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# A comparison between two methods (Warner–Bratzler and texture profile analysis) for testing either raw meat or cooked meat

F. Ruiz de Huidobro *, E. Miguel, B. Blázquez, E. Onega

*IMIA, Apdo, 127, 28800 Alcalá de Henares, Spain*

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**Abstract**

Two methods for assessing texture characteristics of meat (Warner–Bratzler (WB) – and texture profile analysis (TPA)), both performed either on raw or on cooked meat, were tested in 96 samples of *m. longissimus dorsi* muscle of eight heifers and eight bulls, aged 1, 3 or 6 days post-mortem. A sensory analysis was also performed on 96 samples. Sensory variates were predicted by instrumental variates as follows: hardness was better predicted by TPA than by WB; springiness was only predicted by WB; juiciness was only significantly predicted by TPA; greasiness was always poorly predicted, but the prediction was better with TPA, and the number of chewings was also better predicted with TPA. Results suggested the convenience of performing a TPA for assessing meat texture as, in cooked meat, only TPA furnished highly significant correlations for hardness, for juiciness and for the number of chewings. Although WB could predict hardness and springiness, only the equation for the prediction of the number of chewings was useful ($r^2 = 0.171$, $P < 0.004$). It seems that texture parameters, assessed by a TPA and performed on cooked meat, are the best predictors of sensory texture in bovine meat.


*Keywords:* Meat; Bovine; Texture; Cooking

## 1. Introduction

Some of the most important sensory attributes of meat are appearance, juiciness, flavour and texture (Barton-Gade, Cross, Jones, & Winger, 1988). Texture values in bovine meat mainly depend on zootechnical characteristics of the animal such as breed, age and sex (Huff & Parrish, 1993; Ouali, 1990), on anatomical characteristics such as type of muscle (Zamora, 1997), on factors external to the animal, as handling and feeding characteristics (Aalhus et al., 1992), or on technological characteristics such as electrical stimulation (Aalhus et al., 1992) or meat cooking method (Panea et al., 2003; Sañudo, Monsón, Panea, Pardos, & Olleta, 2003). Texture includes a variety of characteristics, such as hardness (some authors call it toughness), springiness, chewiness, and some authors also include juiciness (Szczesniak, 1963), and even greasiness (Brandt, Skinner, & Coleman, 1963). Among texture attributes, hardness is the most important to the consumer, as it decides the commercial value of a meat (Chambers & Bowers, 1993). Texture is by definition a sensory parameter that only a human being can perceive, describe and quantify (Hyldig & Nielsen, 2001). Instrumental texture assessment on meat is made by means of a texturometer, a device that allows tissue resistance both to shearing and to compression to be measured.

The most widespread method normally used as an indicator of meat sensory hardness (tenderness) is the Warner–Braztler (WB) shear test, almost the sole methodology used in raw meat (Bratzler, 1932; Warner,

* Corresponding author. Fax: +34 91 887 9492.
*E-mail address:* felipe.ruiz@madrid.org (F.R. de Huidobro).

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1928), and which is referred to in most papers (Culioli, 1995), even as a technique used for commercial application (Shackelford, Wheeler, & Koohmaraie, 1995, 1999; Wheeler et al., 1997). Safari, Fogarty, Ferrier, Hopkins, and Gilmour (2001) found a negative and very significant correlation between shear force and sensory tenderness in sheepmeat; nevertheless, other authors have not found a good correlationship between WB shear force and overall consumer acceptance (Platter et al., 2003).

There is another method – the texture profile analysis (TPA) – that, although it is widely used for texture assessment in other food (Guerrero & Guàrdia, 1999), meat researchers rarely use. Nevertheless it has been successfully used for texture assessment in fish muscle (Veland & Torrissen, 1999). The main advantage of TPA is that one can assess many variates with a double compression cycle. Variates that can be assessed with this analysis are: hardness, springiness, cohesiveness, adhesiveness, resiliency, fracturability, gumminess, chewiness, etc. In meat the variates assessed are hardness, springiness, and cohesiveness; the three altogether permit the calculation of chewiness (Ruiz de Huidobro et al., 2001).

There is no agreement about which of the meat 'states' (raw or cooked) analysis is the best, the former being quicker and cheaper, and the latter using samples similar to those consumed by people (Onega, Miguel, Blázquez, & Ruiz de Huidobro, 2001). The objective of this work was to investigate which one of the two instrumental methods for the assessment of meat texture (WB or TPA), both in raw meat and in cooked meat, was more useful for the prediction of sensory texture.

## 2. Materials and methods

Sixteen loin muscles were used, and they were taken from eight heifers and eight bulls. Animals used in this study were females 10–12 months old, with a hot carcase weight (HCW) of 236 kg, and entire males 13–15 months old, 364 kg HCW. They were slaughtered in a commercial abattoir. Twenty-four hours post-mortem the loin muscle from both sides of the animal between the 6th and 13th thoracic vertebrae was removed and cut into sample steaks as shown in Fig. 1. Each steak was divided into two halves, by means of a cut parallel to the sagittal plane surface and aged at 4 °C for 1 day, 3 days and 6 days post-mortem. Muscle halves examined were outer left (1 day of ageing), inner right (3 days), and outer right (6 days). Samples were deep frozen (under −30 °C) and preserved at −25 °C until assessment (about three months later).

The characteristics of the samples have been described elsewhere (Ruiz de Huidobro, Miguel, Onega, & Blázquez, 2003b). The samples, shown in Fig. 1, were thawed in cold water (at room temperature) for 2 h before testing. Samples were placed on aluminium-folded strips and grill-cooked to a core temperature of 80 °C after the grill was preheated to 250 °C; a modification of the method described by Onega et al. (2000). After cooking steaks were left to cool on a dish at room temperature for 30 min, and then chilled 2 h in a refrigerator at 4 °C. For texture assessment 1 cm × 1 cm-strips were made from each steak both in raw meat (steak E in Fig. 1) and in cooked meat (steak I in Fig. 1). Meat samples (prisms) were analysed in a texturometer TA-XT2 of Aname™ (Stable Micro Systems, Godalming, Surrey,

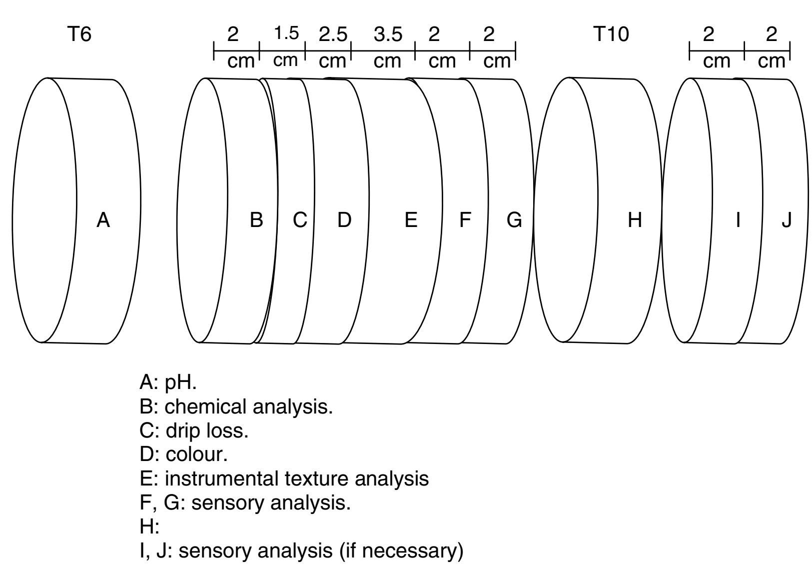


Fig. 1. Diagram of sampling procedure on *m. longissimus thoracis et lumborum* muscle. T6 and T10: 6th and 10th thoracic vertebrae (after Sañudo et al., 2000). Reprinted from Ruiz de Huidobro et al., 2003b Fig. 1, page 1440.