EFFECT OF ANATOMICAL LOCATION ON THE CHEMICAL COMPOSITION OF *LONGISSIMUS THORACIS ET LUMBORUM* MUSCLE IN CATTLE

M. Oliván[1], V. Sierra*[1], A. Coto-Montes[2], N. Aldai[1], M.J. Martínez[1], M. Mocha[1] and K. Osoro[1]

[1] *SERIDA, Apdo. 13, 33300 Villaviciosa, Asturias, Spain.* [2] *Departamento de Morfología y Biología Celular, Universidad de Oviedo, 33006 Oviedo, Asturias, Spain. Email: veroniss@serida.org*

Keywords: *Longissimus* muscle, cattle, moisture, fat, protein

Introduction

Most studies concerning meat quality in ruminants are based on the analysis of the *Longissimus thoracis et lumborum* (LTL) muscle mainly due to its big size, easy access and great importance in the carcass. Furthermore, a high homogeneity of physico-chemical characteristics along the muscle is supposed (Jeremiah and Murray, 1984, Belew *et al.*, 2003), although some authors have shown that there is significant variability along this muscle in quality traits such as tenderness (Gariepy *et al.*, 1990).

However, there are relatively few studies which have investigated the possible variation in the chemical composition of meat within this muscle. The objective of this work was to study the differences of chemical composition (moisture, intramuscular fat and protein contents) at two different anatomical locations (cranial and medial sections) of bovine LTL muscle.

Materials and Methods

Thirty three LTL muscles were taken from yearling bulls of two local breeds from northern Spain, Asturiana de los Valles (AV, n=23) and Asturiana de la Montaña (AM, n=8), and their crosses (AV x AM, n=2). Animals of the AV breed were homozygous (*mh/mh*), heterozygous (*mh/+*) or normal (+/+) for muscular hypertrophy gene. Calves were weaned after 8 months suckling, fattened by feeding concentrate meal and barley straw *ad libitum* and slaughtered at a live weight around 500 kg and with 14 to 18 months age in a commercial abattoir following approved EU procedures. Twenty four hours post-slaughter the left half carcass was quartered between the 5th and 6th thoracic vertebrae with a circular saw, and the LTL muscle was extracted and transported to the laboratory. Two loin steaks of 2.5 cm thick were sampled at two different locations in the muscle, at the 6th rib level (cranial) and at the 9th rib level (medial), aged at 4°C for 7 days and frozen at –20°C for subsequent determinations. Muscle chemical composition (percentage of moisture, intramuscular fat and protein) was determined in ground meat by near infrared spectroscopy transmittance (NIT) using calibrations developed by Oliván *et al.* (2002). Beef samples were scanned by duplicate in a Meat Analyzer 1265 of Infratec (FOSS), which operates from 850 to 1050 nm at 2nm intervals. Samples were placed into a glass cup of 130 mm diameter and the average spectra of 15 scan locations was recorded as log 1/*T* (*T*= transmittance). Analysis of variance was carried out to test the effect of sampling location on the chemical composition of meat. Lineal regressions between variables were assessed by Pearson correlation coefficient (r). All statistical analyses were performed using SPSS (SPSS Inc., Ireland) version 11.5 (2002).

Results and Discussion

Table 1 shows the chemical composition of the loin at two different sampling locations: cranial and medial. In spite of the short distance between these two ribs (6th and 9th), location affected significantly the meat composition. Samples taken in the cranial section had lower moisture (73.4 *vs* 74.8, $P<0.001$), higher intramuscular fat (2.9 *vs* 1.9, $P<0.001$) and higher protein content (22.7 *vs* 22.5, $P<0.05$) than samples obtained from the medial section.

Table 1: Chemical composition of meat at the cranial and medial sections of *Longissimus thoracis et lumborum* muscle

	CRANIAL SECTION (6th rib)			MEDIAL SECTION (9th rib)			EFFECT
	Mean	range	sd	mean	range	sd	LOCATION
Moisture (%)	73.4	72.0-74.9	0.72	74.8	73.2-75.7	0.61	***
Fat (%)	2.9	0.9-4.9	1.18	1.9	0.5-3.5	0.85	***
Protein (%)	22.7	21.8-23.9	0.51	22.5	21.5-23.2	0.43	*

These results agree with those reported by O'Neill *et al.*, (2004), who found that moisture and intramuscular fat contents did vary along the location in the LTL muscle ($P<0.05$), with a lower percentage of moisture and higher of fat in the cranial than in the medial sections, although these authors considered this variation not important due to the small difference between the average values (74.73 *vs* 74.84 for moisture; 1.85 *vs* 1.59 for fat).

Our results showed higher differences, probably due to the wider range of intramuscular fat content in the animals studied (0.5 to 4.9%). Furthermore, we found that the relationships between the chemical composition (moisture, fat and protein) at the cranial and medial sections were lineal (Figure 1). It can be seen that for moisture (Figure 1a) differences between both sections (cranial and medial) decreased and that regression points moved towards the line of equality as

the amount of moisture in muscle increased, while for fat (Figure 1b) and protein (Figure 1c), opposite effect was found, with differences between locations increasing as the amount of fat or protein in muscle was higher. These data show that the magnitude of variation in the chemical composition between the medial and cranial sections of the LTL muscle depends on the composition of meat, being higher in animals or breeds with higher capacity for intramuscular fat deposition.

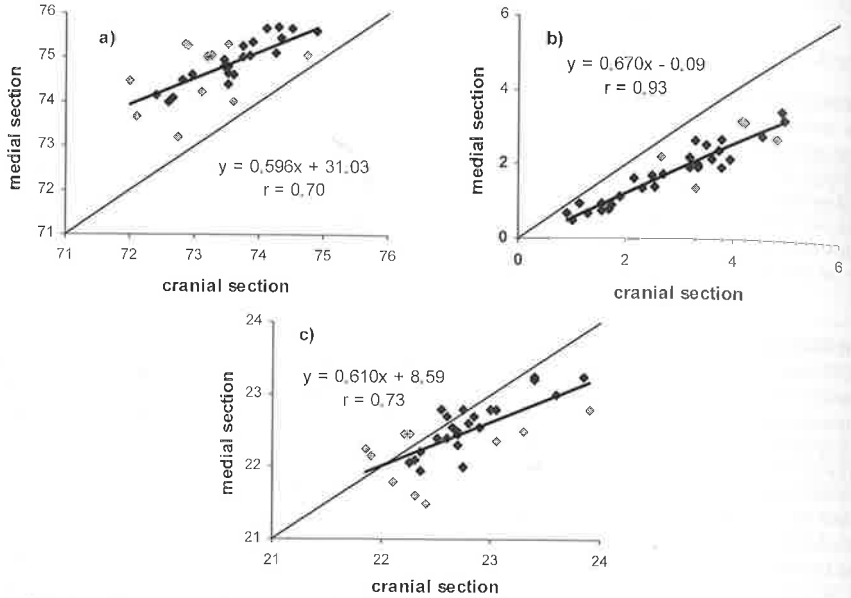

Figure 1: Relationship between the moisture **(a),** intramuscular fat **(b)** and protein **(c)** content (%) of LTL measured at the cranial and medial sections. Solid line is the line of equality.

Conclusions

There was a significant variation in the chemical composition of meat along the LTL muscle, which should be taken into account by researchers when obtaining meat samples for assays. This means that meat samples for chemical analysis should always be extracted at the same region within the muscle in order to avoid confusion when comparing results from different studies.

References

Belew, J.B., Brooks, J.C., McKenna, D.R. and Savell, J.W. (2003). Warner-Bratzler shear evaluations of 40 bovine muscles. Meat Science, 64, 507-512.

Gariepy, C., Jones, S.D.M. and Robertson, W.M. (1990). Variation in meat quality at three sites along the length of the beef longissimus muscle. Canadian Journal of Animal Science, 51, 35-42.

Jeremiah, L.E. and Murray, A.C. (1984). The influence of anatomical location within the *Longissimus dorsi* muscle on everall tenderness and on the concentration and solubility of intramuscular collagen. Canadian Journal of Animal Science, 64, 1045-1047.

Oliván, M, de la Roza, B., Mocha, M. and Martínez, M.J. (2002). Prediction of physico-chemical and texture characteristics of beef by near infrared transmittance spectroscopy. Proc. 10th International Conference of Near Infrared Spectroscopy, Korea, pp. 197-202.

O'Neill, D.J., Troy D.J. and Mullen, A.M. (2004). Determination of potential inherent variability when measuring beef quality. Meat Science 66, 765-770.

SPSS 11.5. (2002). Guía breve. SPSS Inc. Ireland.