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Consumer reactions to creaminess and genetic sensitivity to 6-*n*-propylthiouracil: A multidimensional study

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Abstract

Creaminess consists of complex sensory attributes that are difficult for consumers to describe. Genetic variation in the ability to perceive the underlying flavor and texture attributes of creaminess may play a role. This role was examined in a previous study involving semi-trained subjects who had been screened for genetic taste responsiveness to 6-*n*-propylthiouracil (PROP). Compared to PROP Nontasters (NT), Supertasters (ST) used a more complex vocabulary to describe creaminess in dairy products and they relied more heavily on dairy flavor and texture attributes to make their judgments. The objectives of this study were to extend these initial findings to consumer descriptions of creaminess and to assess consumer acceptance. Sixty-three NT and 51 ST of PROP evaluated nine commercial dairy products for liking and creaminess intensity using nine-point scales. They also selected from a "check box" list of key sensory terms. Principal Component Analysis (PCA) was used to develop models for the "check box" responses. PCA models captured >75% of the variance in the data. The samples were described in three dimensions: product quality (cooked dairy/sugar attributes); creaminess; and basic tastes. The models were similar for NT and ST. However, ST relied more on the creaminess dimension, whereas NT relied more on the quality dimension. Correlations between the attribute ratings and the factor scores of the PCA revealed that creaminess intensity was associated with the quality dimension for NT and the creaminess dimensions for ST. However, liking was related to the quality dimension for both NT and ST. These data suggest that NT and ST use different attributes to describe creaminess in dairy products. However, perceived product quality was the primary driver of liking regardless of PROP taster status.

Keywords: Creaminess; 6-*n*-Propylthiouracil; Dairy products; Consumers

1. Introduction

The perception of creaminess is a complex function of dairy flavor, texture, fat content and other product attributes (Elmore, Heymann, Johnson, & Hewett, 1999; Mela, 1988; Richardson, Booth, & Stanley, 1993). Discrete information about the sensory perception of creaminess is typically obtained by descriptive analysis using trained subjects. Key descriptive flavor terms for milks with different fat contents include aroma/flavor characteristics of boiled milk smell and flavor, sweet taste, creamy smell and flavor (Bom Frost, Dijksterhuis, & Martens, 2001). Important terms to describe the texture of dairy products include thickness, smoothness and slipperiness (Kokini & Cussler, 1983; Kokini, Kadane, & Cussler, 1977; Kokini, Poole, Mason, Miller, & Stier, 1984), residual mouthfill (Bom Frost et al., 2001) and perceived greasiness (Tuorila, 1986).

Creaminess is also a catchall term used by consumers to describe the positive characteristics of dairy products.

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Drewnowski, Shrager, Lipski, Stellar, and Greenwood (1989) noted the hedonic nature of the term creaminess to consumers by observing a high correlation between acceptability and fat content of foods. However, consumers typically have difficulty articulating the specific characteristics that contribute to their perceptions of creaminess (Elmore et al., 1999). Thus, consumer descriptions of creaminess are typically less informative than those derived by trained individuals. Bridging the gap between objective trained panel measures of perceived creaminess and consumer descriptions of creaminess remains a major challenge to researchers and product developers. Thus, a deeper understanding of the relationship between consumers and technical evaluations of creaminess is needed.

Several studies have utilized multivariate mapping techniques to investigate consumer acceptance of dairy products, often relating it to trained panel evaluations. This type of analysis produces perceptual maps to describe relationships between the underlying dimensions of creaminess (obtained by trained panels) and hedonic judgments (obtained from consumers). For example, Elmore et al. (1999) used trained panels to rate the sensory characteristics of puddings varying in texture. Principal Component Analysis (PCA) was used to describe the perceptual dimensions of the samples. This was followed by preference mapping to link consumer acceptance to the perception of the products. The samples were described in three dimensions corresponding to: (1) consistency-sweetness; (2) dairy flavor and; (3) smoothness. Consumer acceptance of creamy texture was heavily weighted on the first and third dimensions.

Li, Marshall, Heymann, and Fernando (1997) used Free-Choice Profiling (FCP) plus consumer testing to understand the relationship between sensory attributes and consumer acceptance of vanilla ice creams varying in milk fat content. In FCP, each subject develops a personalized list of terms to describe the samples. The samples are then rated for intensity and the data are analyzed by Generalized Procrustes Analysis (GPA) to assimilate the individual data to key perceptual dimensions that describe the products. The ice creams were described by a single perceptual dimension with the positive end of this dimension including attributes such as milky flavor, vanilla, sweet, smooth, creamy and soft, and the negative end of the dimension including properties such as whey, bitter, off-taste, weak, fast melting, icy, sandy and powdery. The researchers interpreted this dimension as representing perceived product quality. Although uni-dimensional models are generally considered a poor resolution of the data, consumer preference ratings strongly confirmed this interpretation. High fat ice creams were more acceptable and were associated with high quality, while low fat ice creams were less acceptable and were associated with low quality. These findings strongly suggested that perceived product quality plays an integral role in consumer descriptions of creaminess.

Richardson-Harman et al. (2000) used a slightly different approach to investigate the effects of thickeners on the perception of liquid dairy products. Consumers rated creaminess intensity and overall liking of the products. The consumer data were analyzed by preference mapping and then trained panel ratings were regressed on the preference dimensions to interpret the spaces (Richardson-Harman et al., 2000). Consumer ratings of creaminess intensity of the samples were described in one main perceptual dimension, in which dairy flavor and texture sensory attributes (Dimension 1) accounted for the majority of variance in the model (68%). Preference mapping of the overall liking scores revealed two-dimensional spaces with the same underlying first dimension of dairy flavor/texture and a second dimension describing sweet and sour taste and cheesy/off-flavors. In the model for overall liking, dairy flavor/texture accounted for 34% of the variance whereas basic tastes and off-flavors accounted for 19% of the variance. Thus, in this analysis, consumer liking encompassed two dimensions of dairy products, dairy flavor/texture attributes as well as "quality terms" such as off flavors and basic tastes.

Kirkmeyer and Tepper (2003a) used semi-trained subjects and FCP to understand the perceptual dimensions of creaminess in commercial dairy products. The products varied in physical form (liquid to semi-solid), fat content and sensory attributes (sour to sweet). The products were described in two dimensions: a creamy flavor/texture dimension and basic taste (sweet–sour) dimension. The first dimension was similar to that of Richardson-Harman et al. (2000), further confirming the importance of this dimension for the general description of creaminess. However, our study produced a more comprehensive model for creaminess including a basic taste dimension that was not apparent in the creaminess model by Richardson-Harman et al. (2000).

Individual variation in perception is a well-known chemosensory phenomenon that further complicates our understanding of complex sensory experiences such as creaminess. Since this variation arises, in part, from genetic differences among people, the use of PROP classified subjects in studies on creaminess might provide additional insights that cannot can be obtained through other means. Response to the bitter taste of PROP (6-*n*-propylthiouracil) is a genetically determined trait and sensitivity to this compound follows a tri-modal distribution consisting of Nontasters, Medium Tasters and Supertasters (Bartoshuk, Duffy, & Miller, 1994). Several studies have shown that PROP Tasters are more sensitive to fat and creaminess in dairy products than Nontasters (Duffy, Lucchina, & Bartoshuk, 2004; Prescott, Bartoshuk, & Pruntkin, 2004). Other studies do not