PREDICTING COOKED BEEF CONSUMER LIKING AND SENSORY FRESHNESS USING RAPID EVAPORATIVE ION SPECTROMETRY

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I. INTRODUCTION

Meat plays an important role in ready meals; however, the quality of ready meals deteriorates with storage time, and food loses its freshness condition due to various biochemical changes. The freshness perception of cooked meat leads to a higher consumer acceptability which directly influences consumers' food choice and define the purchase of chilled ready meals. Therefore, predicting the eating quality and freshness of cooked meat is important for the ready meals industry. The objective of this study is to evaluate the use of Rapid Evaporative Ionization Mass Spectrometry (REIMS) to predict consumer liking and freshness rating of cooked beef stored at 4^{o}C for 9 days. REIMS enables real-time evaluation of several complex features from a single measurement [1].

II. MATERIALS AND METHODS

Beef (oyster blade) was sous-vide cooked for 4 hrs and seared for 2 min each side and packed in polypropylene (PP) containers and stored at 4^{o}C for 1, 3, 5, 7 and 9 days. Samples from each storage time were analysed by consumers and REIMS. Consumers (n=100) were asked to rate perceived freshness (0=not at all fresh to 7=very fresh) and overall liking (0=dislike very much to 7=like very much) of cooked beef for each storage time. Consumer liking score and 'freshness' perception rating of cooked beef was transformed to categorical responses; "Like or Dislike" and "Fresh or Not fresh" using the mean value of 4.0 as cut-off point for overall liking and freshness perception. Each cooked beef sample was ablated (20mm/sec, 25% max power) using a CO_2 laser (Thunder Laser, New Zealand) and the generated aerosol was directed into the REIMS source (Waters, Wilmslow, UK). REIMS chromatograms were processed by ProGenesis Bridge and then normalised using ProGenesis QI (Waters). Principal component analysis (PCA) and Orthogonal Partial Least-Squares Discriminant Analysis (OPLS-DA) methods were applied for data analysis using SIMCA 17 (UMETRICS, Umeå, Sweden). The model classified beef samples from 10 animals (two animals per treatment day).

III. RESULTS AND DISCUSSION

REIMS fingerprinting of cooked beef from different storage treatments (D1, D3, D5, D7 and D9) resulted in the detection of 1335 features. Out of these features, 127 were significant in differentiating the storage treatments. Significant features were used in PCA and OPLS-DA analysis. PCA (Figure 1) model clearly explained the variation with three clear clusters (D1& D3, D5 and D7& D9) and good predictability (R^2X=0.732, Q^2=0.644). OPLS-DA modelling explained clear variation in REIMS data (R^2X=0.758) and variation in two categories for sensory liking and freshness (R^2Y = 0.674) of the storage treatments with high degree of model robustness (Q^2 = 0.583). Results suggest that REIMS features can successfully discriminate cooked beef samples based on storage treatments. Further clustering was done to indicate sensory freshness (fresh, not fresh) and consumer liking (like, dislike). REIMS fingerprints of cooked beef from Day 1,3 and 5 storage treatments were considered 'Fresh' and 'Liked' and was differed from cooked beef from Day 7 and 9 (Figure 2). The performance of OPLS-DA models for discriminating REIMS fingerprints between storage treatments was assessed using

AUC-ROC plots. OPLS-DA modelling of REIMS fingerprints can accurately discriminate storage treatments (AUC(D1) = 1.0, AUC(D3) = 1, AUC(D5) = 1.0, AUC(D7) = 0.93, AUC(D9) = 0.96).

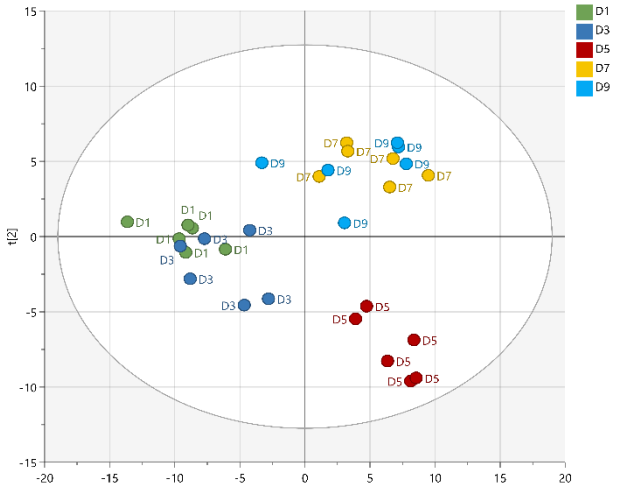

Figure 1.PCA scores plot (SIMCA) for REIMS results for cooked beef chilled stored (4ºC) for 9 days.

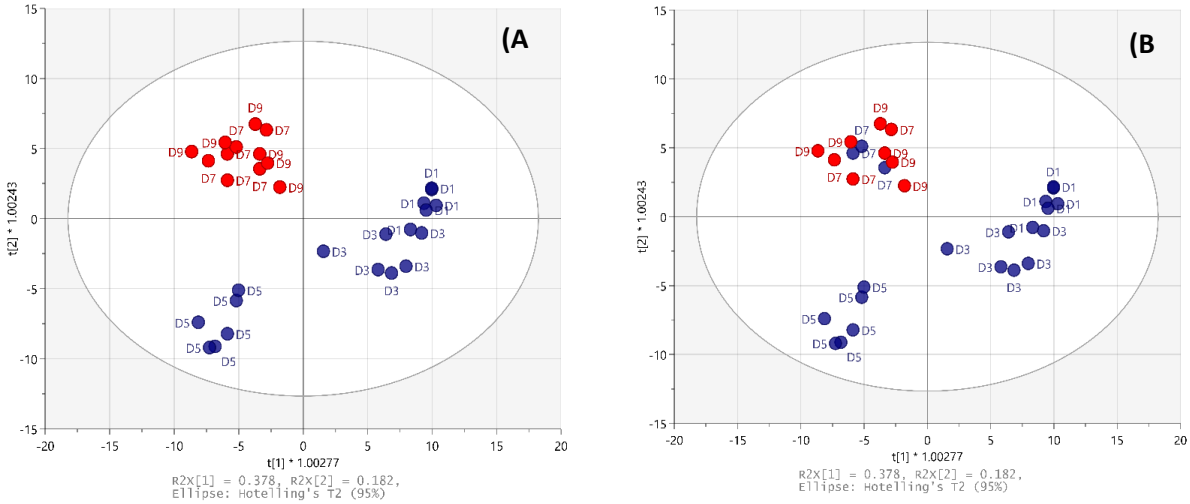

Figure 2. OPLS-DA scores plot (SIMCA) for REIMS(x) and Sensory (y) results for cooked beef from day 1 to day 9 of chilled storage at 4ºC. (A) represent clustering of data based on perceived freshness and (B) clustering of data based on overall liking. The red colour indicates 'Not Fresh'(A) or 'Dislike'(B) and blue colour indicates 'Fresh'(A) or 'Like'(B)

IV. CONCLUSION

The findings of the current study show that metabolic fingerprinting by REIMS can accurately discriminate samples into consumer liking and freshness classes, showing promise as a rapid tool for assessment of freshness and eating quality of cooked meat for ready meals.

ACKNOWLEDGEMENTS

This work was supported by internal SSIF-A27235 (Consumer Experience: pathways to premium foods) funds from AgResearch Limited.

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