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Lamb meat quality of two breeds with protected origin designation. Influence of breed, sex and live weight

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Abstract

Lamb meat quality of two Portuguese products was examined. The influences of slaughter weight, sex and breed on eating quality were evaluated. Data were obtained from 72 lambs of two different breeds with protected designation origin. In accord with the normal slaughter weight in the region three classes were considered: **A**: 9–14 kg live weight; **B**: 14–19 kg live weight and **C**: 19–24 kg live weight. pH of *M. longissimus thoracis et lumborum* muscle (MTL) was measured 1 h and 24 h after slaughter. Meat colour was estimated in the *M. longissimus thoracis et lumborum* muscle (MTL) muscle on the 12th rib using the $L^*a^*b^*$ system. Shear force was evaluated 72 h after slaughter. Sensorial analysis was assessed by a trained taste panel of 12 members. The pH values found could be considered within the normal pH range, between 5.5 and 5.9. When the pH measurement was made 24 h after slaughter, the heavy lambs had significant higher value than the light lambs. In relation to colour variables, live weight, sex and breed had no effect on the red index (a^*). Lightness (L) decreased with increasing live weight and the light lambs had higher yellow index (b^*) than the heavier lambs. Shear force increased with live weight and the Bragançano breed had a greater mean shear force than the Mirandesa (7.8 vs. 6.8 kg/cm^2). The heavy carcasses had more flavour intensity than the light ones. Mirandesa lambs had significantly lower values for toughness, stringy and odour intensity than Bragançana lambs.

Keywords: Lamb; Meat quality; Instrumental measurement; Sensory analysis

1. Introduction

According to Warriss (2000), when most people talk about quality they tend to mean the functional quality that refers to desirable attributes in a product such as yield, technological properties and palatability. We considered yield as the proportion of saleable meat and muscle size and shape, the colour of meat, pH and shear force as technological properties, and texture and tenderness, juiciness, flavour and odour as palatability characteristics.

The increasing importance of lamb meat quality to butchers and consumers has been an objective of several studies in recent years (Bennett, 1997; Bickerstaffe, Le Couter, & Morton, 1996; Carlucci, Napolitano, Girolami, & Monteleone, 1999; Channon, Ross, Cooper, & Maden, 1993; Devine, Graafhuis, Muir, & Chrystall, 1993; Ellis, Webster, & Brown, 1997; Hoffman, Muller, Cloete, & Schmidt, 2003; Hopkins, 1993; Hopkins, Ferrier, Channon, & MacDonald, 1995; Purchas, Silva Sobrinho, Garrick, & Lowe, 2002; Safari, Fogarty, Ferrier, Hopkins, & Gilmour, 2001; Young, Reid, & Scales, 1993). More recently, Rødbotten, Kubbeød, Lea, and Ueland (2004) working with different species, including lamb, investigated if meats could be described and compared by sensory analysis.

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Lamb meat quality is influenced by several factors, such as breed (Fisher et al., 1999; Fogarty, Hopkins, & Vande Ven, 2000; Hoffman et al., 2003; Purchas et al., 2002; Safari et al., 2001; Sañudo et al., 1997; Santos Silva, Mendes, & Bessa, 2002) slaughter weight (Jeremiah, Tong, & Gibson, 1998; Purchas et al., 2002; Sañudo, Santolaria, María, Osorio, & Sierra, 1996) and sex (Butler-Hogg, Francombe, & Dransfield, 1984; Dransfield, Nute, Hogg, & Walters, 1990). Nevertheless other factors could influence meat quality such as pre-slaughter stress, carcass cooling rate and ageing regimen.

The implementation of provisions of Council Regulation (EEC) No. 2081/92 of 14 July, 1992 on the protection of geographical indications and designations of origin for agricultural products and Council Regulation (EEC) No. 2082/92 on certificates of specific character for agricultural products and foodstuffs was a great incentive for small ruminant production in several countries particularly in the NE of Portugal that has a great tradition in lamb production. Producers were encouraged to continue producing according to the traditional methods because the products are well accepted by the consumers. In consequence, more and more information, such as quality and safety guarantee is required by consumers.

This work examines the sensory quality of meat of two Portuguese breeds with protected origin designation, representing the type commonly slaughtered in the Mediterranean area, particularly in Portugal. The influence of slaughter weight, sex and breed on some characteristics of the lamb and eating quality were also evaluated.

2. Material and methods

2.1. Animals and sampling

Data were obtained from 72 lambs (18 lambs from each sex and breed were used) from two different breeds selected at random by each of the two National Association of Breed Producers, and reared under normal conditions and according to the main elements of the specifications for these protected designation origin products. Lambs remain with their mothers during grazing. There are extensive areas of hill grazing at an altitude varying from 481 to 1000 m, in a succession of uplands and deep valleys the weather is often harsh and there are wide variations in food supply. The flocks are rarely given supplementary foods, only during winter some meadow hay is given. Lambs were raised traditionally, suckling milk from their dams, not being weaned until slaughter at 3–4 months of age, normally at the end of autumn.

According to the normal slaughter weights in the region, three classes were considered: **A**: for live weight between 9 and 14 kg; **B**: for live weight between 14 and 19 kg and **C**: for live weight between 19 and 24 kg.

Lambs were transported in an appropriate manner under the animal welfare rules and according to UE government regulations. From the origin to slaughter house the Mirandesa lambs travelled 50 km further than the Bragançana lambs.

All lambs were slaughtered after a 24 h fast in the experimental slaughter house at the Bragança's School of Agriculture (Escola Superior Agrária de Bragança). After slaughter, carcasses were cooled at 4 °C for 24 h. Carcasses were halved carefully. The kidney and pelvic fat were removed and weighed. The left side of each carcass was divided into eight standardized commercial joints: leg, chump, loin, ribs, anterior ribs, shoulder, breast and neck. The joint procedure was outlined by Teixeira (1984) according to the Zootechnique National Station cut (Estação Zootécnica Nacional – EZN cut) Calheiros and Neves (1968). Each joint was then dissected into muscle, subcutaneous fat, intermuscular fat, bone and remainder (major blood vessels, ligaments, tendons and thick connective tissue sheets associated with muscles). In total 72 carcasses were evaluated and completely dissected.

2.2. Instrumental measurement

All instrumental measurements were obtained from the left side of the carcass. *M. longissimus thoracis et lumborum* muscle (MTL) pH was measured 1 h and 24 h after slaughter on the 12th rib using the equipment Crison, pH-metro 507 and a 52–32 spear electrode. Meat colour was estimated in the MTL muscle on the 12th rib using the $L^*a^*b^*$ system with a chromameter Minolta CR 300. This system of colour was described with the coordinates $L^*a^*b^*$ representing lightness, redness and yellowness (CIE, 1986). Colour measurements were made on freshly cut surfaces in seconds after carcasses have been cooled at 4 °C for 24 h. Shear force was evaluated 72 h after slaughter, using an INSTRON 5543-J 3177 equipped with a Warner–Bratzler device. MTL muscles were cooked within plastic bags in a 70 °C water bath for 90 min. Half an hour after, muscle sub-samples (1 cm^2 cross-section) were taken from each MTL muscle for shear force evaluation. For each animal eight shears were made. The measurement was recorded as the average yield force in kilograms, required to shear perpendicularly to the direction of the fibres.

2.3. Sensory analysis

The lumbar region of the *longissimus thoracis et lumborum* muscle from the right side of the carcass was taken for sensory analysis by a trained taste panel of 12 members. Panel members were selected and trained in