Food Quality and Preference 54 (2016) 152–159

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

The blender effect: Physical state of food influences healthiness perceptions and consumption decisions

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ARTICLE INFO

Article history:
Received 12 April 2016
Received in revised form 21 July 2016
Accepted 22 July 2016
Available online 25 July 2016

Keywords:
Physical state
Perceived healthiness
Perceived calorie content
Packaging
Consumption
Categorization

ABSTRACT

The results of four experimental studies show that altering the physical state (e.g., solid, liquid) of a food product, a food pictured on a package, or a food on display influences how healthy and calorific consumers perceive the food to be as well as how much they consume, a phenomenon we term the blender effect. Specifically, holding the volume constant, we show that mechanically processing (e.g., blending, juicing) a food to the extent the physical state changes leads consumers to perceive the food as less healthy and higher in calories. Importantly, we show that healthiness and calorie perceptions are not linked to a specific physical state, but are influenced by the degree of mechanical processing suggested by the physical state, with greater levels of mechanical processing leading food to be perceived as less healthy and higher in calories. Priming consumers to think of the alternative forms foods can take attenuates the blender effect. Our findings suggest that food manufacturers can strategically alter the physical state of foods to drive consumers' perceptions and consumption decisions.

1. Introduction

Consumers often encounter foods in different physical states (e.g., solid, liquid, semi-solid). For instance, at grocery stores apples can be purchased in their raw (i.e., non-mechanically altered) physical state as a solid (e.g., whole fruit), or in other physical states that represent different degrees of processing (i.e., mechanical alteration) such as a semi-solid (e.g., applesauce) or a liquid (e.g., apple juice). Additionally, at sampling stations at grocery stores, cooking demonstrations, and some restaurants (e.g., juice bars) the ingredients in a food or beverage are on display and these ingredients can be in different physical states (e.g., solid/whole fruit vs. semi-solid/fruit puree). Finally, companies often place images of foods on packages, and the foods in these images can be in different physical states.

There is even evidence to suggest that changing the physical state of a food depicted on a package, without changing the contents of the package, can influence consumers' perceptions and purchasing decisions. For instance, when Tropicana removed the image of an orange with a straw inserted into it that had traditionally graced the fronts of packages and replaced it with a glass of orange juice, sales of Tropicana decreased by 20%, while sales of other orange juice brands increased (Nisen, 2013; Zmuda, 2009). Why did changing the physical state of the product depicted on juice packages, and more specifically replacing the solid, whole fruit with a liquid, glass of juice impact Tropicana's sales?

From prior studies the answer to this question is not clear. Prior studies that have examined the effects of physical state have mainly focused on how the physical state of a food influences consumption (de Graaf, 2011; De Wijk, Zijlstra, Mars, de Graaf, & Prinz, 2008; DiMeglio & Mattes, 2000) and satiety (Flood & Rolls, 2007; Irvine, Brunstrom, Gee, & Rogers, 2013). The findings of these studies have been inconsistent, with some studies finding that liquids are more satiating than solids (Kissileff, Gruss, Thornton, & Jordan, 1984; Rolls, Fedoroff, Guthrie, & Laster, 1990); other studies finding solids and semi-solids are more satiating than liquids (de Wijk et al., 2008; DiMeglio & Mattes, 2000; Flood-Obbagy & Rolls, 2009); and still other studies finding no difference in satiety based on physical state (Almiron-Roig, Flores, & Drewnowski, 2004; Flood & Rolls, 2007; Zijlstra, Mars, de Wijk, Westerterp-Plantenga, & de Graaf, 2008). Less attention has been devoted to examining how the physical state of a food influences healthiness and calorie perceptions. It is also unclear how holding the target food constant and altering the physical state of a food on a package or on display will influence consumers' perceptions and consumption. We address these gaps in the literature.

So how would the physical food state of a food influence consumers' evaluations of the healthiness and calorie content of the

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http://dx.doi.org/10.1016/j.foodqual.2016.07.009
0950-3293/

food? When evaluating foods consumers rely on previously formed evaluative categories related to the healthiness/unhealthiness of the food (Chernev, 2011; Chernev & Gal, 2010; Furst, Connors, Sobal, Bisogni, & Falk, 2000). However, all foods in a category (i.e., healthy or unhealthy) would not necessarily be perceived as equally healthy or unhealthy because categories have a graded structure (Barsalou, 1983; 1985). Moreover, category members that are more representative (i.e., prototypical) of the category would receive a different evaluative judgment than category members that are less representative (Trudel & Argo, 2013). In the context of the present research, the above insights suggest that a food that is more representative of the healthy category would be perceived as healthier than a food that is less representative of the category. Of interest here is how the physical state of a food would influence category representativeness and ultimately healthiness and calorie perceptions.

We hypothesized that foods in a physical state that represents the raw (i.e., non-mechanically processed) state or a less processed state would be perceived as more representative of the healthy category than foods in a physical state that suggests a greater degree of mechanical processing. In support of this theorization, research with non-food items shows that physical product differences can influence product categorization (Trudel & Argo, 2013) such that when a piece of paper or a soda can is altered (i.e., crumbled, ripped, dented), consumers categorize the product as more like garbage and are subsequently less likely to recycle it. There is also evidence that food preparation can influence the way consumers categorize the food. For instance, individuals classify boiled eggs as snacks and scrambled eggs as a meal (Ross & Murphy, 1999). Additionally, children easily categorize vegetables (e.g., potatoes) as healthy, however they have difficulty categorizing vegetable based items (e.g., chips and fries) as healthy or unhealthy (Nguyen, 2007). While the physical state of the food remained constant in these studies, the findings suggest that physically altering a food decreases category representativeness.

Based on the previous discussions, we predicted that a blender effect would occur such that when the physical state of a food represented the raw state, or suggested a lesser degree of mechanical processing (vs. a greater degree of processing), the food would be perceived as more representative of the healthy category and ultimately as healthier and lower in calories.

2. Study 1a

The purpose of study 1a was to test whether the physical state of a food influenced healthiness and calorie perceptions. Additionally, we wanted to examine whether differences in expected fullness or expected satiety were driving the effects of physical state on healthiness and calorie perceptions since prior research shows that physical food state can influence expected satiety and expected fullness.

2.1. Design

Study 1a was a within subjects experiment where participants were asked to view and evaluate food items that had been mechanically processed to different degrees (i.e., one version of each food item was less processed the other version was more processed). Participants viewed and evaluated both the less and more processed versions of each food item.

2.2. Procedure

Participants were asked to view a series of more and less processed versions of food items one at a time for five seconds each. After viewing a food item participants were asked to respond to a series of questions about the item. Specifically, the key dependent variables of calorie content and healthiness were measured by asking participants to rate the calorie content (1 = very low, 7 = very high) (Siep, Roefs, Roebroeck, Havermans, Bonte, & Jansen, 2009) of the item and how healthy or unhealthy the item was (1 = extremely unhealthy, 7 = extremely healthy) (Provencher, Polivy, & Herman, 2009) respectively. In addition, participants were asked to estimate the number of calories in the item (Chandon & Wansink, 2007), how full they would be if they consumed the item (1 = not at all full, 7 = very full) (adapted from Brunstrom, Brown, Hinton, Rogers, & Fay, 2011), and the extent to which eating the item would stave off hunger (1 = not at all, 7 = to a great extent) (adapted from Brunstrom & Shakeshaft, 2009).

2.3. Stimuli

The less processed versions of the food items were a fruit and yogurt plate and a cup of peanuts. The more processed versions of the food items were a fruit smoothie (created by blending the fruit and yogurt) and a cup of all natural peanut butter (made of only peanuts and salt). The more and less processed versions of the foods were the exact same weight. Please refer to Appendix A for copies of the stimuli.

2.4. Participants

One hundred and twenty-two members of an online panel (Mechanical Turk) participated in this study in exchange for $0.25 monetary compensation (49.2% females; $M_{age} = 36.63$). Two participants did not evaluate the healthiness of the fruit and yogurt plate and two participants did not evaluate the calorie content of the fruit and yogurt plate. The data from these participants were retained in the sample.

2.5. Data analysis

Paired samples t-tests were used to compare the mean ratings for each food.

2.6. Results

2.6.1. Perceived healthiness

The results supported our prediction and showed that participants perceived the less processed versions of the foods as healthier than more processed versions of the foods. Specifically, participants perceived the less processed fruit and yogurt plate as healthier than the more processed smoothie ($M_{fruit\ and\ yogurt} = 5.74$ vs. $M_{smoothie} = 5.15$; $t(119) = 5.17$, $p < 0.001$). Additionally, participants perceived the less processed cup of peanuts as healthier than the more processed cup of peanut butter ($M_{peanuts} = 4.76$ vs. $M_{peanut\ butter} = 4.33$; $t(1\,2\,0) = 4.82$, $p < 0.001$). Please refer to Table 1.

2.6.2. Perceived calorie content

The results supported our predictions and showed that participants perceived the less processed versions of the foods as lower in calories than the more processed versions. Specifically, the less processed fruit and yogurt plate was perceived as lower in calories than the more processed smoothie ($M_{fruit\ and\ yogurt} = 2.95$ vs. $M_{smoothie} = 3.65$; $t(119) = 5.55$, $p < 0.001$). Additionally, the less processed cup of peanuts was perceived as lower in calories than the more processed cup of peanut butter ($M_{peanuts} = 3.89$ vs. $M_{peanut\ butter} = 4.57$; $t(120) = 6.29$, $p < 0.001$).