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Eating quality of UK-style sausages varying in price, meat content, fat level and salt content

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ABSTRACT

Thirty-six brands of pork sausage were purchased from a total of 10 retailers over a 4 months period and assessed for eating quality. The brands included 5 of the 10 most popular sausages in the UK, 4 basic, 14 standard, 10 premium and 8 healthy eating brands. The average price, meat content, fat content and salt content was £3.31/kg, 62%, 17% and 1.6%, respectively, but there were wide differences in price (£1.08/kg–£5.23/kg), meat content (32–97%), fat content (2.1–29.1%) and salt content (0.5–2.5%).

Sausages were assessed by a trained sensory panel using 100 mm unstructured line scales and 14 descriptors (skin toughness, firmness, juiciness, pork flavour, fattiness, meatiness, particle size, cohesiveness, saltiness, sweet, acidic, bitter and metallic) including overall liking. The declared meat content was positively correlated with price, skin toughness, firmness, pork flavour, meatiness, particle size and perceived saltiness ($r = 0.5$ or better). The declared fat content was positively correlated with fattiness and sweetness ($r = 0.42$ or better) but not juiciness. There was no significant correlation between declared salt content and perceived saltiness.

A principal component analysis showed that the first two principal components accounted for 51% of the variability in the data. Products could be separated into four quadrants according to their price, meat content, fat content and their associated eating quality attributes.

1. Introduction

UK-style sausages have been a staple part of the British diet for many years, with the average household consuming 8.3 kg each year (MLC, 2005). Retail sales exceed £500m. They differ from salami and other fermented sausages in terms of their composition, their method of production, and their sensory properties (Feiner, 2006; Ranken, 2000; Varnam & Sutherland, 1995). UK-style sausages usually contain rusk (a baked wheat dough which is ground to produce a dry, free-flowing granular product) which reduces the formulation cost, modifies product texture and helps to reduce cooking loss. There is no fermentation or drying period, so UK-style sausages tend to have a relatively high pH (~6.0), a high water activity and a relatively short shelf life. Water is sometimes added as flaked ice, partly to limit the temperature rise during comminution, but it can also reduce formulation costs and increase juiciness. It is common practice to add a seasoning mix during production containing salt, polyphosphate, metabisulphite (to inhibit microbial growth), a colouring, an antioxidant and herbs and spices. The product, cooked and eaten hot, is quite different from salami-type products in terms of its textural properties, its flavour profile and the perceived juiciness and succulence. Salamis tend to be much firmer and drier than UK-style sausages.

Other than a study carried out nearly 20 years ago (Jones, Dransfield, Crosland, & Francombe, 1989), there is very little in the scientific literature on the eating quality of UK-style sausages. Consumers buying habits and needs have changed dramatically over this time. Since the 1989 study, consumers have also become more health conscious, the product range has diversified, new labelling requirements have been introduced and products must conform to the new Meat Product Regulations 2003 (MPR, 2003), implementing Commission Directive 2001/101/EC. Many sausages are now packed in a protective atmosphere, rather than being film wrapped. There are large variations in meat content, the fat level and the amount of added salt (FSA, 2003; Matthews, Blades, & Strong, 2003). UK-style sausages have been criticized for containing high amounts of fat and salt (FSA, 2003). Nutritional labelling requires a declaration of energy, protein, carbohydrate and fat as a minimum, known as the big four; many retailers also include sugars, saturated fat, fibre and sodium; other nutrients may be declared voluntarily. There are pressures to remove additives (e.g. metabisulphite) and to replace synthetic additives with natural ones e.g. using cochineal instead of Red 2G. The latter has recently been banned. There is concern about the level of imported pork (Sloyan, 2006) and some products specify the use of British meat.

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The major retailers now have a three tier structure for marketing meat products that includes basic and premium versions alongside a standard version, as well as a healthy product range e.g. low in fat or reduced salt. Consumers make a direct relationship between price and quality, and sometimes wrongly assume that if they pay a higher price for a premium product they will enjoy a better eating quality.

The aim of this study, therefore, was to investigate the eating quality of UK-style sausages in relation to price and the declared composition (meat content, fat content and salt). Thirty-six commercially available sausages were assessed of which five samples were listed in the top 10 brands (MLC, 2005). Information on price and other characteristics were withheld from the members of the sensory panel who assessed the products 'blind'.

2. Materials and methods

2.1. Purchase of sausages and on-pack information

A total of 36 brands of sausages were purchased from a total of 10 retailers over a 4 months period. The products were assessed in a total of ten sensory panels, with four brands and four replications per panel. A couple of brands were assessed in more than one panel.

On each purchase occasion, four brands of sausages (two packs of each brand) were bought on Monday, kept chilled overnight in a refrigerator for sensory assessment the following day. Pack prices were recorded and the price per kg calculated. Information was extracted from the pack on declared meat content, fat content, salt content, level of saturated fat, casing type, source of pork (e.g. British), and the ingredients used. Information on salt content was missing from four of the sausage brands. Salt contents were calculated as 2.5 times the sodium content. All brands were assigned a number to maintain anonymity.

Although the nutritional content was not verified analytically, there is usually good agreement between the declared and actual nutrient content within the limits of analytical variation (FSA, 2003).

2.2. Sensory analysis

Sausages were grilled on setting 4 (80% of full power) in pre-heated conventional Tricity low-level grills and turned every 2 min until an internal temperature of 100 °C was reached, measured by a hand-held digital thermometer. The ends of each sausage were discarded and the remainder cut into 2 or 3 samples which were kept at 60 °C after cooking, wrapped in pre-coded foil wrappers and served warm to a nine member sensory panel. The assessors were all female, aged 35–55, selected in accordance with the British Standard for the selection, training and monitoring of assessors (British Standards Institution, 1993) and had received further training in the sensory assessment of meat broadly in line with the methods of Cross, Moen, and Stanfield (1978).

Each assessor was given the list of sensory descriptors and the definition of these words (Table 1), which had been agreed by the assessors at previous training sessions used to develop a consensus of fixed choice sensory profile descriptors. Assessors were asked to rate the samples for each attribute by marking a point on a 100 mm unstructured line scale with anchor points at each end. A hedonic scale for overall liking, which served as an indication of preference, was also included. This cannot, however be used to infer consumer acceptance since the results were based on only nine assessors who cannot be considered as typical consumers because of the training they have received in meat assessment.

All assessments took place in a purpose-built panel room with separate booths illuminated by red light so the assessors were not aware of any large variation in sausage colour that could be present. The assessors were instructed to rinse their mouth out with water and to use palate cleaners, bread and water biscuits, when necessary. The assessors used direct entry into a computerised sensory assessment programme (Fizz, Version 2.10c, Biosystemes, Couternon, France) to record their results.

Table 1
Sensory descriptors and definitions used to assess different brands of sausages.

Attribute	End points	Definition
Skin toughness	From tender to tough	Texture of the skin on biting
Firmness	From soft to firm	Firmness of the meat on biting
Juiciness	From dry to juicy	Perceived moisture in the sample
Pork flavour	From nil to extreme	Amount of cooked pork flavour
Fattiness	From nil to extreme	Perceived fat within the sample
Meatiness	From bready to meaty	Perceived meatiness of the sample
Particle size	From fine to coarse	Size of particles in the samples
Cohesiveness	From non-cohesive to cohesive	Degree to which sample sticks together
Saltiness	From nil to extreme	Taste associated with salt
Sweet	From nil to extreme	Taste associated with sugar
Acidic	From nil to extreme	Taste associated with acids
Bitter	From nil to extreme	Taste on the tongue associated with caffeine/quinine
Metallic	From nil to extreme	Tangy metallic taste
Overall liking	From poor to good	Overall liking of the sample

2.3. Statistical analysis

Mean values were calculated for price, fat content, meat content and salt content. The sensory data were analysed using full factorial analysis of variance models with sausage brand and assessor as factors, but using the generalised linear model procedure to enable post hoc Tukey comparisons between brands to be made. Pearson product moment correlation coefficients (r) between sausage price and composition and components of eating quality were determined.

The combined data for the sensory attributes and assumed composition consisted of 17 inter-correlated variables. A principal component analysis was performed on the correlation matrix formed from the sample means (average rating for a sausage tasted in one panel) to investigate the spatial configuration of the various types of sausage in terms of sensory attributes and assumed composition. The hedonic 'overall liking' was excluded from the analysis, as were the four samples with missing data for salt content.

3. Results

A total of 36 brands were assessed which included 5 of the top 10 brands (MLC, 2005). Four were 'basic' brands, 14 were standard, 10 were premium and 8 were healthy option brands which were low in fat or salt.

3.1. Sensory data and declared compositional data

Table 2, panel one, shows the results for the first four brands of sausages. There were significant differences in skin toughness ($p < 0.001$), firmness ($p < 0.001$), meatiness ($p < 0.001$), particle size ($p < 0.001$), and bitterness ($p < 0.05$). Ratings for acidic, metallic and bitter were generally quite low, indicating that the assessors used only a small part of the scale. As might be expected, the products with a high meat content (products 1 and 2), had higher ratings for meatiness compared with products 3 and 4 which had