External preference mapping of beef: Relationship of fatty acids and flavour precursors with consumer's preferences

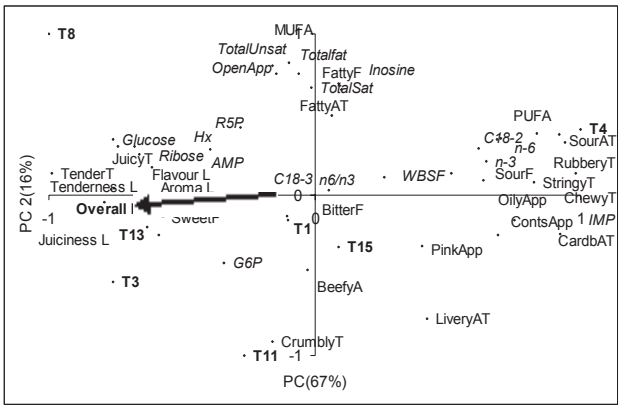
O R Oltra[1,2], L J Farmer[2], B Moss[2], A W Gordon[2], J Birnie[1]
[1]Queen's University Belfast, Belfast, United Kingdom, [2]Agri-food and Biosciences Institute, Belfast, United Kingdom, [3]Dunbia, Dungannon, United Kingdom *Email: ooltra01@qub.ac.uk*

Introduction The beef eating quality attribute, tenderness, has been traditionally considered more important than flavour (Miller, 2001). However, recent sensory research has found a higher correlation between flavour liking and consumers overall acceptability than tenderness and overall liking (Oliver *et al*, 2006). These beef eating quality attributes can be influenced by pre and post slaughter factors. Amongst the pre-slaughter factors, diet can change the fatty acid composition of the meat, with an impact on the nutritional characteristics of the meat and also on flavour (Wood *et al*, 2004). Recent studies have reported that diet can also influence in the content of the water soluble flavour precursors on beef and therefore could affect the formation of the flavour volatiles (Koutsidis *et al*, 2008). The aim of this experiment is to identify, through external preference mapping, the beef eating quality attributes driving the preference of consumers and relate these attributes to instrumental analyses of tenderness and flavour precursors.

Materials and methods Twenty eight cattle from 14 treatments were selected with the intention of achieving a wide range of eating quality attributes. The pre-slaughter factors which varied were age, breed, sex and diet and the post-slaughter factors were ageing time, electrical stimulation and hanging method. The animals were slaughtered on four different days at a commercial abattoir. The carcasses were stored at 10ºC for 10 hours and then the air temperature dropped to 2ºC for the next 38 hrs. The carcasses were boned out 48 hours after slaughter and the *longissimus dorsi* was removed, vacuum packed and aged for the time assigned to each group. The muscle was cut into samples for profiling panels, consumer panels, Warner Bratzler shear force (WBSF), fatty acids profile, reducing sugars (glucose, ribose, glucose-6-phosphate and ribose-5-phosphate) and nucleotides (AMP, IMP, inosine and hypoxanthine). During profiling panels, trained panellists assessed *l. dorsi* grilled steaks from the 14 treatments. The data obtained was analyzed by ANOVA and principal components analysis and the 7 most different treatments were selected for consumer panels. These treatments were presented to 120 consumers to determine scores for the liking of aroma, flavour, tenderness, juiciness and overall liking in a line scale between dislike extremely to like extremely (0 and 100). External preference mapping, using a vector model was conducted using sensory profiling data, consumer preference data and instrumental data. Direct correlations were also conducted between the attribute descriptor and instrumental analysis.

T1, T3, T4, T8, T11, T13, T15 = treatments; L=liking of attribute

Figure 1 External preference mapping of *longissimus dorsi* grilled beef steaks for overall liking PC1/PC2 (83% Variation)



Results Overall liking of the consumers in the external preference map showed association with the descriptors, "sweet flavour", "juiciness" and "tender texture"; in the opposite direction were found "rubbery", "stringy", "chewy texture," sour" flavour and aftertaste and "cardboard aftertaste" (Figure 1). Overall liking is also related to components such as ribose, hypoxanthine, AMP, glucose and less closely to ribose-5-phosphate and glucose-6-phosphate. IMP is in opposite direction to the consumers' preferences. When direct correlations were conducted between the attributes and the flavour precursors, "juicy texture" was positively correlated ($P<0.05$) with ribose ($r=0.97$) and negatively with IMP ($r=-0.85$). The polyunsaturated fatty acids (PUFA), omega 3 and 6 fatty acids (n-3 and n-6) and linoleic acid (C18:2) are situated opposite to consumer liking. These fatty acids appear related to the descriptors of "sour" flavour and aftertaste, "cardboard aftertaste" and "oily" appearance. PUFAs were positively correlated ($P<0.05$) with "sour flavour" ($r=0.78$) and "sour aftertaste" ($r=0.77$) and negatively correlated with "sweet flavour" ($r=-0.59$). Total fat is correlated ($P<0.05$) with the attributes, "fatty flavour" ($r=0.72$) and "fatty aftertaste" ($r=0.80$). These attributes seem not to be associated with overall liking. WBSF is situated opposite to the overall liking and, as expected, is related to the texture descriptors of "rubbery", "chewy" and "stringy".

Conclusions The technique of external preference mapping demonstrates relationships between the overall liking of consumers, specific flavour and texture attributes and instrumental measurements of flavour and texture.

Acknowledgments The authors gratefully acknowledge funding from Dunbia

References

Koutsidis, G., J. S. Elmore, M. J. Oruna-Concha, M. M. Campo, J. D. Wood, and D. S. Mottram. 2008. Meat Science 79, 124-130.
Miller, M. F., M. A. Carr, C. B. Ramsey, K. L. Crockett, and L. C. Hoover. 2001. Journal of Animal Science 79, 3062-3068.
Oliver, M. A.. Nute, M. F. I. Furnols, R. San Julian, M. M. Campo, C. Sanudo, V. Caneque, L. Guerrero, I. Alvarez, M. T. Diaz, W. Branscheid, M. Wicke, and F. Montossi. 2006.. Meat Science 74, 435-442.
Wood, J. D., R. I. Richardson, G. R. Nute, A. V. Fisher, M. M. Campo, E. Kasapidou, P. R. Sheard, and M. Enser. 2004. Meat Science 66, 21-32.

https://doi.org/10.1017/S2040470010002736 Published online by Cambridge University Press