การรับรู้ทางประสาทสัมผัสของผู้บริโภคที่มีต่อน้ำอ้อยพันธุ์ต่าง ๆ

SENSORY PERCEPTIONS OF SUGAR CANE JUICES

เกษม นันทชัย (Kasem Nantachai)* วรนุช ศรีเจษฎารักษ์ (Voranuch Srijesdaruk)*
สุนันทา วิริยาภิรมย์ (Sunanta Viriyapirom)** รัชฎา ดั้งวงศ์ไชย (Ratchada Tangwongchai)**

บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์การรับรู้ทางประสาทสัมผัสของผู้บริโภคและประเมินความชอบของผู้บริโภคที่มีต่อน้ำอ้อย 7 พันธุ์ คำหรือข้อความที่ผู้บริโภคส่วนใหญ่ใช้อธิบายลักษณะทางประสาทสัมผัสของน้ำอ้อยถูกนำมาสร้างเป็นแบบสอบถามมาตรฐาน ผู้บริโภค 42 คน ประกอบด้วย ชาย 21 คน และหญิง 21 คน ทำการทดสอบชิมน้ำอ้อย 7 พันธุ์ พร้อมทั้งระบุระดับความรู้สึกทางประสาทสัมผัสในด้านต่าง ๆ และระดับความชอบที่มีต่อน้ำอ้อยแต่ละพันธุ์ตามที่ปรากฏในแบบสอบถาม จากการวิเคราะห์ข้อมูลที่ได้โดยวิธีการวิเคราะห์ปัจจัย ด้วยวิธีการสกัดปัจจัยโดยวิธีองค์ประกอบหลัก พบว่า สามารถอธิบายการรับรู้ทางประสาทสัมผัสและความชอบของผู้บริโภคที่มีต่อน้ำอ้อยได้ด้วย 2 องค์ประกอบหลักคือ (1) ความชอบต่อน้ำอ้อย ความเป็นธรรมชาติ และความสดของน้ำอ้อย และ (2) ลักษณะปรากฏและความหวานของน้ำอ้อย ผู้บริโภคมีแนวโน้มชอบน้ำอ้อยพันธุ์ที่ให้ความรู้สึกเป็นธรรมชาติและมีความสดมาก น้ำอ้อยที่ผู้บริโภคชอบมีสีไม่เข้มมาก มีความขุ่นน้อย และไม่หวานจัด จากน้ำอ้อยที่นำมาทดลองทั้งหมด ผู้บริโภครู้สึกชอบน้ำอ้อยพันธุ์อู่ทองมากที่สุด

Abstract

The aim of this study was to identify sensory perceptions and hedonic responses toward juices of 7 sugar cane varieties. Sensory attributes were elicited using a technique that was modified from the repertory grid technique. The most frequently occurring terms and a hedonic scale were compiled into a questionnaire used to profile the sensory perceptions of sugar cane juices. Twenty one female and twenty one male respondents rated 7 sugar cane juices on 100-mm line scales to indicate the degree of liking toward each juice and how intense of each juice 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 sugar cane juices. They were designated as "liking, naturalness and freshness" and "appearance and sweetness". The respondents seem to like juice samples providing sensations of high naturalness and freshness. The well-liked juices are also perceived to have light colour, low turbidity and low sweetness. The sugar cane juice of U-thong variety is most liked by the respondents.

*ผู้ช่วยศาสตราจารย์
**อาจารย์ ภาควิชาเทคโนโลยีอาหาร คณะเทคโนโลยี มหาวิทยาลัยขอนแก่น.

Introduction

Consumption of fruit and vegetable juice in Thailand is gaining momentum. The number of juice varieties available to consumer has been increased in recent years (Office of the Board of Investment, 1993). This may be a result of economic growth, together with the increasing affluence and changing lifestyles of the consumer. At the same time, there is a propensity for consumer to use convenience foods. All of these factors could have an influence on increased consumption of fruit and vegetable juice (Smith and Wilkinson, 1995).

Sugar cane juice is one of the fruit and vegetable juices available on the market. Although the domestic market of sugar cane juice is still relative small, its consumption has shown significant growth. This is considered to be a result of greater recognition of refreshing effect and nutritional quality. However, only some varieties of sugar cane are suitable for making beverages. It is not known exactly what makes juice of some sugar cane varieties more suitable than others. They may posses specific characteristics that make them more appeal to consumers.

It is well accepted that characteristics of food products generally encompass both physical and chemical components that are normally perceived by consumers as sensory attributes. Sensory attributes refer to those sensory aspects of food products such as taste, texture, flavor and colour (Wierenga, 1983; Meiselman et. al., 1988). Thus sugar cane juice that capture various sensory attributes in accordance with consumer expectations is expected to be more acceptable to consumers.

This study was performed to identify consumer sensory perceptions and hedonic responses toward juices of 7 sugar cane varieties. This was done in an effort to see how each juice was liked and what sensory attributes make some juices relatively be more liked than the others.

Materials and Method

Products

A range of 7 sugar cane juices was used as stimuli to elicit consumer sensory attributes. Six sugar cane juices were freshly extracted from 6 sugar cane varieties namely; Marcos, Q38, F154, Pinda, U-thong and Philippines. Only one sugar cane juice of unknown variety was obtained directly from the market.

One day before the day of tasting the juice samples were prepared and stored at the temperature of 10°C. Before tasting, all juice samples were placed in identical, coded, disposable, white polystyrene containers. Each container was filled with approximately 50 cm^2 of juice. 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 testing was carried out at the sensory laboratory of the Department of Food Technology, Faculty of Technology, Khon Kaen University.

Consumers

Twenty one males and 21 females, aged between 18 and 45 years, who used to consume and buy sugar cane juice, 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

Five females and five males drawn from the initial pool of respondents were asked to take part in the sensory attributes elicitation process. Sensory attributes of sugar cane juices were elicited by using the technique described by Nantachai, et. al. (1992). There were, however, some modifications in the procedure. Respondents were asked to taste the real samples and state their sensory perceptions rather than using the food names as the stimuli. Also instead of presenting a triad of products to each respondent at a time, only a pair of

samples was presented to a respondent. This approach was taken because if a respondent had to taste three products in a triad by the time she/he finished tasting the last product she/he might not have been able to recall the sensation of tasting the first product.

Before starting the elicitation process, a set of product pairs to be presented to each respondent was randomly pre-determined. The first pair of products was randomly selected from the pool of 7. The second pair was formulated by selecting one of the products from the first pair and the new product from the remaining pool of 5. 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 6 pairs of products derived from a pool of 7 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 7 pairs. Each respondent 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 respondent 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 "sweetness"; the two poles associated with this term were "not sweet at all" and "very sweet".

When the respondent could no longer express any more new terms, the second predetermined pair was introduced. The same procedure was repeated for the second pair and the remaining five 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 7 sugar cane juices. The sensory attributes elicitation session for each respondents lasted approximately 45 minutes.

Construction of questionnaires

Those terms that had been mentioned by at least five respondents were selected as the common sensory attributes of the selected sugar cane juices. These selected sensory attributes were used to construct a standard questionnaire to be used by all respondents.

A questionnaire was designed to evaluate consumer sensory perceptions of the selected sugar cane juices. 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 experiment, the degree of liking of each respondent towards each juice 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

Respondents were asked to rate each sugar cane juice 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. Respondents 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 respondent were prepared in the form of separate product by attribute data matrices. The prepared data sets for the group of respondent were 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 eigen-value 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 co-ordinates can be simply use to plot the products on an *n*-dimensional map.

Results and Discussion

Between 5 and 12 constructs were elicited to denote sensory attributes of the juice samples. Further screening of the elicited constructs was conducted by selecting those that were mentioned five or more times. A total of 6 elicited attributes were selected as common to all respondents 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 the subject used for rating one particular product is shown in Table 2.

The sensory attributes and a hedonic scale are grouped into two uncorrelated principal components (PCs) or underlying dimensions which account for 60.7% of the total variance in the data, as shown in Table 3. We interpret that the respondents' perceived sensory attributes of the sugar cane juice samples is summarised on two major dimensions.

The first PC, which explains 33.8% of the total variance in the data, is associated in descending order of component loadings by the attributes 'liking', 'naturalness' and 'freshness' (Table 3). These attributes are not independent concepts, together they make up a single component. The component is therefore labelled as 'liking, naturalness and freshness'. We also interpret that 'liking' is defined in terms of juice naturalness and freshness.

The second PC, combining another three sensory attributes namely; 'darkness of juice colour', 'juice turbidity' and 'sweetness' explains a further 26.9% of the variation in the terms consumers use to define the sugar cane juices. It is therefore designated as 'appearance and sweetness'. 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 (liking, naturalness and freshness), the sugar cane juices of U-thong, Philippines, Pinda, F154, unknown, Q38 and Marcos varieties are perceived in descending order of their naturalness and freshness characteristics. The juice of U-thong variety is perceived to have the most naturalness and freshness while the product with the least naturalness and freshness is the juice of Marcos variety.

Since 'liking', 'naturalness' and 'freshness' are associated with this sensory dimensions, it seems that the respondents associate their liking with the 'naturalness' and 'freshness' characteristics of the products. When a product is perceived to have more naturalness and freshness characteristics, the more product is liked. Amongst all the juice samples, U-thong juice is liked the most. On the other hand the juice of Marcos variety is the least liked product. The juices of U-thong and Philippines varieties are well liked by the respondents in comparison with the juice currently available on the market.

Also in Figure 1, the products can be assigned to two main groups along the second sensory dimension (appearance and sweetness). All products in the first group showing all positive loadings consist of the juice of Q38, Marcos, F154 and Pinda varieties. These juices are considered quite similar regarding their darkness of colour, turbidity and sweetness. The products in the second group showing all negative loadings include the juice of unknown, U-thong and Philippines varieties.

It is apparent that the juice of U-thong and Philippines varieties are perceived quite similar to that of the unknown variety obtained from the market.

Conclusion

Two principal components were found to describe the underlying sensory dimensions of the sugar cane juices. They were designated as "liking, naturalness and freshness" and "appearance and sweetness". The respondents seem to like juice samples providing sensations of high naturalness and freshness. The well-liked juices are also perceived to have light colour, low turbidity and low sweetness. The sugar cane juice of U-thong variety is most liked by the respondents.

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Table 1. Elicited sensory attributes, a hedonic statement and their associated two poles that were used to design questionnaires.

Attribute	Associated poles	
Sensory attribute		
Naturalness	not natural	very natural
Freshness	not fresh	very fresh
Sweetness	not sweet	very sweet
Turbidity	not turbid	very turbid
Colour of juice	light	dark
Strength of flavour	weak	strong
Hedonic scale		
Liking toward product	dislike extremely	like extremely

Table 2. An example of the questionnaire designed for sensory evaluation of sugar cane juices.

Product 851

Please taste and rate the above product according to each statement appearing in the questionnaire, by placing a vertical line on a line scale associated with each statement at the point that best describes your personal opinion.

Strength of flavour
weak — strong

Sweetness
not sweet — very sweet

Naturalness
not natural — very natural

Overall liking
dislike extremely — like extremely

When you finish tasting and rating this product, please use a piece of bread provided and a sip of water to cleanse your palate before tasting and rating the next product.

THANK YOU VERY MUCH FOR YOUR HELP

Table 3. Loadings of sensory attributes and a hedonic response on two principal components, which were defined as their underlying dimensions, evaluated by 42 respondents on a range of 7 sugar cane juices.

Sensory attribute	Principal components	
	1	2
Liking	0.85	-
Naturalness	0.83	-
Freshness	0.76	-
Colour of juice	-	0.81
Turbidity	-	0.77
Sweetness	-	0.66
Strength of flavour	-	-
Percentage of variance accounted for	33.77	26.94
Cumulative percentage of variance accounted for	33.77	60.71

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.*

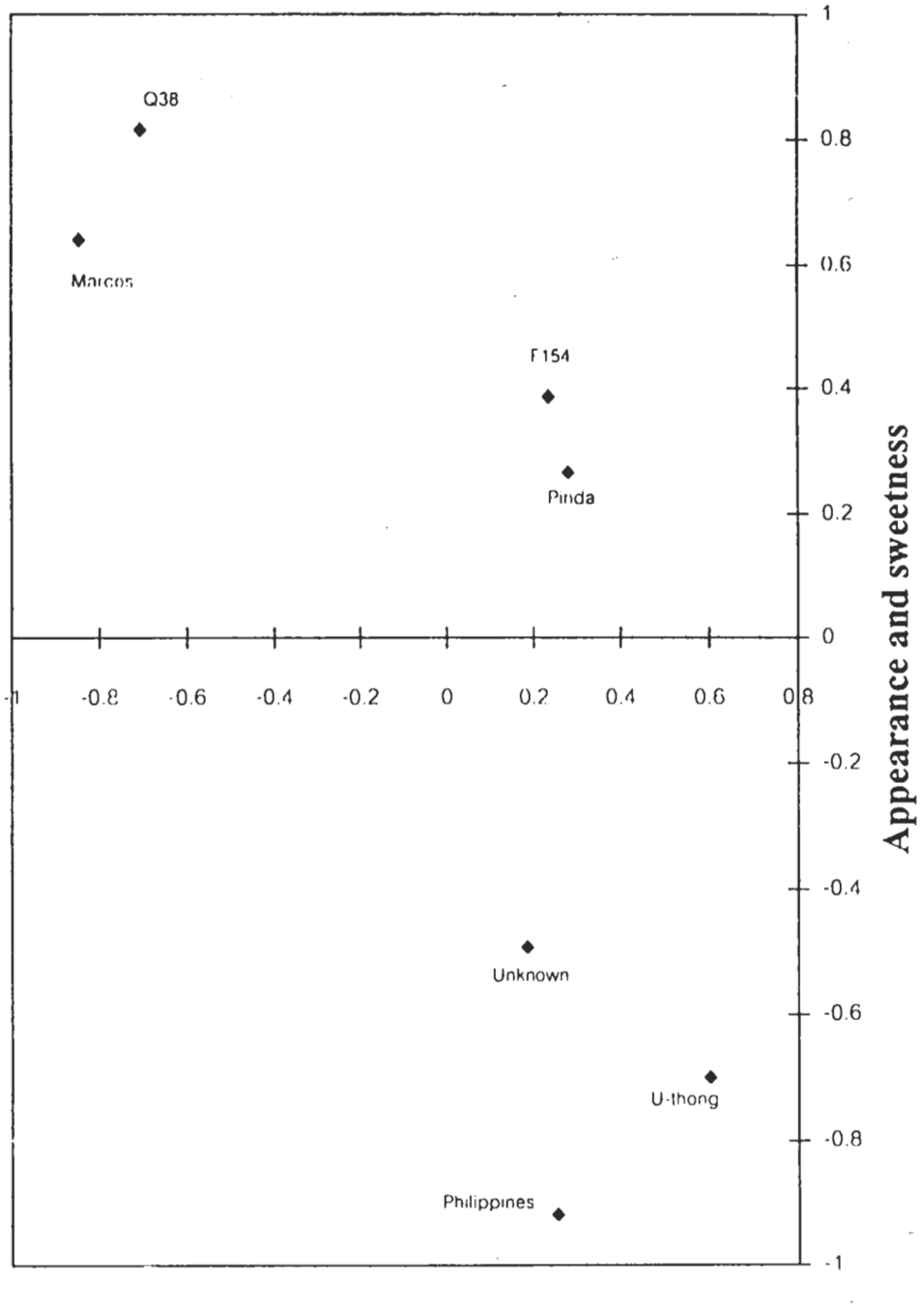

Figure 1 Location of 7 sugar cane juices in perceptual space defined by the first and second sensory dimensions (principal components) as perceived by the respondents. (Principal component 1, Liking, naturalness and freshness; principal component 2, appearance and sweetness).