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Effect of ageing period on volatile flavour compounds in cooked beef (#638)

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Introduction

As a result of globalisation, the beef industry is looking to promote beef products in distant markets, creating the possibility of ageing beef during transportation. Previous studies reported that ageing increased flavour development due to the changes in volatile precursors [1]. Other studies have suggested that the flavour is less liked after 28-35 days [R Polkinghorne, personal communication]. In this study, the effect of extended ageing on volatile flavour compounds is studied.

Methods

Two separate trials were conducted to identify the effect of extended ageing on volatile compounds. In the first trial, three batches of samples (A,B,C) were analysed, from 5, 5 and 18 animals, respectively. Samples were aged to 7, 48 and 70 days in batch A and B while batch C samples were aged for 5, 21/22 and 70 days. To further explore the effects of extended ageing, a second trial was conducted focusing on striploin samples (n=90) collected from just one animal and aged for 4, 7, 21, 49 and 120 days post-mortem at 4^0C.

In Trial 1, beef samples were grilled and cored (1.27cm diameter). 2.0±0.1g of beef samples were transferred into a 20ml glass vial following an existing protocol [2]. The glass vial was placed into a 65°C waterbath and a 75µm CAR/PDMS manual-SPME fibre (Supelco, Bellefonte, PA, USA) was used to extract headspace volatiles before transferring to GC-MS (Agilent 5973 MSD/ HP6890 GC).

In Trial 2, the beef samples were prepared the same way but headspace volatiles were collected using an automated SPME injection system (Gerstel Multi Purpose Sampler Robotic Pro with SPME injection tool holder) and analysed by gas chromatography-mass spectrometry (Agilent 5977B MSD/ Agilent 7890B GC). Scan mode was selected in both trials. The data was quantified using Agilent integration (Trial 1) or MassHunter integration (Trial 2) based on one quantification ion and three target ions. The ratio of the quantity of volatiles collected relative to the smallest ageing period was calculated.

Results

In Trial 1, approximately 30 volatiles were detected and classified into categories. Although there were apparent trends in the change of volatile categories due to ageing, the variation was very high (Figure 1). It is not clear whether these high variations were caused by experimental noise from animals or the manual volatile collection method employed. Therefore, Trial 2 was conducted to follow the effect of ageing on volatiles from meat from one animal, using auto-SPME analysis. The concentration of Strecker aldehydes (e.g., methional, 3-methylbutanal, 2-methylbutanal) were significantly ($P<0.001$) increased 3 to 5-fold after 120 days of ageing (Figure 2), which could explain the pleasant roast odours reported in a previous study [4]. Ageing decreased the concentration of n-aldehydes, which confirmed the trends observed in Trial 1. Ageing significantly ($P<0.05$) increased the concentrations of all pyrazine compounds (e.g., methylpyrazine, 2,3/5-dimethylpyrazine, trimethylpyrazine), which concurred with the trends showed in Trial 1. The compound, 2-ethyl-3,5-dimethyl pyrazine has previously been associated with roast beef aroma [3]. Sulphur-containing compounds, such as dimethyl disulphide increased significantly ($P<0.05$) after 120 days of ageing.

Conclusion

Extended ageing appears to influence the quantities of the volatile compounds but variation between animals reduces significance. These changes are very clear when followed in one animal. Improvements in the technology for volatile collection methods have also helped to reduce variation.

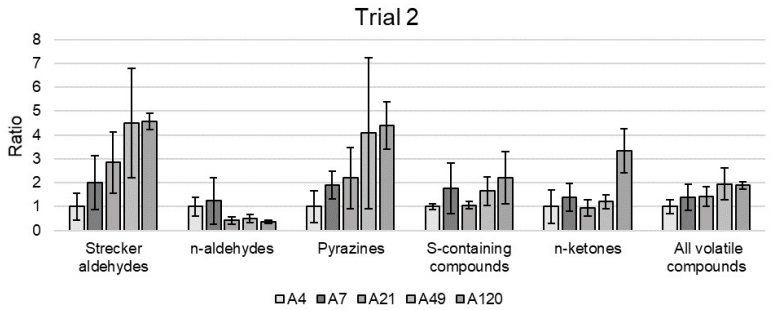

Figure 2 Effects of ageing on volatile compounds from beef sirloin from one animal.

Notes

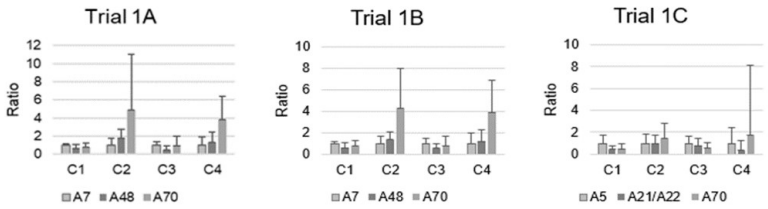

Figure 1 Volatile analysis from Trial 1 A, B and C. Categories of volatiles shown: C1 (n-aldehydes), C2 (Strecker aldehydes), C3 (sulphur-containing compounds) and C4 (pyrazines). Error bars show standard deviations for 5, 5, 18 samples, respectively.

Notes