



Emotional responses to sweet foods according to sweet liker status



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ABSTRACT

Sweetness is usually associated with positive affect, but it is known that there are systematic individual variations in the degree of pleasantness of sweet tastes. These variations are thought to be important in determining food preferences. The objectives of this study were to classify people according to sweet liker status, and to examine how they expressed emotions to foods varying in sweetness. The samples used in the study were four commercial products: two beverages (OD and MJ) and two biscuits (WB and CB), each pair differing in sweetness. Subjects were asked to rate their liking for the samples and any emotions elicited by them immediately after they consumed each of the products. Sweet likers (SL) and sweet dislikers (SD) were selected by hierarchical cluster analysis based on hedonic responses to the five concentrations of sucrose solution. SL expressed strong positive emotions in response to the CB and MJ, which were both highly sweet and highly liked by SL. However, they expressed relatively strong negative emotions to the far less sweet OD. In contrast, SD expressed relatively strong positive emotions to WB and MJ which were both liked, while they neither were positive about, nor liked, CB. This study clearly shows that emotional responses are subject to similar individual variations to sweet foods as are measures of liking. In turn, sweet liker status can be shown to be associated with varied emotional states elicited by foods varying in sweetness.

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1. Introduction

From birth, taste is involved in accepting or rejecting foods in humans. Universal preference for sweetness is evident in infants (Desor, Maller, & Turner, 1973; Steiner, Glaser, Hawilo, & Berridge, 2001), who also show innate dislike for bitterness (Steiner et al., 2001). These innate stereotyped responses to common tastes affect early learning and exposure to foods, and consequently other aspects of eating behavior (Elfagh & Erlanson-Albertsson, 2006). Responses to sweet tastes in particular influence food acceptability and choice throughout life (Birch, 1999; Blundell, Rogers, & Hill, 1988). In adults, hedonic responses to sweetness show an inverted-U shape as sweetener concentrations increase, a pattern that has been reported across different cultures (Prescott, 1998). Nevertheless, individual differences in preferences for optimal level of sweetness have long been reported (Moskowitz, 1971; Moskowitz, Jacobs, & Lazar, 1985; Pangborn, 1970). More recently, individual patterns of hedonic responses to sweetness have been classified in terms of sweet likers and dislikers (Laeng, Berridge, & Butter, 1993; Looy & Weingarten, 1991,

1992). Sweet likers typically show increases in liking across sweetener concentrations, while sweet dislikers show monotonic decreases or reach an optimal sweetness point at low – moderate concentrations. Subsequently, other, intermediate patterns of hedonic responses that vary in optimal sweetness within a concentration series have been described (Kim, Prescott, & Kim, 2014).

Efforts to understand food choice, which is often poorly predicted by preference/liking measures, have seen an increased focus in the past decade on measures of emotions that foods may elicit (King & Meiselman, 2010; Meiselman, 2015). Typically, using emotion profiles that include multiple, largely positive, emotion terms, researchers have been able to distinguish products through both the range and intensity of these emotion terms (Cardello et al., 2012; Piqueras-Fiszman & Jaeger, 2014; Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014; Spinelli, Masi, Zoboli, Prescott, & Monteleone, 2015). While emotion terms are often highly correlated with measures of liking (e.g., Spinelli et al., 2015), there is also evidence that they can provide additional discriminative power among products (Dalenberg et al., 2014; Gutjar et al., 2015).

Given the inherently positive valence – albeit with variations – of sweetness, as well as its ubiquity as a food sensory quality, we might expect that responses to sweet tastes in solution would be reasonably strongly predictive of variations in liking for actual

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foods. To date, the evidence for this has been limited. Thus, sweet likers showed significantly increased preference for three out of fifteen sweet foods and five out of twenty-four savoury foods (Kim et al., 2014) when the classification was based on sweet solutions. However, there remains the possibility that measures of emotion might link sweet liking with food preferences more directly.

A major psychological model of emotions describes two underlying dimensions: valence (negative to positive) and arousal (Gerber et al., 2008; Russell & Pratt, 1980). In food-related emotion research, identical dimensions have also been identified (Ng, Chaya, & Hort, 2013; Spinelli et al., 2015). While the valence dimension has much in common with measures of liking, the arousal dimension may also provide explanatory value in sweet liking to food preferences. Arousal is known to more closely relate to the motivation state of wanting rather than to liking (Berridge, 2009). Thus, hunger tends to increase arousal since this facilitates any search for food (Mercer & Holder, 1997). Conversely, food consumption has been associated with reduced arousal, e.g. feelings of calmness (Berridge & Robinson, 1998; Blass, Shide, & Weller, 1989; Macht, Haupt, & Salewsky, 2004). Measures of emotion may also tap into *underlying* motivations for food intake, and they may be particularly revealing when it comes to sweetness. It has been suggested that emotional eating increases the intake of sweet and high-fat foods (Macht, 2008) and emotional and uncontrolled eating positively affected the preference for sweet and fat foods (Lähteenmäki & Tuorila, 1995). Thus, emotional issues could be an important factor for explaining individual differences in sweet liking. Recently, Rudenga and Small (2013) investigated a relationship between brain responses to sweet taste according to sweet liker status, and indicated that responses in the ventromedial prefrontal cortex (vmPFC), which reflects affective value of sucrose, might underlie sweet taste preference. Interestingly, in that study, likers and dislikers did not differ in their characteristics such as diet, alcohol use, body weight and gender, but sweet likers showed a trend to eat foods emotionally, that is, to overeat sweet or high calorie foods in responses to stress or negatively aroused emotions (Larsen, van Strien, Eisinga, & Engels, 2006).

Finally, individual differences have been observed in emotion studies (Gibson, 2006; Macht & Simons, 2000) and it is possible that the link between emotions and food choice are mediated by such variations (Macht, 2008). As one example, Jaeger and Hedderley (2013) considered the importance of individual differences (gender, neophobia, and private body consciousness, PBC) in emotional responses to foods, and compared to their emotions using EsSense Profile. They showed that individuals who have higher PBC scores rated the emotional words higher than those with lower PBC scores. A gender effect on emotional responses was also observed. Likewise, understanding personal characteristics could be an important issue when measuring emotions associated with foods, especially in sweet tasting foods.

The present study investigated individual differences in emotional responses to various types of sweetened foods as a function of sweet liker status. The objectives of the study were to classify sweet likers and sweet dislikers, and examine how this distinction influences the expression of emotions to foods differing in sweetness. We expected that sweet likers might express more negative emotions when consuming less sweet products than would sweet dislikers. Conversely, sweet dislikers, might be expected to express negative emotions to very sweet products. Therefore, it is thought that even though food related emotions are mainly positive, negative emotion terms are important for understanding emotional responses to foods. For this reason, we used both positive and negative emotions from both the EsSense Profile (King & Meiselman, 2010) and the PANAS (Watson, Clark, & Tellegen, 1988).

2. Methods

2.1. Selection of emotion terms

A total of 35 female subjects (mean age = 23 years; age range: 18–35 years) participated in the test. Subjects were asked to name their most favorite and least favorite foods, and to describe how they would feel when consuming these foods, by selecting one or more terms on an emotion list which contained a total of 55 emotion terms from EsSense Profile (King & Meiselman, 2010) and PANAS (Watson et al., 1988). The terms, translated into Korean, were presented on a consumer ballot in randomized order across subjects.

The number of emotion terms elicited by most and least favorite foods is shown in Table 1. The total number of all emotion terms for the most favorite food was 539, while that for the least favorite food was 244. Emotion terms for the main study were selected considering the frequency of use and the balance of terms obtained from both most and least favorite foods, and the top 20% ranked terms from each category were selected. This consisted of 11 terms associated with most favorite foods (*happy, glad, satisfied, joyful, good, pleased, pleasant, friendly, eager, inspired* and *affectionate*), and 11 terms for least favorite foods (*disgusted, distressed, irritable, hostile, afraid, nervous, scared, strong, upset, adventurous* and *alert*).

2.2. Sweet liker classification

A total of 120 female subjects (mean age = 24 years; range = 18–43 years) were recruited from Ewha Womans University campus in Seoul using on-line and off-line flyers. They were asked to participate in the test within the 1–4 h after a meal. The test protocol was approved by the Ewha Womans University Ethics Committee. Subjects gave informed consent and were compensated for the participation. To determine sweet liker status, five concentrations (3, 6, 12, 24 and 36%) of sucrose solution as used in an earlier study

Table 1
Top 20% ranked emotion terms selected for the main test.

Ranking	Most favorite foods		Least favorite foods	
	Emotion terms	Number	Emotion terms	Number
1	Happy	32	Disgusted	28
2	Glad	31	Distressed	26
3	Satisfied	31	Irritable	24
4	Joyful	31	Hostile	23
5	Good	29	Afraid	19
6	Pleased	27	Nervous	18
7	Pleasant	24	Scared	15
8	Friendly	23	Strong	13
9	Eager	20	Upset	12
10	Inspired	20	Adventurous	11
11	Affectionate	19	Alert	11

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