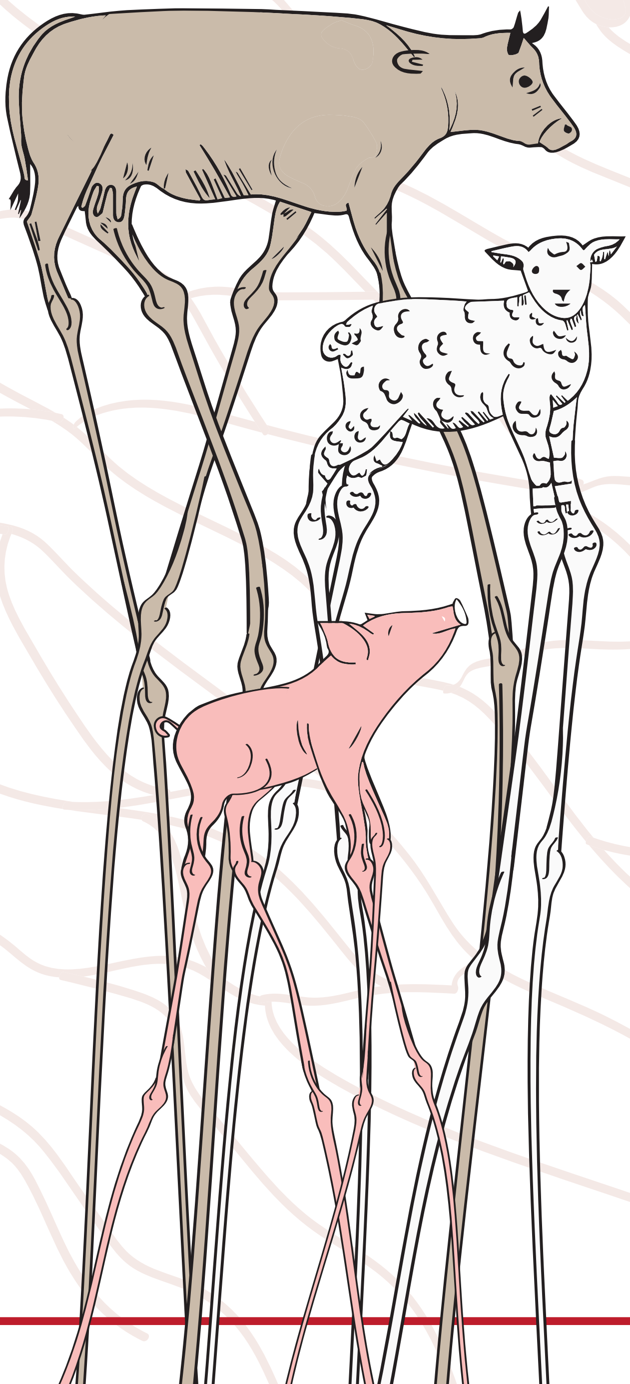
ABSTRACTS BOOK

71st ICoMST

International Congress of Meat Science and Technology



IRTA

Generalitat de Catalunya

CORRELATIONS BETWEEN DIFFERENT TEXTURE DEVICES (WBSF, SSF, BMORS) AND SENSORY PROPERTIES IN VARIOUS PORK MEATS

Isabel Revilla[1*], Marta Rodríguez-Fernández[1], Ana M. Vivar-Quintana[1], Chaoyue Wang[2], Shai Barbut[2]

[1] Food Technology Area, Universidad de Salamanca, EPSZ de Zamora, Avenida Requejo, 33, 49022, Zamora, Spain.

[2] Department of Food Science, University of Guelph, 50 Stone Road E., Guelph, Ontario N1G 2W1, Canada.

*Corresponding author email: irevilla@usal.es

I. INTRODUCTION

The feasibility of developing models to predict meat texture from instrumental analysis is a topic of great interest [1,2] because Descriptive Sensory Analysis, which has traditionally been used for sensory analysis, is time consuming and expensive (requires the recruitment, selection, training and qualification of assessors) [3]. Of the available shear methods, the most widely used has been Warner-Bratzler Shear Force, although Slice Shear Force (SSF) is currently the method recommended by the National Cattlemen's Beef Association (NCBA). Another option is the Meullenet-Owens Razor Shear (BMORS) blunt test which is claimed to be the fastest, most accurate and simplest tool for measuring poultry tenderness. However, this method has not been used for pork loin. Furthermore, although several studies have been conducted on the correlation between sensory and instrumental measurements, the relationships appear to be food specific [4].
The aim of this work was to study the feasibility of using the BMORS device for pork texture evaluation and to establish which device is the most suitable by calculating the correlations between the parameters obtained with the different devices and the texture parameters determined by a trained sensory panel.

II. MATERIALS AND METHODS

Two 3.5 cm thick pork loin slices were cut between T9 and T13, kept at 4°C for 72 h and then vacuum packed, frozen and stored at <-20°C for up to 3 months. A total of 100 samples were selected from different breeds, management systems and diets: animals raised in montanera, i.e., fed outdoors with grass and acorns (50% and 100% Iberian), fed with feed outdoors (cebo de campo) (50% Iberian) and for the latter system, samples from a trial with or without space enrichment with pond, chain and toys (100% Iberian) were also analyzed. For the intensive systems, samples were collected from an enriched environment trial (playing with balls and ropes) vs. non-enriched (50% Iberian) and finally white breed animals fattened with different diets: control vs. feed including 0.015% citrus by-products (Biocitro ®, Probena, Zaragoza, Spain) and control vs. feed including 0.2% carob were also analyzed.
Samples for room temperature analysis were vacuum packed, cooked in water bath at 76ºC until internal 72°C (Checktemp1 Hanna Instruments, Eibar, Spain), after which they were transferred to an ice bath, for 10 min, and then refrigerated for 6 h. Samples for hot analysis were grilled on a plate grill (KGJ442, GGM Gastro International, Ochtrup, Germany) preheated to 200ºC. When the center reached 40ºC, the samples were turned over reaching 68ºC, removed from the plate and allowed to stabilize until the internal temperature was 70ºC. For WBSF analysis, six cylindrical portions (1.27 cm diameter) were obtained parallel to the muscle fiber direction and were sheared in the perpendicular direction of the muscle using a 2.97 mm thick Warner–Bratzler blade. For SSF analysis, a kit was used to cut each of the two slices, obtaining two subsamples per slice which were sheared using flat blunt-point blade with a thickness of 1.1684 mm and a half-round beveled cutting edge. BMORS analyses were performed at six different points along the entire slice surface with the blade (9 mm wide x 0.42 mm thick) positioned at 90° to the surface. Both WBSF and SSF were attached to a TA-XT2i texturometer (Stable Micro Systems) using a crosshead speed of 2 mm/sec, while BMORS used a crosshead speed of 10 mm/sec. WBSF and BMORS were performed on both hot and room temperature samples and SSF only on hot samples. The values recorded were shear force, which is the maximum force recorded (N), and shear work, which is the area under the force-strain curve (N x mm) from the start of the test to the maximum force. The texture parameters of hardness, fibrousness, chewiness and juiciness were analyzed by a 8 members panel trained and experienced in QDA analysis according to the methodology described by Hernández-Ramos et al. [5] using a structured scale from 1 (low intensity) to 9 (high intensity of the attribute). Correlations between the different parameters were studied using a two-tailed Pearson significance correlation.

III. RESULTS AND DISCUSSION

A pair-wise correlation analysis was conducted to investigate the existence of significant correlations between the sensory and the instrumental texture parameters (Table 1). When WBSF was performed on cold samples only a significant correlation between shear work and juiciness ($p<0.05$) was observed. This correlation was negative, as this parameter showed a negative correlation with the rest of sensory parameters (>0.600; $p<0.01$). However, when this WBSF device was used in hot grilled samples, significant correlations were observed between force and sensory hardness ($p<0.05$) and between force and fibrousness ($p<0.05$), while work showed stronger correlations ($p<0.01$) for all sensory parameters, with the highest absolute value corresponding to fibrousness.

The SSF device was used only for hot grilled samples and the results showed a good correlation for both force and work and all sensory parameters ($p<0.01$). The coefficients being particularly high for juiciness, followed by chewiness, in the case of the shear force, or hardness in the case of the shear work.

Regarding BMORS probe, no significant correlations were observed when the analysis was performed on hot samples. However, cold samples showed significant correlations between shear work and all sensory parameters ($p<0.01$), with the highest correlation coefficient for juiciness ($p<0.01$) as previously observed for SSF. As far as BMORS force is concerned, less significant correlations were observed, and basically only with hardness and juiciness ($p<0.05$).

Table 1 – Pearson correlation coefficients between sensory attributes and texture parameters force (N) and shear work (Nxmm) for the different devices and sample preparations.

Probe	WBSF	WBSF	WBSF	WBSF	SSF	SSF	BMORS	BMORS	BMORS	BMORS
Parameter	Force	Work	Force	Work	Force	Work	Force	Work	Force	Work
Sample type	Cold	Cold	Hot	Hot	Hot	Hot	Cold	Cold	Hot	Hot
Hardness	-0,059	0,155	0,198*	0,304**	0,383**	0,378**	0,210*	0,369**	0,051	0,099
Chewiness	-0,039	0,189	0,196	0,295**	0,390**	0,366**	0,182	0,360**	0,110	0,073
Juiciness	0,013	-0,223*	-0,182	-0,263**	-0,412**	-0,415**	-0,246*	-0,454**	-0,085	-0,064
Fibrousness	-0,009	0,196	0,199*	0,324**	0,342**	0,347**	0,158	0,355**	-0,034	0,070

* Significant correlation at $p<0.05$; ** Significant correlation at $p<0.001$

IV. CONCLUSIONS

The results revealed that texture parameters obtained after performing SSF test, force and shear work, were highly correlated with all sensory parameters analyzed in this work. Furthermore, when the BMORS test was carried out on cold samples and WBSF test was applied to hot samples, shear work showed highly significant correlations with all sensory parameters. It is noteworthy that in the case of BMORS the correlations were as high as for the SSF test hence, as it is very easy to perform, these results point out to the suitability of BMORS work for predicting textural sensory parameters. On the other hand, when WBSF test was carried out on cold samples or BMORS was applied for hot samples scarce or not significant correlations were found.

ACKNOWLEDGEMENTS

mEATquality project has received funding from the European Union's Horizon 2020 research and innovation programme under funding agreement no. 101000344. Authors are gratefull for the SSF kit donated by Texture Techologies, Hamilton, MA.

REFERENCES

1. Meullenet, J.F.; Jonville, E.; Grezes, D.¸ Owens, C.M. (2004). Prediction of the texture of cooked poultry pectoralis major muscles by near-infrared reflectance analysis of raw meat. Journal of Texture Studies 35, 573–585.
2. Luckett, C.R.; Kuttappan, V.A.; Johnson, L.G.; Owens, C.M.; Seo, H. (2014). Comparison of three instrumental methods for prediction sensory texture attributes of poultry deli meat. Journal of Sensory Studies 29:171-181.
3. González Casado, A., Jiménez Carvelo, A.M. & Cuadros-Rodriguez, L. (2019). Sensory quality control of dry-cured ham: A comprehensive methodology for sensory panel qualification and method validation. Meat Science, 149, 149-155.
4. Meullenet, J.F.; Lyon, B.G.; Carpenter, J.A.; Lyon, C.E. (1998). Relationship between sensory and instrumental texture profile attributes. Journal of Sensory Studies 13, 77–93.
5. Hernández-Ramos, P.; Vivar-Quintana, A.M.; Revilla, I., González-Martín, M.I., Hernández-Jiménez, M., Martínez-Martín, I. (2020). Prediction of sensory parameters of cured ham: A study of the viability of the use of NIR spectroscopy and artificial neural networks. Sensors 20; 5624,