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Sensory expectations and perceptions of Austrian and Thai consumers: A case study with six colored Thai desserts

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ABSTRACT

This work studied evaluations by Austrian and Thai consumers of their sensory expectations and perceptions of six Thai desserts, each made in three different colors (green, pink, yellow). The color variants differed only in color but not in their ingredients or taste. Expectation tests were performed by showing pictures of the desserts on a monitor and asking them to evaluate their expected overall liking and expected intensities of sweetness, bitterness, sourness and hardness. Results showed that colors of the products were important in predicting expected liking and taste intensity. For the perceived liking test, the samples were served so they could be tasted, and the perceived liking was scored on a visual analog scale. Austrians expressed a strong preference for yellow products whereas Thais preferred green and pink products. Findings of this study can be used as a model for adapting colors of products for new markets and consumer demand.

1. Introduction

Expectations have been indicated as a determining factor in the acceptance of novel (Deliza & MacFie, 1996) and unfamiliar foods (Tuorila, Meiselman, Cardello, & Lesher, 1998). They play an important role in forming acceptance structures, which are key factors in the success of food products in the market. Sensory expectations have a powerful influence on food selection and purchase decisions (Ares, Barreiro, Deliza, Gimenez, & Gambaro, 2010). Consumers have a higher probability of choosing a product when the expectations promise positive quality attributes, and they will probably reject the product when it induces negative expectations (Almli, Verbeke, Vanhonacker, Næs, & Hersleth, 2011; Deliza & MacFie, 1996).

In general, expectations can be defined as hypotheses about future events, and perception itself is the testing of this hypothesis, resulting in new experiences, which then form the basis for further expectations. The dynamic feedback process of expectations, perception and memorable experience (Fig. 1), which is evocative of the scientific method, thus guarantees that our perceptional hypotheses are adjusted to reality. Brain science claims that our brain does not like surprises and therefore permanently creates hypotheses about future events in the form of expectations, with the intention to be able to act very quickly in the moment of confrontation with an actual stimulus (Alink, Schwiedrzik, Kohler, Singer, & Muckli, 2010).

Food expectations are based on former experiences or inborn evaluation patterns. Johansen, Laugesen, Janhøj, Ipsen, and Frøst (2008) showed that sensory expectations are formed basically on prior experiences and familiarity with more or less similar products. The actual formation of an expectation starts with the subjective perception of the situation in which a food product stimulus is given. Already within the situation, there are cues that give indications to quality attributes, which are perceived when the product is consumed. Most of the cues will be in the product itself or in the packaging. Sensory evaluation of food products is always a multi-modal process, meaning that it involves several sensory modalities. The evaluation process starts before the actual tasting by means of visual or acoustical distal perception and goes on proximally with the actual eating or drinking of the product, thus stimulating all of the chemical and physical sensory systems in the oral and nasal areas. The product and the situation deliver so called quality cues, which are perceived prior to the actual consumption and give hints of the quality attributes that are perceived during the course of consumption (Steenkamp, 1989). Consumers will consume the product when quality cues give hope that the product will taste good, and they will refuse it when it is expected to taste poorly (Brunso & Grunert, 2007; Hurling & Shepherd, 2003).

Color plays an important role in the development of food preferences and sensory perception (Crozier, 1996; Spence, Levitan, Shankar, & Zampini, 2010). Colored products have a significant impact on perception thresholds. Many reports revealed that the color of aqueous

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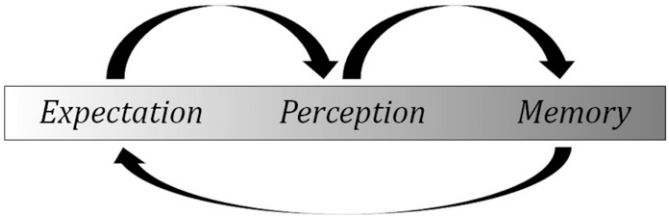

Fig. 1. The dynamic feedback process of expectations, perception and experience.

solutions had an effect on taste thresholds, e.g., (i) "sour" was associated with green and yellow; (ii) "sweet" with pink, orange and red; (iii) green raised sweet thresholds but lowered thresholds for sour and bitter; (iv) violet, black and brown made people think of something bitter; and (v) white, gray and blue enhanced the salty taste (Bayarri, Calvo, Costell, & Duran, 2001; Cardello, 1996). Stummerer and Hablesreiter (2010) reported that colors such as red, orange, yellow or green are associated with ripe fruits or crunchy vegetables through references to natural products. In contrast, blue, black or dark colors were linked with attributes like bitter, unpalatable or even poisonous. Thus, it seems to be obvious that the food color preferences of consumers are based on past experiences, cultural habits, feelings, thoughts, and eating behaviors (Costell, Tárrega, & Bayarri, 2009; Shankar, Levitan, Prescott, & Spence, 2009).

Additionally, color cues are interpreted differently in different cultures. For instance, red-colored food in China is, in general, associated with good taste (Grossman & Wisenblit, 1999). Consumers in Uruguay reject black packages of milk dessert because they seem to have negative associations with this color variant (Ares & Deliza, 2010).

There has been a growing interest in cross-cultural sensory studies in the recent years. The measurement of culturally caused differences in the sensory field is critical to obtain an understanding of hedonic acceptance differences for developing ethnic food products or adapting products for international markets (Buisson, 1995; Yeh et al., 1998). Additionally, Äström et al. (2006) stated that cross-cultural research is an essential step to help food manufacturers in optimizing food products for different markets. Several sensory studies have been conducted on cross-cultural preferences of breads and muffins (Mialon, Clark, Leppard, & Cox, 2002), jellies (Blancher, Lê, Sieffermann, & Chollet, 2008), apple juice (Rodbotten et al., 2009), soy yogurts (Tu, Valentin, Husson, & Dacremont, 2010), salad dressing and beverages (Chung et al., 2012), and green tea products (Kim, Jombart, Valentin, & Kim, 2013). However, the number of investigations on ethnic food products is limited.

Although cross-cultural differences in food perception have been demonstrated, there has been little research about the influence of food color on the expectations and perceptions of consumers across cultures. In the present study, Thai desserts were selected 1) to understand consumers' expectations and hedonic perceptions of novel foods for Austrians and common foods for Thais, and 2) to investigate the effects of the different colors of dessert products on individuals from two different cultural backgrounds. The results of this study can be used as a model to enhance the ability to compete in a foreign marketplace by adapting the colors of products to market preferences.

2. Material and methods

2.1. Sample preparation

The following six Thai desserts, each one colored in green, pink and yellow, were used in this study: *Ar-lua* (AL), *Khao-neow-moon* (KN), *Kleeb-lum-duan* (LD), *Ka-nom-shun* (NS), *Pui-fai* (PF), and *Woon-krob* (WK). Artificial colors (*Winner brand*®, Bangkok, Thailand) were used at concentrations of 0.05 ml/kg for the pink and 0.1 ml/kg for the green and yellow colors. The color concentrations were investigated and defined in preliminary tests by twenty Thai people in Vienna, Austria. The ingredients of each product and cooking method are shown in Table 1.

2.2. Subjects

One hundred twenty subjects, including 60 Austrians and 60 Thais, participated in the experiment. All of the subjects had normal color vision, as indicated by self-reporting. Austrian subjects were recruited within staff members and students at the University of Natural Resources and Life Sciences, Vienna (28 females, 32 males; mean age 27.7 years). The Thai subjects who participated in this study were students and staff members at Mahasarakham University, Thailand (35 females, 25 males; mean age 25.2 years). Subjects were asked to complete a questionnaire after the evaluation of the products. The questionnaire consisted of questions about the following: (1) gender, (2) age, (3) familiarity with the Thai desserts used in this study, and (4) eating frequency of these desserts.

The study was performed in compliance with the ethical guidelines for scientific research of the University of Natural Resources and Life Sciences, Vienna. The subjects were informed about the testing procedure and were also asked to give written informed consent before the test.

2.3. Procedure

The effect of color variations on the expectations of overall liking and the intensities of bitterness, hardness, sourness, and sweetness were investigated before the actual sensory acceptance test. For the expectation test, food pictures were taken with a Canon EOS 400D digital camera. One color variant of one product was shown on the monitor at a time. Subjects were asked to look at the food pictures and to rate their expected likability on visual analog scales, line-scales from 0 to 100 mm. The anchor on the left end was described with "Dislike extremely" and the anchor on the right end with "Like extremely". The subjects also evaluated the expected intensities of sweetness, bitterness, sourness and hardness using line-scales with anchor descriptions on the left end ("Not at all") and the right end ("Extremely bitter (hard, sour, and sweet)").

After the expectation test, the samples shown on the monitor were served, and the participants tasted them to rate how much they liked the samples overall as well as their color, flavor, taste, and texture on line-scales ranging from "Dislike extremely" to "Like extremely". Six samples (two kinds of desserts with three color variations each) were served per day.

All products were served within 24 h of preparation. The samples were presented in a randomized and coded way following a balanced incomplete block design.

2.4. Data analysis

All statistical analyses were performed using SPSS version 21 for Windows (IBM Corporation, Armonk, USA). Repeated measurements of ANOVA (RM-ANOVA) with Bonferroni adjustment were performed with the cultural group (Austrian/Thai) as the main factor. The responses of consumers across the regions for each sensory attribute of the desserts were calculated, checking for significant differences at the $p < 0.05$ level. Independent sample t-tests were conducted to measure differences in the ratings of the expected and perceived sensory attributes between Austrian and Thai consumers and additionally, the results between the expected and perceived overall liking for each sample for both consumer groups. Principle Component Analysis (PCA) allows the recognition of quite intuitive relationships between various factors, and we therefore used PanelCheck (Version 1.4.0; General Public License) to map the relationships among the various liking evaluations (expected and perceived), the dessert type, the