Sargentini et al., 1999). The meat of *Ll* in Group *B* was less bright, redder and tougher especially when cooked. The chemical composition of meat from older animals presented a higher incidence of protein and fat.

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