Determining the sensory characteristics, associated emotions and degree of liking of the visual attributes of smoked ham. A multifaceted study

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ABSTRACT

The aims of the study were to determine the sensory characteristics of hams and to evaluate consumers' sensory liking of the tested samples. Also the relation between liking and emotion before and after consumption of the products was examined. The type of emotion in respect to the hams using FaceReader (FR) has been studied. To assess the consumers' visual perceptions of the external trait the Eye tracking (ET) was used. The smoked hams varied in colour, ease of chewing, juiciness, fibrousness, tenderness, softness and certain taste/flavour attributes. The differences and disconfirmation between the expected and experienced liking of some hams could have been caused by less experienced odour, lower taste/flavour liking, disappointment and the higher expectations of some consumers. The hams received nearly the same degree of liking of their colour and consistency and significantly different level of liking of their odour and taste/flavour attributes. The ham samples elicited the largest number of "neutral" reactions (FR). The appearance liking of ham images was determined mainly by the difference in perception of fatness and colour. The visual perception (ET) was expressed as various sum of the duration of all fixations for whole areas of the slice of ham.

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1. Introduction

The expectation of liking and emotions play an essential role in food perception by consumers. The expectations are associated with quality cues, such as the intrinsic or extrinsic attributes of the product, which are crucial for the pork purchasing decisions of consumers (Verbeke, De Smet, Vackier, Van Oeckel, Warnants, & Van Kenhove, 2005). The extrinsic attributes of products include the brand name, price, origin, packaging, familiarity, labelling, and psychologically related aspects, whereas the intrinsic attributes contain the sensory and physical characteristics of the products (Deliza & Macfie, 1996; Grunert, 2002; Morales, Guerrero, Claret, Guŕrdia, & Gou, 2008). According to Bello Acebrón and Calvo Dopico (2000), visual impressions are based on the perceived extrinsic cues and provide essential input that may induce quality expectations for meat products. All of these characteristics can affect the consumer's attitude and lead to various choices and purchasing decisions (acceptance or rejection of a food) (Morales et al., 2008).

While a product is being consumed, its sensory characteristics are experienced. Some researchers have assumed that the expectation and sensory experiences are involved in a global product-quality evaluation (Lange, Issanchou, & Combris, 2000). It is worth noting that much less is known about the intrinsic factors that affect food-liking expectations (Köster, 2009).

The emotions evoked by a food product (including ham as an example) may be associated with both its sensory qualities and functionality, as well as its usability, the social implications of using, any related memories, and the anticipated effects of product usage or ownership (Schifferstein & Desmet, 2010). According to Desmet and Schifferstein (2008), products often elicit different types of emotions, which are 'mixed' emotions that occur simultaneously in regard to a given product rather than as single reaction. Emotion can be evaluated prior to, during and/or after consumption of the product (King & Meiselman, 2010). The most appropriate time to measure emotions is during the consumers' exposure to a stimulus or immediately afterward, when the direct reaction to the product occurs.

Cured ham is a popular and liked product by consumers in Poland as well in many other countries. The sensory quality image of a ham is an important feature in determining its acceptance and the decision-making processes of consumers who are considering buying it. The qualitative aspects of a product are all features associated with its aroma, appearance, flavour, texture, aftertaste and sound properties that distinguish it from other products (Murray, Delahunty, & Baxter, 2001). In dry-cured ham (which differ from the ham used in this study) flavour and aroma are the key attributes that affect the overall acceptance and are strongly affected by the raw material, the processing techniques used, and the aging period (Pham, Schilling, Mikel, Williams, Martin, & Coggins, 2008; Sánchez-Peńa, Luna, Garcia-Gonzalez, & Aparicio, 2005).

For ham, it is important to learn more about the intrinsic cues perceived by the senses in terms of the quantitative—qualitative as well as emotional and hedonic dimensions, and their impact on the sensory quality and consumer acceptance of a product. It is also interesting to investigate consumers' opinions on the visual characteristics of meat products that are crucial at the moment of product purchase. In the last decade new device-aided measurement techniques as FaceReader (FR) and Eye Tracking (ET) were introduced in this area (Graham, Orquin, & Visschers, 2012; King & Meiselman, 2010).

The aims of the present study were the following: (1) to describe the similarities and differences in the sensory profiles of smoked hams prepared from various raw material, (2) to evaluate consumers' sensory liking of the tested hams and to observe the relationship between the expected and experienced liking and related emotions before and after consumption of the products, (3) to conduct a preliminary study on determining the type of emotion experienced by the consumers in respect to solid samples (as opposed to liquid or semi-solid foods) using FR measurements and (4) to observe the consumers' visual perception of the external features of the selected hams by ET technique and compare the results with the liking scores of the visual attributes of the hams.

The studies presented in this paper are part of a larger complex project focus on evaluating sensory characteristics of pork meat products and determining the impact of sensory and non-sensory factors on the acceptance of meat products by consumers. The studies also include methodological issues related to the possible use of devices such as FaceReader and Eye tracking to determine, respectively, emotions and visual perceptions regarding meat products, represented by the ham.

2. Experimental

2.1. Samples

The products used in the study were smoked hams obtained from the pork raw material characterized in Table 1. The hams were produced in the Olewnik-BIS meat factory in Poland. The slaughter and post-slaughter procedures were identical as used in meat industry. The hams were delivered to the sensory laboratory (at the Faculty of Human Nutrition and Consumer Science, WULS-SGGW, Warsaw).

2.2. Experiment design and methods

The experiments within the study were performed consecutively, using different methods (Fig. 1).

2.2.1. Sensory analytical method

The sensory characteristics of the smoked hams were assessed by the Quantitative Descriptive Analysis method (ISO 13299:2010a). Twenty-one attributes were chosen and defined according to the QDA protocol. The intensity of the attributes was measured on a linear unstructured scale (0—10 cm), anchored "light" to "dark pink" for colour and "none" to "very strong" for visually perceived fatty, odour (smoked, meat, acidic, fatty and other), flavour (meat, smoked, fatty, spicy) and taste (salty, sour, bitter, other), and "low" to "high" for the textural characteristics (tenderness, softness, density, ease of chewing, fibrousness, juiciness) of the samples.

2.2.2. Consumer test (n = 30)

The consumers' liking of the colour, odour, taste/flavour and texture of the hams and the liking of the photo-images of some hams were assessed using a linear 9-point hedonic structured scale (ISO 4121:2010b). The general expected and experienced liking and emotion before and after tasting the samples were evaluated. The scale was anchored "extremely disliked" to "extremely liked" (with respect to the liking attributes) and "not positive at all" to "very positive" (to measure the emotional effect). The expected liking and the emotion before tasting were based on the consumers visual impressions regarding the sensory attributes of the hams. Separately, the consumers' visual liking of several attributes (colour, surface, fatness, consistency, freshness, overall liking and emotion) when looking at the photo-images of slices of ham displayed on a computer monitor was determined.

2.2.3. FaceReader study (n = 30)

Seven basic emotions ("happy', "sad", "angry", "surprised", "scared", "disgusted" and "neutral") in relation to the ham samples were determined using FaceReader 4 software (Noldus Information Technology, Wageningen, The Netherlands). This software renders the face in three dimensions based on 491 model points, allowing for a reliable determination of the above-mentioned facial expressions. The participating consumers were thoroughly informed about the assessment procedure, which was established during the preliminary session. To minimise artefacts due to tasting and chewing the products, the emotions of the consumers were

Table 1
Characteristics of samples used as experimental material.

Ham sample	Breed or cross breed	Type of feeding	Feed supplementation
RK	PBZ breed animals	Standard feed, 2 g/100 g canola oil	Without supplementation
R1D1	PBZ breed animals	Standard feed, linseed oil (3 g/100 g), selenium (1 mg kg^{-1}) of feed	Vitamin E (100 mg kg^{-1} of feed), lower level — LL
R1D2	PBZ breed animals	As above	Vitamin E (200 mg kg^{-1} of feed), higher level — HL
R2D1	PBZ × Duroc (PBZ hybrid breed of Duroc)	As above	Vitamin E (100 mg kg^{-1} of feed), lower level — LL
R2D2	PBZ × Duroc (PBZ hybrid breed of Duroc)	As above	Vitamin E (200 mg kg^{-1} of feed), higher level — HL