Sensory Properties and Consumer Preference of Characterising Flavour Compounds of Sheepmeat

Lynda O'Neill[a], Owen Young[a] and John Prescott[b]
[a]AgResearch, Hamilton, New Zealand. [b]Sensory Science Research Centre, University of Otago, Dunedin, New Zealand.

Introduction

The production and consumption of sheepmeat in most Asian countries is very low compared with many other countries. Major sheepmeat exporters like New Zealand and Australia wish to encourage higher consumption in Asia, but this meat is not well accepted. In fact, cooked sheepmeat has a characteristic species odour and flavour that is not well accepted by most people, Asian or otherwise, who have had little exposure to it.

Although the odour/flavour of cooked sheepmeat is due to a wide range of volatile compounds (Young *et al.*, 1997), the characteristic species flavour that non-sheepmeat eaters find unusual or unpleasant is caused by branched chain fatty acids (BCFAs) that have about nine carbon atoms. These fatty acids are esterified into storage triglycerides (Wong *et al.*, 1975; Young *et al.*, 1997), then are liberated to some extent on cooking. Young *et al.* (1997) also showed that skatole (3-methylindole) contributes to sheepmeat odour, and later research has specifically linked skatole to the faecal and barnyard notes associated with sheepmeat odour (Young *et al.*, 1999).

The relative and absolute concentrations of BCFAs and skatole in fat can be controlled through animal diet, and possibly breeding. It therefore seemed important to establish which of these two compounds was less preferred by consumers unaccustomed to sheepmeat. This paper summarises work to date with Japanese consumers, and also shows how culinary herbs/spices can be systematically screened for effectiveness in suppressing undesirable flavours, and so be used as an alternative or complementary strategy to gain sheepmeat acceptance.

Methods

For all three experiments, 'sheepmeat' samples were generated by artificially adding various levels of BCFAs and skatole to beef, to systematically simulate sheepmeat flavour, an approach previously used by Wong *et al.* (1975) and Ha & Lindsay (1991). The compounds were added to a base sample of fat from grain-finished beef (containing negligible BCFAs or skatole), which was then minced with very lean pasture-finished beef in a 5:95 fat:beef ratio. The BCFAs comprised 4-methyloctanoic plus 4-methylnonanoic acids in the weight ratio of 15:1. Suitable concentrations of skatole and BCFAs were established by preliminary trials, and the highest levels used were about triple those naturally occurring in sheepmeat. The additions of skatole and BCFAs generated a factorial design of nine combinations in total (Figure 1). Details specific for each experiment are presented below.

Experiment 1: Descriptive sensory assessment of beef mince spiked with BCFAs and skatole

An experienced, trained 10-member descriptive panel evaluated samples from the 9 treatments (shaded in Figure 1). Panellists used a descriptive vocabulary generated during their training to evaluate the samples.

The most significant and obvious differences between treatments were for the attributes 'barnyard', 'sheepmeat' and 'milky' (Figure 2). The greatest intensity of these flavours was for samples containing skatole and BCFAs combined. BCFAs had a greater effect than skatole on the intensity of sheepmeat flavour. However, BCFAs and skatole produced equal effects on barnyard and milky flavour. The influence of BCFAs on barnyard flavour is particularly interesting, as previous studies have associated skatole with the attribute 'barnyard'. These findings indicate that sheepmeat flavour can be simulated by the addition of BCFAs and skatole to a bland substrate, and that both volatiles contribute to a different extent to the various flavour notes associated with cooked sheepmeat.

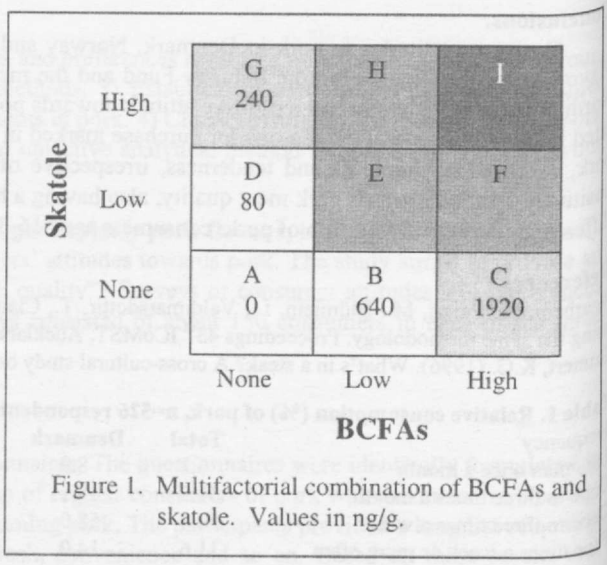

Figure 1. Multifactorial combination of BCFAs and skatole. Values in ng/g.

Experiment 2: Importance of BCFAs and skatole in determining meat flavour preferences of Japanese consumers

To assess consumer responses to BCFAs and skatole, Japan was chosen as an Asian market where sheepmeat is currently under-represented. For this experiment all nine treatments were hedonically assessed by 123 Tokyo females who were regular consumers of red meat, but not lamb. The trained descriptive panel in New Zealand also evaluated the samples, and the consumer and trained panellist data were statistically linked by using internal preference mapping. Figure 3 shows the preference map of consumers against treatments. The plot indicates that most consumers preferred the base sample A (which had no added compounds) and the samples with added skatole. Samples containing either BCFAs, or the two compounds in combination, were the most disliked. These findings strongly suggest that the negative perception of sheepmeat, at least amongst urban Japanese females, is not related to the odour/flavour of skatole *per se* but to that of BCFAs or a combination of the two compounds.

Experiment 3: Modification of sheepmeat flavour by a herb

Rosemary was chosen for study, as this herb is commonly used in lamb and mutton dishes. A fat- and water-soluble, nature-identical extract of the herb was used. Treatments A (no additions), C (high level of BCFA) and G (high level of skatole) were selected from the matrix of nine treatments (Figure 1) to study whether rosemary suppressed components of sheepmeat flavour. Three incremental levels, doubling at each level, were added to each of the treatments A, C and G in a multifactorial combination. The samples were evaluated by the same trained panellists as in Experiments 1 and 2, using the same descriptors, with the addition of the term 'herb' flavour.

An example of the suppressive effect of rosemary (on barnyard flavour) is shown in Figure 4. Rosemary significantly reduced barnyard, sour/acidic, sheepmeat, pastoral, and milky flavour in all three treatments. This herb appeared to exert a similar effect on these flavours regardless of the level used. Furthermore, the effect of rosemary was the same across all three treatments. Thus, rosemary appeared to modify the perception of both BCFAs and skatole to the same extent. The ability of rosemary, and perhaps other herbs, to influence the negative attributes of sheepmeat flavour may help explain the use of herbs in culinary traditions.

Conclusions

Of all treatments studied, samples containing both BCFAs and skatole were the least preferred by Japanese female consumers. Furthermore, the trained panel data indicate that these combinations were the most effective at producing intense sheepmeat, barnyard and milky flavours. Thus, it appears likely that sheepmeat, barnyard and milky are the characteristic attributes of mutton that are most distasteful to Japanese, and perhaps to all unaccustomed consumers of sheepmeat. Product developers wanting to make sheepmeat more marketable could exploit the ability of rosemary to diminish the negative flavour attributes of this meat. Work in progress includes an investigation of the suppressive effects of other herbs and spices on perceptions of BCFAs and skatole.

References

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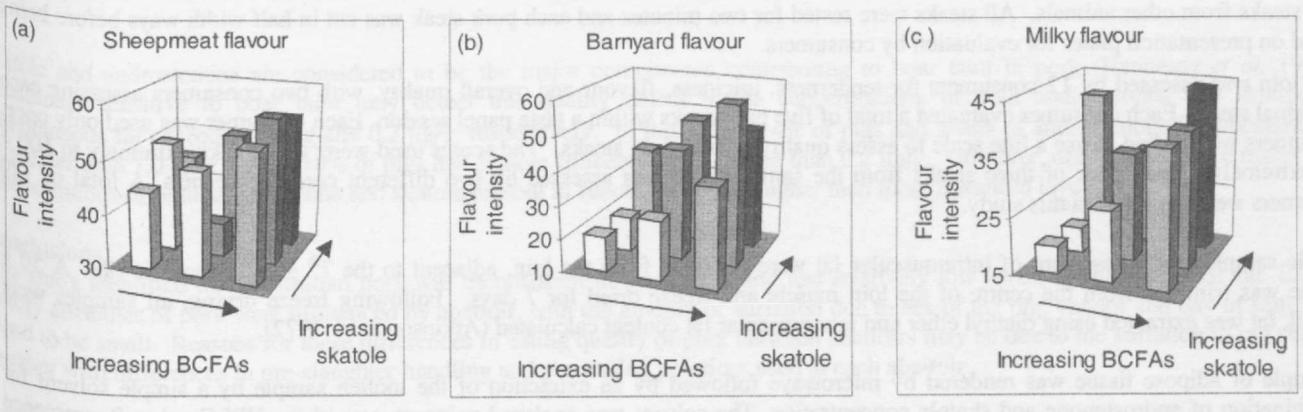

Figure 2. Effect of BCFAs and skatole on (a) sheepmeat, (b) barnyard and (c) milky flavour.

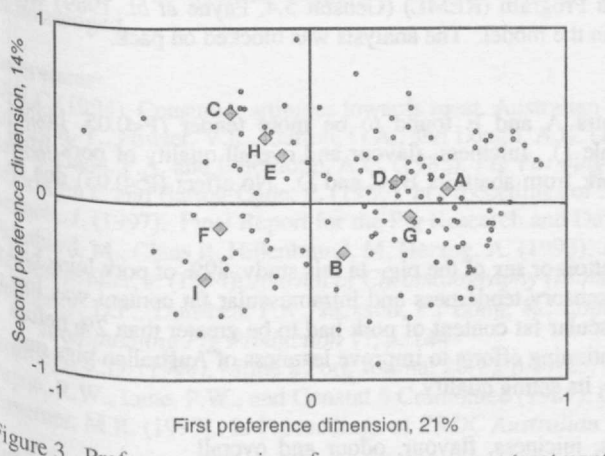

Figure 3. Preference mapping of consumers versus treatments.

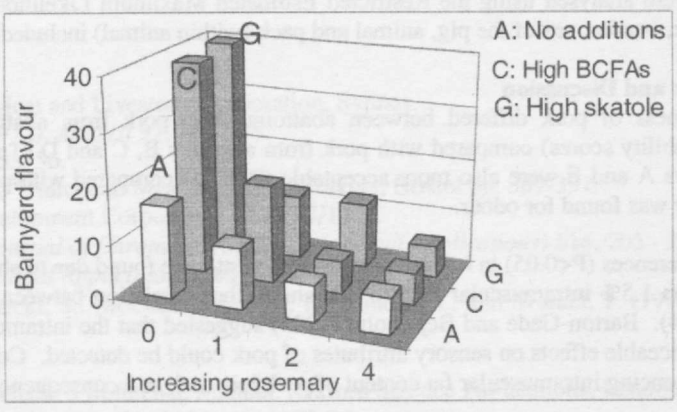

Figure 4. Effect of rosemary on barnyard flavour.