EFFECT OF COOKING METHOD ON BEEF FLAVOUR MARKER COMPOUNDS

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Abstract – Beef flavour arises from a large number of non-volatile and volatile components present in cooked meat, and many of these are difficult to measure. This study uses the concept of volatile marker compounds for flavour to assess the impact of cooking method. Differences in the volatile compounds due to cooking are extensive. This explains some of the known flavour differences caused by cooking method. This approach is yielding a new understanding of the factors affecting the formation of groups of flavour compounds in cooked beef.

Key Words – beef, flavour, volatiles.

I. INTRODUCTION

Many compounds important for beef flavour are present at very low concentrations and are therefore very difficult to determine. Research at AFBI has identified marker compounds for beef eating quality which may not be the cause of desirable flavour but may be markers for it (1). Other studies have shown a direct relationship between cooking method and the formation of specific volatile compounds which could influence consumer acceptance (2,3). Meat composition combined with a chosen cooking methodology is one of the factors that affects the perceived eating quality of meat products (4). The aim of the study is to evaluate the effect of three different cooking techniques (grilling, roasting, slow cooking) on the volatile compound composition of beef.

II. MATERIALS AND METHODS

Beef animals: Beef from 9 muscles from 5 bulls of Holstein-Friesian breed were sourced from an extensive study conducted in Poland and were transported to Belfast and stored at -80^{o}C until analysed.
Volatile analysis: The headspace volatiles were collected using Solid Phase Micro Extraction (SPME Carboxen/PDMS fibres). Samples were cooked according to a standard protocol (5) and were transferred to a 15 ml sealed vial. After equilibration the volatiles were collected for 10 minutes, as described previously (6). A HP 6890 Series GC System equipped with a 5973 Mass Selective Detector was used for separation and detection of volatile compounds. Extracted volatile compounds were analysed and selected volatiles quantified. Peak areas were converted to $\log_{10}$ values to create a normal distribution. Statistical analysis was by REML variance components analysis. Analyses were conducted using Genstat version 18.1.

III. RESULTS AND DISCUSSION

A comparison of casserole, roast and grill methods of cooking showed substantial and consistent differences in several classes of volatile compounds: aldehydes, ketones, an alcohol, heterocyclic compounds, an ester and sulphur compounds. There were no interactions between muscle and cooking method for most of these compounds and the data is illustrated for striploin.
Strecker aldehydes (Figure 1a) are good markers for the Maillard reaction and have been associated with flavour liking in a previous study (1). Not all Strecker aldehydes follow the same pattern with different cooking methods. The formation of 3-methylbutanal and 2-methylbutanal is greatly increased by grilling ($P<0.001$). The higher temperatures of grilling explain the higher formation of these two compounds (as only the centre portion of the roast was sampled) but this does not explain reason why 2-methylpropanal and benzaldehyde (ns) did not show the same effect.

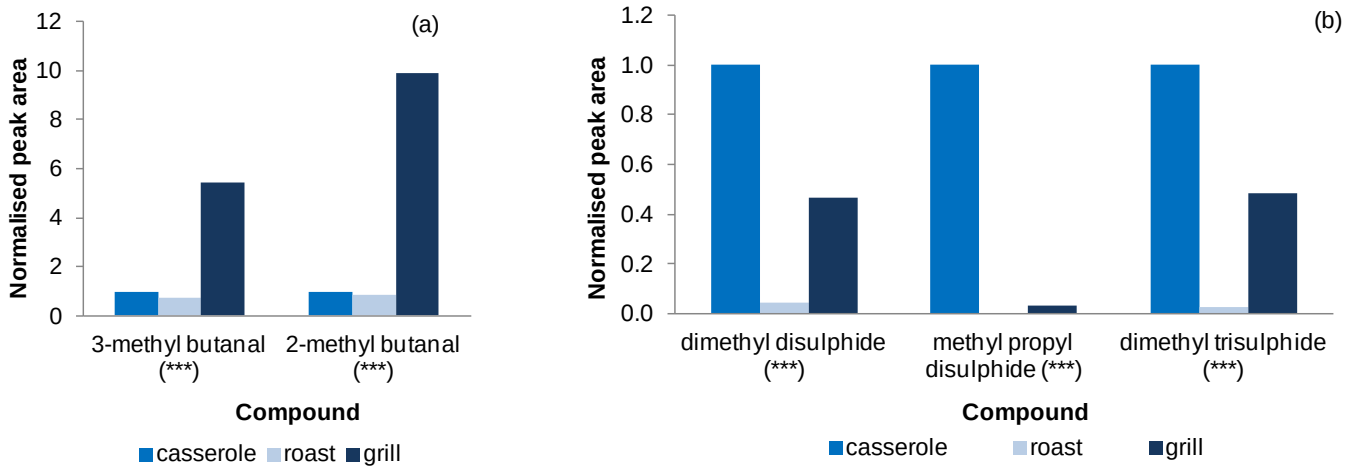

Figure 1. Effect of three cooking methods on (a) Strecker aldehydes and (b) sulphur compounds from striploin (relative to casserole = 1)

Sulphur compounds show the most extreme differences between cooking methods. This is illustrated for striploin in Figure 1b, but the same pattern is followed for all the muscles. The much lower concentrations of these compounds in the centre of roast beef may be due to less oxidative conditions, or lower cooking temperatures. Further elucidation is required. A similar pattern was observed for heterocyclic compounds (not shown). These and related compounds play a marked role in the flavour of meat and it is likely that changes in concentrations of sulphur compounds are partly responsible for the noticeable flavour differences due to cooking method.

IV. CONCLUSION

Differences in the volatile compounds explain some of the known flavour differences caused by cooking method. This approach is yielding a new understanding of the factors affecting the formation of flavour compounds in cooked beef.

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