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Short Communication

Is there a fit in cognitive and sensory evaluation of yogurt? The moderating role of nutrition training

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ABSTRACT

Food selection at a particular occasion is guided by properties of the food itself (sensory or intrinsic properties), but also by the information provided with the food, for example, packaging information (extrinsic properties). We compared preference responses of 71 consumers with a considerable type 2 diabetes risk, who had undergone nutrition counseling in a prevention program, in sensory assessments and product evaluation integrated into Adaptive Conjoint Analysis with the response of a healthy control group (n = 101). Vanilla yogurt, varied in composition (fat content, sugar content, flavor intensity) and packaging information (fat content, sugar content, flavor intensity), was used as stimulus material. Both groups of consumers preferred yogurt with a higher fat content on the basis of sensory evaluation, but rejected products with a higher fat content (10 g/100 g) when this information was available on the package. The degree of rejection was significantly higher for the high risk group. Whereas both groups preferred reduced-sugar yogurt on the basis of declaration, preferences towards the less sweet product were only observed for the high risk group.

1. Introduction

Because of the continuously increasing prevalence of nutrition-related or nutrition-associated diseases such as obesity and type 2 diabetes, it is necessary to understand the attitudes and preferences of a consumer towards food. This knowledge could then serve as the basis for countermeasures and is of special importance as any diet modification, induced by prevention measures such as nutritional counseling, can be regarded as important intervention tool for fighting the metabolic syndrome (Schwarz, Greaves, Lindstrom, Yates, & Davies, 2012). In the context of food choice a technologist, who is mainly in charge of product development and product innovation, places his focus on intrinsic sensory properties of the food. Social and business scientists, however, preferably scrutinize how the evaluation of a consumer is influenced, and how preferences are elevated by extrinsic cues such as brand, price, or packaging. The respective methods that are used to achieve measures of food quality may therefore overestimate or underestimate the relative importance of particular attributes; this indicates that it is strictly necessary to gain a holistic perspective. The study of Hoppert, Mai, Zahn, Hoffmann, & Rohm (2012a) has, in particular, revealed that either the intrinsic or the extrinsic representation of the same constituent may have a different impact on food choice. Using vanilla yogurt as an appropriate and easy-to-manipulate model food, Hoppert, Mai, et al. (2012a) demonstrated that regular consumers are attracted by intrinsic product sweetness, but that the same consumers prefer reduced-sugar products when they decided on the basis of the sugar content that was labeled on the package. In that particular study, intrinsic and extrinsic evaluations of fat content also moved into different directions.

It is therefore obvious that sensory and cognitive processes may not be in accordance during food selection and food choice (see also the goal conflict; Laran & Janiszewski, 2009), and that consumers may not be able to match results of the sensory assessment of intrinsic product properties with their rather cognitive evaluation of, for example, packaging information that may be guided by health considerations. It can also be suspected that Hoppert, Mai, et al. (2012a) found the aforementioned differences because young consumers who were recruited for their study were without urgent needs towards a more healthy eating behavior. Our hypothesis is that this may be different when consumers are considered who are forced towards a healthier lifestyle because of medical needs. In the present study, we therefore intend to measure how a particular consumer characteristic, namely the diagnosis of a severe diabetes risk, influences the interplay in the judgment of intrinsic and extrinsic food attributes.

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Consumers with a high risk of the metabolic syndrome (including type 2 diabetes) who undergo medical treatment and/or participate to prevention programs are usually trained to pay more attention to the composition of foods and its energy density when they choose a particular item (Lindstrom et al., 2010). For these consumers, it may be expected that there is a less pronounced gap between the results of extrinsic and intrinsic food attribute evaluation. This is of special importance as concepts for primary prevention programs may contribute to delaying the progression of the syndrome (Schwarz et al., 2012), especially when beneficial life style changes induced through prevention campaigns can be sustained over a prolonged period of time (Lindstrom et al., 2010; Tuomilehto, Schwarz, & Lindstrom, 2011).

To underline the hypothesis that food evaluation and preference generation is biased by training, the present study aims to reveal the major drivers of yogurt choice for high risk consumers, and to reveal whether and to what degree intrinsic and extrinsic evaluations are conflicting. We therefore apply an integrated decompositional approach using sensory preference testing combined with conjoint analysis.

2. Method

2.1. Study design

To measure the attractiveness of intrinsic and extrinsic food attributes simultaneously, we included conventional sensory preference testing in Adaptive Conjoint Analysis (ACA) by partly replicating the procedure of Hoppert, Mai, et al. (2012a). Because participants are asked to choose between alternatives of a controlled set of products, this approach reflects real-life situations much better than traditional compositional methods in which only one product is evaluated or specific attributes are considered.

The composition of vanilla yogurt that was served to the subjects in 100 mL glasses with twist-off lids was varied in three attributes. Fat content in the milk fraction was either 0.1, 1.5, 3.5, or 10 g/100 g. Plain yogurt with 0.1 and 10 g/100 g fat was provided by Molkerei Freiberg-Hainichen GmbH & Co. (Freiberg, Germany), and fat contents of 1.5 and 3.5 g/100 g were obtained by mixing respective amounts in our laboratory. A vanilla flavor preparation (Zentis GmbH & Co. KH, Aachen, Germany) was added to the plain yogurt base to achieve a concentration of 4 or 7 g/100 g. Total sugar content (sucrose and lactose) was adjusted to either 16 g/100 g or, to ensure a 30% carbohydrate reduction, to 11.2 g/100 g by adding commercial sugar. To manipulate the same sixteen attribute/level-combinations extrinsically, corresponding product labels were printed (Fig. S1). Apart from nutritional information, the labels contained information regarding fat content (the same four levels as given above), sugar content or sugar reduction, and flavor intensity (regular or intensified). As each of the 16 yogurt different samples could be served with 16 different labels, this gives a grand total of $16 \times 16 = 256$ different yogurt variants for presentation in the experiments. Labels were attached to yogurt glasses prior to serving.

In the individual sensory sessions, each panel member received a first identical sample set in a paired-comparison set-up that allowed to assess the internal validity of the preferences. Yogurt A contained 0.1 g/100 g fat, 16 g/100 g sugar, and 7 g/100 g vanilla preparation. Fat content on the label was 0.1 g/100 g, and no additional claims were present. Sample B had 1.5 g/100 g fat, 11.2 g/100 g sugar, and 7 g/100 g vanilla; labeled fat content was 1.5 g/100 g, and sugar reduction was claimed. The subjects were asked to indicate their preference on a nine-point scale with anchors of 'strongly prefer yogurt served left', +4, and 'strongly prefer yogurt served right', +4; the option 'prefer neither nor', 0, served as scale midpoint. To hide the purpose of the study, we decided to omit the compositional importance questions of a typical ACA procedure.

In the following seven individual comparison tasks, each panel member was asked to carefully examine and taste two yogurt samples, which varied in at least one intrinsic and one extrinsic attribute. Each time the subject answered the question, the ACA algorithm updated the estimation of the preference patterns of the respondent. This adaptive conjoint design selects the samples for the next paired comparison question in such a way that the decision of the subject provides the greatest incremental information to improve the estimation of the attribute utilities. Subsequent to the paired comparisons, four calibration tasks were carried out. Each of these consisted of one particular yogurt that was served to the participants. They had to indicate their individual purchase probability, that is related to liking (Drewnowski & Moskowitz, 1985), by using a 0–100% scale. The entire procedure is described in detail in Hoppert, Mai, et al. (2012a).

2.2. Measures

In breaks during ACA sessions, the respondents were asked to respond to a brief questionnaire that was split into five parts. The participants completed the first part before, and the second part after the initial holdout decision. The following parts were completed after the fourth and the final paired-comparison. The remaining part of the questionnaire that contained the health- and food-related questions was answered by the participants after completing the assessments. We measured health awareness of the subjects by adapting a two-item scale from Gould's (1988) Health Consciousness Scale, and further assessed their nutrition self-efficacy (the ability to achieve and sustain healthy eating), and their outcome expectancy (the expected consequences of a healthy eating behavior) by four-item scales (Mai & Hoffmann, 2012; Schwarzer & Renner, 2000). We also measured whether the subjects intend to eat more healthily in the future by a four-item scale (Renner et al., 2008), and whether they have already made respective plans using two-item scales (Schwarzer & Renner, 2000). All multi-item scales were evaluated on seven-point Likert scales ranging from −3 to +3. Internal consistency (for all scales Cronbach's $\alpha \geqslant 0.72$; average explained variance $\geqslant 0.57$) and discriminant validity are given (Fornell & Larcker, 1981). The subjects further stated whether they are aware of the 10 guidelines of the German Nutrition Society (DGE) for a wholesome diet (Fig. S2); these answers were compiled to an index value ranging from 0 to 1. We also asked the participants how frequently they consume food that is generally considered as healthy (i.e., fruits, vegetables, whole wheat products) or that are considered as unhealthy (i.e., deep-frozen convenience food, fried food, and candy, chocolate and confectionary).

2.3. Sample

A total of 172 participants contributed to our study. For the high risk group, 71 subjects were recruited from the diabetes genetic (DIAGEN) study database of patients whose diagnosis is a high risk of type 2 diabetes, and who undergo medical treatment as reported previously (Schwarz et al., 2006). These participants were 56.0 ± 17.8 years old, 61% were female, the average Body Mass Index (BMI) was 29.0 ± 5.3, and they had taken part in prevention programs with specific information about nutrients and food choice in context with the metabolic syndrome. The control group was 101 young consumers from the original research of Hoppert, Mai, et al. (2012a): 24.1 ± 3.7 years, 65% female, BMI = 23.1 ± 2.5. All participants indicated that they were moderately hungry when consuming the yogurt.