RELATIONSHIP BETWEEN SENSORY EVALUATION AND QUALITY INDICATORS OF MAP BEEF STEAKS

P.I. Zakrys*[1], M.G. O'Sullivan[1], S.A. Hogan[2], P. Allan[3], J.P. Kerry[1]
*[1]*Department of Food & Nutritional Sciences, University College Cork, Republic of Ireland*
[2]*Teagasc Food Research Centre, Fermoy, Co. Cork, Republic of Ireland*, [3]*Ashtown Food Research Centre, Teagasc, Ashtown, Castleknock, Dublin 15, Republic of Ireland*
*zakryspat@yahoo.ie

Keywords: sensory analysis, MAP, texture, beef

Introduction

Meat quality is a complex issue comprising a range of attributes such as colour, flavour and texture. Consumers consider flavour to be one of the most important sensory traits of meat (Byrne et al., 2002), and the absence of off–flavours is expected to be critical for acceptance (Risvik, 1994). Display under modified atmosphere conditions promotes colour stability but may cause lipid oxidation and produce off-flavours and odours in meat. Tenderness has also been demonstrated as beef's most important palatability attribute (Huffman et al., 1996). The aim of this work was to study the relationship between several meat quality attributes and sensory parameters used to assess the quality of MAP beef steaks including warmed over flavour.

Materials and Methods

Beef steak *(Longissimus dorsi)* muscle was obtained from a local slaughterhouse. LD muscles were cut into uniform 2.54 cm thick steaks and packed under in modified atmosphere (MAP) with O_2 concentrations ranging from 0 to 80% O_2. CO_2 was included at 20% and N_2 was used as makeup gas. Samples were stored at 4°C ± 1°C for 15 days.

Two eight member untrained sensory panels were recruited from the students of University College Cork, Ireland. Two steaks from each treatment were assessed every 3 days during the 12 days of retail display. Steaks were grilled in an electric cooker at 200°C to an internal temperature of 70°C, then they were cut into uniform pieces and free from connective tissue. Each panellist was presented with one of five randomly presented samples, one from each treatment and asked to assess the attributes according to a standard 9-point hedonic scale and to indicate overall preference. Objective quality indicators examined included CIE colour analysis (Minolta CR 300 colorimeter), lipid oxidation (TBARS) (Siu and Draper, 1978), protein oxidation (PO) (Oliver et al.,1987), oxymyoglobin (OxMb) (Krzywicki, 1982), heme iron analysis (HI) (Schricker et al., 1982) and Warner-Bratzler shear force (WB) (Shackelford et al., 1991)

Results and discussion

The sensory evaluation of tenderness by taste panel used in this study did not fully correspond with WB values. The tenderness evaluation by the taste panel corresponded directionally to the lower oxygen samples (0, 10, and 20%) and also to the first 3 days of the shelf life study. Also, panellists indicated that meat was more tender at the beginning of shelf life storage in low oxygen treated samples, although these results were not significant. A previous study by Rowe (2004) reported increased protein oxidation during the first 24 h post-mortem (as measured by carbonyl content) can substantially decrease beef tenderness even in steaks aged 14 days. In present study the connection between protein oxidation and tenderness was not demonstrated definitively although directional correlations were observed.

Warmed-over flavour (WOF) is known from stored and reheated cooked meat and is caused by oxidation of fatty acids (Byrne et al., 2002). The off-flavour in MAP samples (Fig.1) was due to oxidative rancidity in the high oxygen MAP, as indicated by high TBARS numbers. Greene & Cumuze (1981) reported that the general population of meat consumers would not detect oxidation flavours until oxidation products reached levels of at least 2.0 mg/kg tissue. We propose that because TBARS levels were below 2 mg/kg tissue in the present study and that the panellists found the higher O_2 samples relatively more acceptable, that this could be to an adaptation effect. Periodic exposure to MAP meat products in the supermarket could result in consumers becoming more familiar to warmed over flavour and thus associating it with the normal status quo. Overall, panelists most preferred steaks stored under 50% O_2.

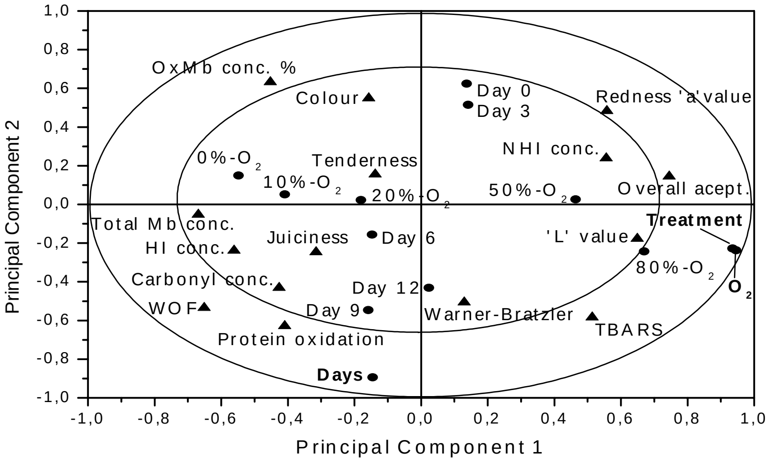

Figure 1. An overview of the variation found in the mean data from the ANOVA-Partial Least Squares Regression (APLSR) correlation loadings plot for each of the 5 MAP treatment groups. Shown are the loadings of the X- and Y-variables for the first 2 PCs for level corrected data. ● = days and oxygen treatments, ▲ = sensory descriptor and instrumental variables. The concentric circles represent 100% and 50% explained variance respectively.

Conclusions

The sensory evaluation of tenderness by sensory pannellists used in this study did not fully correspond with WB values. Possible correlations between increased toughness and higher O_2 storage, as reported in scientific literature, due to protein oxidation has not been observed definitively although directional correlations were observed. Objective and sensory evaluation suggested that the quality of steaks was best promoted by packaging under atmosphere containing 50% oxygen. Sensory panel results indicated that the higher O_2 samples are more acceptable by panellists, which could be consumer adaptation to constant exposure MAP products on the supermarkets shelves. That panellists preferred steaks showing signs of oxidative deterioration requires further research effort.

References

Byrne, D.V., Bredie, W.L.P., Mottram, D.S., Martens, M. (2002). Sensory and chemical investigations on yhe effect of oven cooking on warmed-over flavour development in chicken meat. Meat Science, 61, 127-139.

Greene, B.E. & Cumuze, T.H. (1981). Relationship between TBA numbers and inexperience panellists assessments of oxidized flavour in cooked beef. *Journal of Food Science*, 47, 52-54, 58.

Huffman, K.L., M.F., Miller, L.C., Hoover, C.K. Wu, Brittin, H.C., Ramsey, C.B. (1996). Effect of beef tenderness on consumer satisfaction with steaks consumed in the home and restaurant. Journal of Animal Science, 74, 91-97.

Krzywicki, K. (1982). The determination of heam pigments in meat. *Meat Science*, 7, 29-36.

Oliver, C. N. ; Ahn, B.-W.; Moerman, E. J.; Goldstein, S.; Stadtman, E. R. (1987). Age-related changes in oxidized proteins. *Journal of Biological Chemistry*, 262, 5488-5491.

Risvik, E. 1994. Sensory properties and preferences. Meat Science, 36, 67-77.

Rowe L.J., Maddock K.R., Lonergan S.M, Huff-Lonergan E. (2004). Influence of early post-mortem protein oxidation on beef quality. *American Society of Animal Science*, 82, 785-793.

Schricker B. R., Miller D. D., Stouffer J. R. (1982). Measurement and content of nonheme and total iron in muscle. *Journal of Food Science*, 47, 740-743.

Shackelford S.D., Koohmaraie, M., Whipple, G., Wheeler, T.L., Miller, M.F., Crouse, J.D. and Reagan, J.O. (1991). Predictors of beef tenderness: Development and verification. *Journal of Food Science*, 56, 1130-1135.

Siu, G.M., & Draper, H.H (1978). A survey of malonaldehyde content of retail meats and fish. *Journal of Food Science*, 43, 1147-114.