FLAVOUR PROFILE OF TURKEY BREAST ROLLS CONTAINING ONION JUICE

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Introduction

Flavour, which encompasses the sensations of taste and odour, is one of the major factors that influence the eating quality and consumer acceptance of meat. While fresh meat flavour is known to be affected by post-mortem conditions, e.g., aging, packaging and storage, the flavour of processed meats is largely influenced by added ingredients and processing procedures that tend to alter the product composition (Sink, 1979).

In a previous study (Tang and Cronin, 2007) we showed that cooked turkey breast meat prepared with brines containing onion extracts oxidised at a significantly lower rate than controls during storage, and this was attributed to natural antioxidant quercetin present in the onion juice. In addition, the onion extract-treated meat , when stored in sliced form, maintained a much fresher flavour than the control meat under the same storage conditions. It was suggested that the observed effect may have resulted from a combination of the antioxidant and off-flavour masking effects of the non-volatile and volatile components of the onion juice. High-intensity sulphur containing compounds, including various aliphatic disulphides and trisulphides, are prominent volatile components in cooked onions (Schultz et al., 1998). The uptake by the meat of some of these compounds from the onion juice brines may be of considerable importance in helping to maintain the desirable flavour profile of stored meat. The presented study was to further investigate the protective effect of onion juice for turkey breast flavour, and to examine in more detail the status of sulphur volatiles in treated, cooked turkey rolls.

Materials and Methods

Control and onion juice (OJ50) turkey rolls were manufactured as described elsewhere (Tang and Cronin, 2007). Aliquots of 50 ml meat homogenates (10 g/50 ml) were transferred to 100 ml flasks that were subsequently purged with nitrogen gas. Each sample flask was sealed and a 22-gauge hypodermic needle along with a 75 µm CAR/PDMS SPME fibre was inserted. For the analysis of high-volatility headspace components, the mixture in the flask was equilibrated for 15 min at room temperature (24±2 °C) after which volatiles were collected for exactly 5 min. To obtain a full profile of the volatile sulphur components, the samples were heated to 80 °C. After equilibrating for 15 min with magnetic stirring, the headspace was sampled with the SPME fibre for 30 min.

GC analysis was performed on the ATI Unicam Model 6100 gas chromatograph fitted with a flame photometric detector, which was set up to operate in the sulphur specific mode using a 394 nm interference filter to register the mission signal. Extracted volatiles were desorbed from the SPME fibre for 1 min at 300 °C and separated on the same 60 m ´ 0.32 mm i.d. Zebron fused silica column. For the separation of high-volatility headspace components, N_2 gas at a flow rate of 2 ml/min was used as the carrier gas; the column temperature was set at 35 °C. H_2 gas at a flow rate of 2 ml/min was used as the carrier gas for the full sulphur volatile analysis, and the column temperature was programmed from 40 to 200°C at 3 °C/min after sample injection.

Results and Discussion

Compared to the control (Figure 1a), the profile of OJ50 (Figure 1b) shows the presence of two additional sulphur-containing compounds with retention times of 7.0 and 9.3 min, respectively. While the peak at 7.0 min corresponded with that observed in the SPME headspace profile of the 1% onion juice, which corresponds to approximately the same concentration of onion extracts incorporated into the OJ50 meat samples, as shown in Figure 1c, the peak at 9.3 min was possibly generated during cooking from reactions between precursors present in the onion extracts with volatiles from the turkey meat. Although we were unable to identify these two compounds, GC-peak sniffing runs clearly indicated a pleasant onion-like aroma corresponding to the peak having a retention time of 7.0 min. The most abundant volatile sulphur compound which occurs in significant amounts in most varieties of onion and leek is propanethiol (Schulz et al., 1998). It is almost certain that the peak eluting at 7.0 min in both the OJ50 turkey breast roll and in the onion juice is propanethiol. In addition, both its aroma and its preponderance (accounting for 85% of the total peak area if the broad distorted H_2S peak eluting at 8.53 min is excluded) of the highly volatile sulphur fraction of the onion juice-treated turkey meat suggest that the onion juice contributed strongly to the improved sensory properties displayed by the cooked meat product.

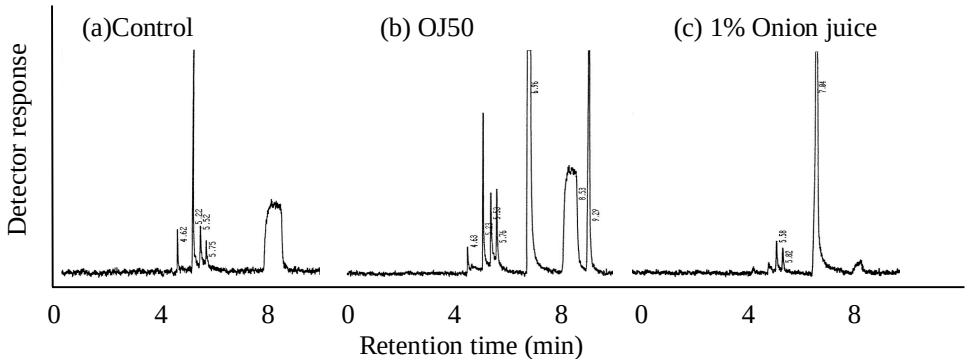

Figure 1. SPME-GC headspace chromatograms of high volatility sulphur components in aqueous homogenates at room temperature of (a) control turkey breast rolls, (b) OJ50 rolls, (c) 1% strength cooked onion juice.

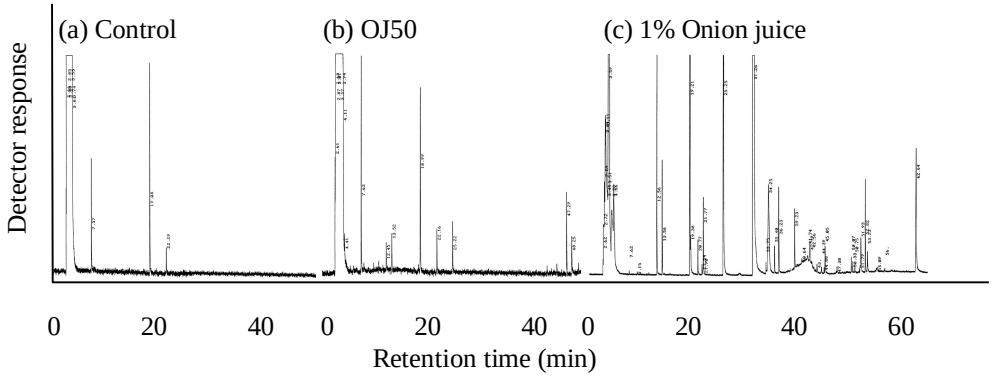

Figure 2. SPME-GC headspace chromatograms of total sulphur volatiles in aqueous homogenates at 80 °C of (a) control turkey breast rolls, (b) OJ50 rolls, (c) 1% strength cooked onion juice

Except for the early peaks, only 3 major peaks, with retention times of 7.6, 19.0 and 22.2 min, respectively, were observed in the control samples (Figure 2a). The profile of the OJ50 sample (Figure 2b) showed a series of additional peaks with retention times of 12.5, 13.5, 25.2, 47.3 and 48.3 min, of which the first 3 corresponded with peaks observed in the profile of 1% onion juice (Figure 2c). It was surprising that the dominant peak present in the onion juice chromatogram (RT=31.26 min) was completely absent from the OJ50 treated turkey breast sample. In addition, two peaks present in the latter sample (RT=47.3 and 48.3 min) were absent both from the control turkey breast samples and from the onion juice. These compounds may have originated as a result of chemical reactions between certain onion juice volatiles and volatile components from the meat.

There is little doubt that volatile sulphur compounds from cooked onions contributed positively to the improved sensory properties of treated turkey breast samples. To examine further the cause of this improvement would require GC-headspace analysis in combination with odour evaluation of the individual compounds as they are eluted from the chromatographic column. For example, the application of SPME-GC-O analysis as described by Brunton et al. (2002) would represent a logical approach.

Conclusions

In this study, headspace analysis with sulphur specific detection clearly demonstrated significant but selective uptake of sulphur volatiles from the onion juice by turkey meat. There was also evidence that some compounds may have derived from interactions of onion juice and meat components. Thus, the results help explain the improved flavour characteristics of turkey rolls by the treatment with onion juice.

References

1. Brunton, N.P., Cronin, D.A., and Monahan, F.J. (2002). Volatile components associated with freshly cooked and oxidized off-flavours in turkey breast meat. *Flavour and Fragrance Journal*, *17*, 327–334.
2. Schulz, H., Krüger, H., Liebmann, J., and Peterka, H. (1998). Distribution of volatile sulphur compounds in an interspecific hybrid between onion (*Allium cepa* L.) and leek (*Allium porrum* L.). *Journal of Agricultural and Food Chemistry*, *46*, 5220–5224.
3. Sink, J.D. (1979). Symposium on meat flavour - factors influencing the flavour of muscle foods. *Journal of Food Science*, *44*(1), 1–5, 11.
4. Tang, X. and Cronin, D.A. (2007). The effects of brined onion extracts on lipid oxidation and sensory quality in refrigerated cooked turkey breast rolls during storage. *Food Chemistry*, *100*(2), 712–718.