

ความเข้าใจเรื่องการรับรู้ทางประสาทสัมผัสของผู้บริโภคที่มีต่ออาหาร และความสัมพันธ์กับการยอมรับของผู้บริโภคที่มีต่ออาหารนั้น

Understanding Consumer Sensory Perception of Food and Its Relationship with Food Acceptability

เกษม นันทชัย (Kasem Nanatachai)*
ธนกร โรจนกร (Tanakorn Rojanakorn)**
รัชฎา ตั้งวงศ์ไชย (Ratchada Tangwongchai)**

บทคัดย่อ

การศึกษานี้มีจุดมุ่งหมาย เพื่อที่จะสื่อสารหลักการและวิธีการที่ใช้ประเมิน การรับรู้ทางประสาทสัมผัสของผู้บริโภคที่มีต่ออาหาร ได้เลือกผลิตภัณฑ์เนื้อ 5 ชนิดเป็นตัวอย่างอาหารที่ใช้ในการศึกษา โดยใช้เป็นตัวกระตุ้นให้ผู้บริโภคระบุคำ หรือกลุ่มคำ ที่ใช้อธิบายลักษณะทางประสาทสัมผัสของผลิตภัณฑ์เนื้อเหล่านั้น คำ หรือข้อความ ที่ผู้บริโภคส่วนใหญ่ใช้อธิบายลักษณะทางประสาทสัมผัสของผลิตภัณฑ์เนื้อดังกล่าว ถูกนำมาสร้างเป็นแบบสอบถามมาตรฐาน ผู้บริโภค 120 คน ประกอบด้วย ชาย 60 คน และหญิง 60 คน ทำการทดสอบชิมผลิตภัณฑ์เนื้อทั้ง 5 ชนิด และระบุระดับความรู้สึกทางประสาทสัมผัสในด้านต่าง ๆ และระดับความชอบที่มีต่อผลิตภัณฑ์เนื้อแต่ละชนิดลงในแบบสอบถาม เมื่อวิเคราะห์ข้อมูลที่ได้โดยวิธีการวิเคราะห์ปัจจัย ด้วยวิธีการสกัดปัจจัยโดยวิธีองค์ประกอบหลัก พบว่า การรับรู้ทางประสาทสัมผัสของผู้บริโภค ที่มีต่อผลิตภัณฑ์เนื้อเหล่านั้น สามารถอธิบายได้โดยองค์ประกอบหลักเพียง 2 องค์ประกอบคือ "ความรู้สึกที่มีต่อเนื้อสัมผัสของผลิตภัณฑ์เนื้อ" และ "กลิ่นรสชาติและสีของผลิตภัณฑ์เนื้อ" เมื่อทำการวิเคราะห์การถดถอยพหุโดยใช้ค่าคะแนนความชอบเป็นตัวแปรตาม และองค์ประกอบหลักทั้งสองเป็นตัวแปรอิสระ พบว่าค่าคะแนนความชอบมีความสัมพันธ์ต่อกับองค์ประกอบหลักทั้งสอง ในกรณีนี้ผู้บริโภคอาจใช้ปัจจัยอื่น ๆ ร่วมกับความรู้สึกทางประสาทสัมผัสที่มีต่อผลิตภัณฑ์เนื้อเหล่านั้น ในการกำหนดความชอบที่มีต่อผลิตภัณฑ์

Abstract

The aim of this study was to communicate an approach and technique in identifying consumer sensory perception of food. A range of 5 meat products was used as stimuli to assist consumers in verbalizing sensory attributes. The most frequently occurring terms were compiled into a questionnaire used to profile the consumer sensory perception of the meat products. Sixty female and sixty male subjects rated 5 meat products on 100-mm line scales to indicate how intense of each product for each of the sensory attributes listed. These data were subjected to principal component analysis. Two principal components were found to describe the underlying sensory dimensions of the meat products. They were designated as "sensation of texture" and "flavour and colour". The multiple regression analysis however shows that there essentially no correlation between liking scores and these two sensory dimensions. The consumers may use these dimensions in combination with some other factors in determining their liking towards products.

คำสำคัญ : ผลิตภัณฑ์เนื้อ การรับรู้ทางประสาทสัมผัส การวิเคราะห์ปัจจัยโดยองค์ประกอบหลัก การวิเคราะห์การถดถอยพหุ

Keywords : Meat products; Sensory perception; Principal component analysis; Multiple regression analysis.

* ผู้ช่วยศาสตราจารย์

** อาจารย์ ภาควิชาเทคโนโลยีอาหาร คณะเทคโนโลยี มหาวิทยาลัยขอนแก่น

Introduction

Developing food products is a very important activity in maintaining a healthy organization as well as the successful growth of the food industry. It is not, however, expected to be an easy task. Every year, many food products are developed and launched and it has been estimated that over 80 % are not commercially successful (Best 1991; Buisson 1995). One of the major contributors to product failure is a poor understanding of consumer needs and of the market. It is well accepted that in the process of food product development, consumers needs must be identified at an early stage to ensure a greater chance of commercial success (Fuller 1994). Thus information about consumer needs must be acquired for food product development to be successful.

There are various approaches to collecting useful information. It is argued that information on consumer needs can be generated from an understanding of the behavior of potential consumers to existing products. It is well accepted that the existence of sensory attributes is significant in food choice (Fuller 1994). It is believed that a specific range of food products would be well accepted should they capture various sensory attributes in accordance with consumer expectations (Raats et al 1995). The authors have extended this idea to suggest that if the sensory attributes of a specific product range can be identified then this may be used in the marketing of existing products or to develop new products.

This study was therefore performed to see whether various sensory attributes of a specific product range could be identified and what are their relationship with consumers liking. It should be emphasized that the paper aims to communicate an approach and technique, rather than the specific outcomes of this research.

Materials and Method

Products

A range of 5 meat products available in Khon Kaen was used as stimuli to elicit consumer sensory attributes. They are fermented pork

sausage (Nam), pork emulsion sausage (Moo Yaw), frankfurter, ham and pork ball. Meat products were specifically selected since in the North-East they have been popular food items and have grown in the number of varieties available to the consumer.

On the day of tasting the meat product samples were prepared and placed in identical, coded, disposable, white polystyrene containers. Each container was filled with 3 pieces of prepared meat products. Tasting was carried out at room temperature in individual booths and water and pieces of white bread were provided for rinsing and cleansing the palate. The tasting was carried out at the sensory laboratory of the Department of Food Technology, Faculty of Technology, Khon Kaen University.

Consumers

Sixty males and 60 females, aged between 18 and 45 years, who normally consume and buy meat products, were invited to participate in the study. All subjects were associated with Khon Kaen University, as lecturers, technicians, supporting staff or students. These subjects had never been trained in taste testing before.

Elicitation of sensory attributes

To enhance ability to communicate with consumer effectively, words and descriptors used to design a questionnaire must be as close as possible to the common language of consumers (Sokolow 1988). The sensory attributes of the product must therefore be identified by consumers. In this research, a vocabulary elicitation technique described by Nantachai et al (1996) was used to assist subjects in verbalizing sensory attributes. Subjects were however asked to taste and state their sensory perceptions rather than using the food names as stimuli. In addition, instead of presenting a triad of products to each subject at a time only a pair of samples was presented to a subject.

Ten females and ten males drawn from the initial pool of subjects were asked to take part in the sensory attributes elicitation process. Before starting the elicitation process, a set of

product pairs to be presented to each subject was randomly pre-determined. The first pair of products was randomly selected from the pool of 5. The second pair was formulated by selecting one of the products from the first pair and the new product from the remaining pool of 3. The product common to the first and the second pairs was then discarded. The remaining product and other new product from the remaining pool were used to form the third pair. This procedure was repeated until all the products were included in predetermined pairs. There were a total of 5 pairs of products derived from a pool of 5 products.

In the elicitation process, each subject was presented one at a time with his or her own individually randomized pre-determined order of the 5 pairs. Each subject was firstly asked to look at and taste any one product in the pair and memorize the sensation. After tasting the first product, the subject was instructed to use a piece of bread and to sip water to cleanse the palate before looking at and tasting the next.

When both products in the first pair were looked at and tasted, a subject was then asked to describe his or her perceived differences and similarities in sensation between the products. The elicited terms and words were recorded. The subjects were also asked to describe the two poles of each elicited term. For instance, one of the elicited term was "Chewiness"; the two poles associated with this term were "not chewy" and "very chewy".

When the subject could no longer express any more new terms, the second pre-determined pair was introduced. The same procedure was repeated for the second pair and the remaining 3 pairs. The acquired information was a list of terms and the two poles of each term for each individual who took part in the elicitation process, describing his or her sensory perceptions on the range of 5 meat products. The sensory attributes elicitation session for each subject lasted approximately 45 minutes.

Construction of questionnaires

Each individual list of elicited attributes and their individual two poles were first examined, then those terms that had been mentioned by at least ten subjects were selected as the common perceived sensory attributes of the selected meat products. These selected attributes were then used to design a consensus questionnaire to be used by all subjects. The questionnaire was constructed by listing all the selected sensory attributes vertically and each attribute was associated with a 110-mm horizontal continuous line scale with anchor points 5 mm from each end.

In this research, the degree of liking of each subject towards each product was also measured. This was done by including a statement "your liking toward this product is...." in a questionnaire. The line scale associated with this statement was anchored with the words "dislike extremely" on the left-hand side and "like extremely" on the right-hand side respectively.

Response collection

Subjects were asked to rate each meat product for the perceived intensity of each attribute presented in a questionnaire. Rating of each product was done by placing a mark on the line scale for each attribute at the point that best reflected their perceived intensity of that particular attribute.

The order of product presentation and attributes in the questionnaire was adjusted to avoid positional bias. Subjects were asked to cleanse their palate with a piece of bread and a sip of water after tasting each product. Responses were recorded as line lengths from the left-hand anchor on the scale to where the line was marked.

Data analysis

The data obtained from each subject were prepared in the form of separate product by attribute data matrices. The prepared data sets were then subjected to principal component

analysis (Chatfield and Collins, 1980; Dillon and Goldstein, 1984) to identify those attributes that have common characteristics as a smaller set of underlying dimensions.

The analyses were performed by using the SYSTAT statistical package (Wilkinson 1990). Only the principal components with an eigenvalue of at least 1.00 were selected for further interpretation (Piggott, 1986). These principal components were then subjected to a varimax rotation, before interpretation.

Each selected, rotated, principal component was interpreted judgmentally by determining attributes that were highly correlated with the particular principal component. Only the attributes with component loading of 0.5 or more were used in the description of the selected principal components (Schutz, 1988).

The means of the component scores of all respondents on each product, across all selected rotated principal components, were also calculated. Since all selected principal components (axes) are always orthogonal to each other, the mean component scores of each product can be viewed as co-ordinates of that specific product on the space defined by those axes. These coordinates can be simply use to plot the products on an n-dimensional map.

To understand the relationships of sensory dimensions and the subjects liking for the selected products, a linear regression analysis was also performed. Each derived sensory dimension was taken as an independent variable and the hedonic response was used as a dependent variable. The regression analysis was carried out on a combination of products and respondents. The parameters of a regression equation were estimated by using a SYSTAT statistical package (Wilkinson 1990).

Results and Discussion

Between 5 and 13 constructs were elicited to denote sensory attributes of the selected meat products. Further screening of the elicited constructs was conducted by selecting those that were mentioned ten or more times. A total

of 7 elicited attributes were selected as common to all subjects taking part in the study. All the selected sensory attributes and a hedonic scale presented in a questionnaire and their associated two poles are shown in Table 1. A sample questionnaire and the specific instructions for a subject used for rating one particular product is shown in Table 2.

The sensory attributes are grouped into two uncorrelated principal components (PCs) or underlying dimensions which account for 59.6% of the total variance in the data, as shown in Table 3. We interpret that the subjects perceived sensory attributes of the meat products is summarized on two major dimensions.

The first PC, which explains 33.4% of the total variance in the data, is associated in descending order of component loadings by the attributes "chewiness", "springiness", "crispness" and "smoothness/coarseness" (Table 3). These attributes are not independent concepts and are highly correlated. Together they make up a single component and are explaining the sensation of product texture. It seems that when a product is perceived to be more chewy, the more springy, crispy and smooth texture it would be. The component is therefore labeled as "sensation of texture".

The second PC, combining another three sensory attributes namely; "strength of flavour", "sour taste" and "intensity of colour" explains a further 26.1% of the variation in the terms subjects use to define the meat products. It is therefore designated as "flavour and colour".

The relative positions of the products in the space defined by the first and second sensory dimensions (principal components) are shown in Figure 1. Along the first sensory dimension (sensation of texture), pork ball, pork emulsion sausage (moo yaw), frankfurter, pork fermented sausage (nam), and ham are perceived in descending order of their chewy, springy, crispy and smooth characteristics. Pork ball is perceived to have the most chewiness while the product with the least chewiness is ham.

In Figure 1, the second sensory dimension (flavour and colour) appears to separate the products into three main groups. Nam is showing the highest positive loading in PC2. It is perceived to be a product with the most intense flavour, the darkest colour and the most sour taste. Frankfurter is showing a low positive loading in PC2, thus it is considered to have less intense flavour, lighter colour and less sour taste than nam. Pork ball, moo yaw, and ham are products that show their negative loadings in PC2, thus they are quite similar products regarding their mild flavour, light colour and low sour taste.

Table 4 shows the results of multiple regression analysis of liking scores on the derived sensory dimensions. The results show that there is essentially no correlation between liking and those two sensory dimensions ($R^2=0.219$). This may reflect that the subjects may use the product sensory attributes in combination with some other factors which were not considered in this research to determine their liking. Nevertheless, when the standardized coefficients of sensory dimensions are compared, "sensation of texture" appears to be relatively more important than "flavour and colour" in determining subjects' liking.

Conclusion

The technique and approach employed in this research could be used to generate information that might be useful for product development. Those defined product characteristics however merely give guideline information on what are expected by the consumers, should the products are to be developed. Despite the understanding of the consumer sensory perception, it is believed that further works have to be conducted to find out what would be other factors determining the products' acceptability.

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Table 3. Loadings of sensory attributes on two principal components, which were defined as their underlying dimensions, evaluated by 60 subjects on a range of 5 meat products.

Sensory attribute	Principal components	
	1	2
Chewiness	0.78	-
Springiness	0.77	-
Crispness	0.76	-
Smoothness/coarseness	0.72	-
Strength of flavour	-	0.79
Sour taste	-	0.77
Intensity of colour	-	0.70
Percentage of variance accounted for	33.43	26.13
Cumulative percentage of variance accounted for	33.43	59.56

Note: Only the component loadings of 0.5 or more have been shown and these component loadings were derived after the submission of the selected principal components to varimax rotation.

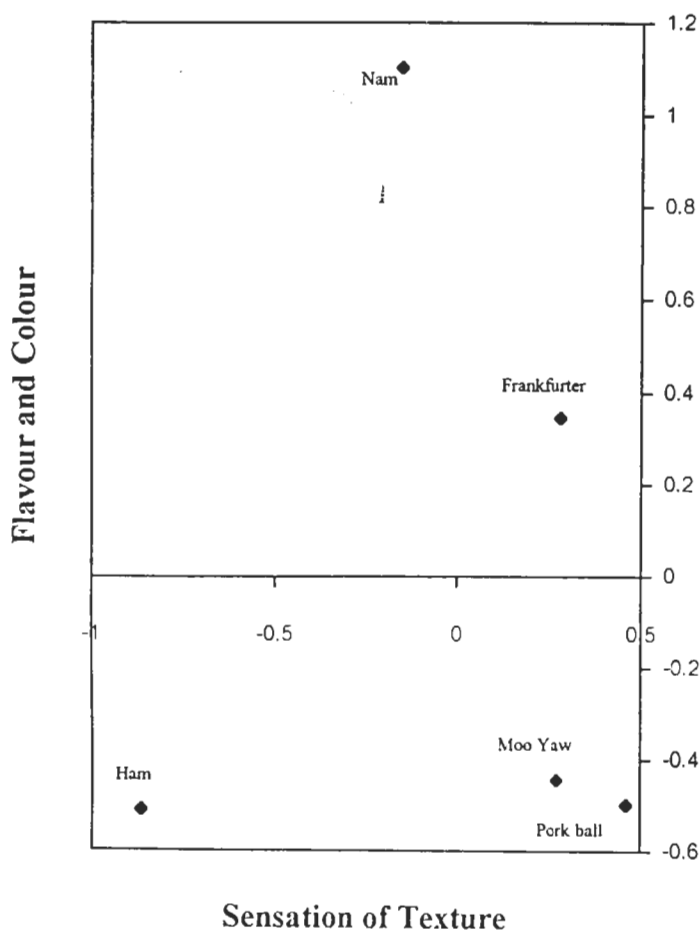


Figure 1. Location of 5 meat products in perceptual space defined by the first and second sensory dimensions (principal components) as perceived by the subjects. (Principal component 1, "sensation of texture" ; principal component 2, "flavour and colour").

Table 4. Multiple regression results relating liking towards selected meat products to sensory dimensions (N = 600).

Variable	Regression coefficient	Standard error	Standardized regression coefficient	p
Dependent:				
Liking	-	-	-	-
Independent:				
Constant	65.243	0.953	0.000	< 0.01
Texture	12.363	0.954	0.468	< 0.01
Flavour and colour	1.446	0.954	0.055	> 0.05
$R^2 = 0.219$				