Hindawi
Journal of Food Quality
Volume 2022, Article ID 7676353, 11 pages
https://doi.org/10.1155/2022/7676353

Research Article

How Food Shape Influences Calorie Content Estimation: The Biasing Estimation of Calories

Shan Li, Yichen Zhao, and Siyue Liu

Business School, Sichuan University, Chengdu 610065, China

Correspondence should be addressed to Shan Li; lishan@scu.edu.cn

Received 27 January 2022; Accepted 5 May 2022; Published 24 May 2022

Academic Editor: Luis Patarata

Whether for improving health or keeping in shape, consumers are beginning to pay attention to calorie intake. However, although a growing number of studies have focused on the impact of food attributes on consumers, the sensory correspondence between food shape and calorie estimation is an underresearched topic. This review, therefore, reports on three studies investigating the effect of food shape on calorie content estimation, whereby participants perceived food in a square shape to have a higher calorie content than food in a circular shape. Perceived food weight plays a mediating role in the relationship between food shape and calorie estimation. Moreover, the more mindful participants were about calorie intake, the weaker the mediation effect of perceived weight. Conversely, the mediation effect of perceived weight was stronger for people who did not care about their calorie intake. These findings break novel ground by presenting food shape as a relevant factor for calorie content estimation. It not only pays attention to the information brought by the visual sense of food, but also complements the relevant literature in the field of food marketing, and has implications for marketing management.

1. Introduction

The global obesity rate is increasing as people's lifestyles change. However, people have recently been paying more attention to their physical health and weight management, meaning that they are often concerned with their day-to-day calorie intake [1]. In many cases, accurate calorie information on food packaging is available to consumers; however, they are often in situations where they have no time or inclination to read the label carefully [2, 3]. Moreover, there are many food products that are not packaged or that calorie labels are difficult to notice or even overlooked by consumers [4, 5]. In these scenarios, sensory inputs concerning the food object play an important role in consumer behavior [6], such as food calorie estimation.

Sensory inputs include vision, taste, audition, olfaction, and haptics, and product characteristic is a visual factor derived from these inputs. In the case of food products, it influences consumers' food perception and expectations through the physical properties of the product, even before the food has been tasted [6, 7]. The phenomenon of "judge food by its cover" often occurs. For example, consumers generally perceive the total amount of food in multiple small packages to be higher than the amount in a combined package [8]. In addition, consumers' perceptions of healthiness and taste [9], as well as weight [10] and quality [11], are influenced by the external characteristics of the food.

Food shape, as a fundamental feature of food information, can be easily accessed and used as a reference factor in food information judgment. Most of the previous attention to food shape has focused on its influence on food perception. For example, food shape affects taste perception [12–15], willingness to pay [16], and expected and actual food consumption [1, 17, 18].

Despite the importance of external food information to consumers, few studies have focused on the effect of the shape of the food itself on calorie perception. Although Koo and Suk [1] noted the effect of the volumetric size of the food package (height vs. width) on calorie estimation, they did not consider the effect of the shape of the food itself, ignoring the role of visually perceived weight. Moreover, there is no

in-depth study of the psychological consumer pathway attribution for this process. To fill this gap, our work combined food shape, a visual cue of food, with calorie estimation and observed a significant effect of food shape on calorie estimation. The mediating role of weight perception and calorie control awareness were also established.

Drawing on previous research on food shape and weight perception, we hypothesize that different visual estimates of weight associated with different food shapes mediates the magnitude of the calorie assessment. That is, the heavier the weight visually estimated, the higher the number of calories it is perceived to contain. Furthermore, this effect varies inversely with the degree of consumer concern about calorie intake. Specifically, when consumers are particularly concerned about calorie intake, they tend to rationally seek more accurate calorie information rather than making judgments based simply on sensory input.

The findings reported in this study improve the understanding of calorie estimation from the perspective of food shape. In terms of theoretical contribution, this research quantitatively relates food shape to calorie content estimation thereby extending the understanding of calorie content estimation in the current study. More generally, the present study also considered calorie control awareness. Directional evidence is provided for the effect of individual differences in calorie content estimation based on awareness. In terms of managerial insights, marketers can consider using different shape designs in conjunction with visual effects to trigger different psychological responses from consumers and ultimately meet appropriate marketing objectives.

The remainder of this article is structured as follows: First, we briefly review food shape, calorie content estimation, and individual effects of calorie control consciousness. Next, we test our predictions in three different studies by self-reporting. Later, we discuss the concept and management implications of our findings. The limitations of our work and suggested directions for further research are discussed at the end of this article.

2. Conceptual Background

2.1. Food Shape and Calorie Content Estimation. There are different shapes of food and ingredients that vary depending on cooking or preparation, packaging, and ingredients [19]. Squares and circles, for example, are common basic shapes for prepared foods. The different shapes of food can lead to different volume perceptions. Studies concerning the area size of a shape suggested that squares are often perceived to be larger than circles and that elongated objects are perceived to be larger than shorter objects [20]. Based on these findings, we can infer that square-shaped food may seem be larger than circular food when they are equal in weight and height. Existing research about food shapes also focused on the perceived meanings and identities of shapes and their effects on consumers. For example, Liu and Bogicevic et al. [21] demonstrated that compared with angular shapes, circular shapes influenced consumers' emotional expressions and judgment positively. Existing research indicates that circular shapes are often associated with friendliness, warmth, and softness, while angular shapes convey strength and individuality [21–23]. Based on consumers' mental interpretation, the shape of food as a visual element is associated with emotional experience. People tend to assign pleasant feelings to circular shapes and less pleasant feelings to angular shapes [24].

Perceptions of the volume and meaning of food shape will affect consumers' estimation of calorie content. According to existing research, the process of calorie content estimation is still under discussion. Calorie content estimation is usually done in a largely heuristic way, and it is influenced by many factors, including package shape [1], ingredient lists [25], perceived healthiness [26, 27], type of food, and food volume. For example, Koo and Suk [1] suggested that the shape of packaging influenced consumers' estimation of calorie content by its visual image. Chernev and Gal [28] stated that the perceived healthiness of a food product was influenced by the calorie content estimation. Food volume is positively related to calorie content. The larger the food, the higher the calorie content [18, 29]. The volume of solid food is usually calculated by weight, which is the method used in this study. According to the visual size theory of shape, square shapes were perceived to be larger than circular shapes. Consumers perceive food in a square shape to have a larger surface area than food in a circular shape, indicating a larger overall size. Considering the positive relationship between size and calorie count, square food is therefore estimated to contain more calories than food with equal weight and volume, but with a circular shape.

In addition to visual perception, oral haptic input can also influence size and calorie content perception. For example, Szocs and Biswas [18] proposed that the perceived size of the surface area mediated the effect of food shape on evaluated size in oral inputs. They showed that thinner and rectangular-shaped foods were perceived to have a larger two-dimensional surface. As a result, consumers think thinner foods are larger than thicker and cube-shaped foods of equal weight. As the surface of a square is perceived to be larger than a circle, the evaluated size based on oral inputs is larger too. We therefore suggest that the size of square food perceived by consumers is larger than circular food and that square food is perceived to contain more calories than circular food. This statement supports the deduction that food in a square shape is regarded to have a higher perceived weight and therefore has more calories than food in a circular shape. Based on the evidence above, this study aims to evaluate the effect of food shape on calorie content estimation and the mediation effect of perceived weight.

However, some researchers regard calorie content estimation as a top-down process that is influenced by the nature of the food [30, 31]. In this regard, calorie content estimation is based on food healthiness [28], food topping [32], and food sweetness [33], which supports a competing theoretical model that predicts the effect of food shape on calorie content estimation. Shape symbolism refers to the association of a particular shape with certain properties [34]. For example, circular objects—which inspire friendliness

and harmony—may be preferred rather than angular shapes [35]. Many studies have suggested a relationship between circular shapes and the hedonic effect [36], as curved shapes evoke higher hedonic scores [37]. Additionally, Raghunathan et al. [38] suggested that individuals associate a hedonic effect with unhealthy food and displeasure with healthy food. Considering the predictive effect of healthiness on calorie content, it can be said that food shape influences calorie content because of the hedonic effect. Consumers associate a circular shape with unhealthy and high-calorie food, while they relate more square or angular shapes to healthy and low-calorie food. However, the assumption concerning the hedonic effect and unhealthy food may not be accurate in all cases [39, 40]. Werle and Trendel et al. [41] pointed out that cultural differences concerning food influence the relationship between health perception and hedonic effect. For example, in France, healthy food is considered to be more pleasurable than unhealthy food; however, for Americans—who have a more utilitarian view—unhealthy food is usually associated with tastiness. Similar to the French, Chinese people regard food as an important part of life and associate food with pleasure. Referring to a study on the Chinese eating culture by Ma [42]; Chinese people regard food as not only an energy source but also an essential part of life. Food has many social functions and special meanings in Chinese society. This contributes to the question of food shape and how it affects people's hedonic perception. However, this relationship is not enough to mediate the effect between food shape and calorie content estimation, which will be demonstrated in this study.

Moreover, previous studies have demonstrated that people's tastes match the dimensions of the shape. For example, for a food product such as yogurt, design-sensitive consumers will perceive yogurt with a polygonal package shape (vs. a rounded package shape) as having a stronger flavor [12]. Another example is that round shapes are more strongly associated with sweetness, while angular shapes are more strongly associated with bitterness and sourness [13, 15, 43, 44]. This study also provides evidence for the idea that circular shapes used in food-related packaging or typefaces tend to increase sweetness expectations [45, 46]. In some cases, it can even affect the perception of sweetness [14, 47]. Moreover, it has been found that food shape abnormalities affect consumers' purchase intentions when food products deviate significantly from normal food. Additionally, there is an interaction between food shape abnormality and the perception of food waste problems and self-identification of environmental protection [48]. In summary, the shape of food can affect consumers' perceptions of food characteristics to some extent.

2.2. Individual Effects of Calorie Control Consciousness. Food appreciation is affected by various factors, such as the food itself, individual differences, and the situation [49]. Apart from food shape, other aspects of food-related consciousness can influence consumers' evaluation of food, as different people have different personal requirements. Howlett and Burton et al. [50] proposed that nutritional information and calorie estimation had a stronger effect on people who care about weight management and health issues. Many dieters are more attentive and sensitive to the calorie content of food. They regard calorie content as important and are very concerned about gaining weight. Therefore, they can often estimate calorie content more accurately [27, 51]. Conversely, people who lack calorie control awareness are free from relying on eating and their body shape to perform heuristic assessments of foods [52]. More intuitive size perceptions influence their calorie content estimation process comparatively, meaning that they are not affected by other food-related information. This creates an active environment for perceived weight differences. As a result, the mediation effect of perceived weight is more obvious for people who do not focus on their calorie intake. The larger perceived size automatically leads to a perception of more weight, resulting in a higher calorie content estimation. However, the more people focus on calorie intake, the less they estimate the calorie content to be according to food weight, which leads to a weakening of the mediation effect of perceived weight. We therefore propose that calorie control consciousness moderates the mediation effect of perceived weight on the relationship between food shape and calorie content estimation.

The statements in this section suggest that there is a relationship between food shape and calorie content estimation. This study conducts a thorough exploration by using three studies to determine the effects and the mechanism behind them. The purpose of study 1 was to examine the direct effect of food shape on calorie content estimation. Study 2 further examined the underlying mediation mechanism of the main effect, and in Study 3, we considered calorie control consciousness and explored the boundary mechanism of the effect.

Most consumers make very subjective judgments about the calorie content of foods that are rarely based on objective and realistic information about food calories. Studies have found that consumers' subjective perceptions of food calories are often biased. For example, adding a visible healthy food to an unhealthy base food (e.g., adding fruit to a cake served on a plate) can lead consumers to underestimate the calorie content of the food [28, 32, 53].

Similarly, in many contexts, consumers may mistakenly believe that a harmful item contains more calories than a beneficial one [54]. Previous studies have shown the health properties of foods to be linked to calorie estimates, leading to the biased belief that foods that are harmful to health contain higher calorie levels [32, 55]. A field experiment in a large restaurant franchise in the southern United States demonstrated this. The restaurant used a menu labeled with calorie content values, and as a result, reduced consumers' high-calorie consumption [56]. Additionally, there are also contextual factors that can influence calorie estimates. For example, when faced with two cups of yogurt with practically the same caloric content, one with a low-fat label and the other with a full-fat label, people may perceive the full-fat yogurt as having more calories [57].

3. Overview of Studies

We offer supporting evidence for our propositions in three empirical studies. We investigated the relationship between food shape and calorie content estimation and the mechanisms behind it. Study 1 provides initial evidence of the direct effect of food shape on calorie content estimates. Study 2 selected different real stimuli and replicated the findings of Study 1. Further, the potential mediating mechanism of the main effect was investigated by a field experiment, where food weight perception mediated the relationship between food shape and calorie estimation. In Study 3, we considered caloric control awareness and explored the boundary mechanisms of the effect. The findings shed light on the potential mechanisms of when the above effects are stronger or weaker. The three studies cascaded from main effects to mediating effects to moderating effects, each giving sound explanations. The relationship between food shape and calorie content estimation and its mechanism is scientifically and rationally explained. Our research model is shown in Figure 1.

4. Study 1

4.1. Participants and Experimental Design. Study 1 was designed as a one-way factor experiment (food shape: circular vs. square) and was performed using two groups. We omitted the data of 12 (13.0%) participants who failed our attention check, leaving a final sample of 80 participants ($N = 80$; 37.5% females; $M_{age} = 27.03$; $SD = 3.09$) responding to online advertisements. Participants were recruited through the WeChat platform (the most widely used social platform in China), and joined the experiment in exchange for 20 RMB. The two groups differed only in the stimuli, which was the display of pictures of either a circular or square cake.

4.2. Stimuli and Pretest. Two pictures of cake were designed by professional designers. The size of cakes and the background in the pictures were designed to have the same dimensions and content. Sixty-three participants ($N = 63$; 68.3% female; $M_{age} = 22.54$; $SD = 2.75$) who did not participate in the formal trial evaluated the two stimuli in a pretest. The results suggested no significant differences in familiarity (F (1, 61) = .02; $p = 0.892$), quality of picture (F (1, 61) = .74; $p = 0.392$), or visual appearance (F (1, 61) = 1.50; $p = 0.226$).

4.3. Procedures and Variables. The experiment was conducted in an acoustic laboratory. Before the experiment, all the participants were informed of the disguised general aims and procedures of the experiment ("The food company is preparing to launch a food product and needs your evaluation opinion. Please check the food picture and complete the questionnaire about it."). Next, the participants were asked to provide written informed consent. Once they agreed, they were randomly divided into two groups on average. In the experiment, participants were asked to look at a picture of cake (circular or square) displayed on an iPad Air 2, after which they expressed their perception of the stimuli picture by completing a questionnaire. All questionnaires were made through Wenjuanxing (https://www.wjx.cn), the largest online survey platform in China. Participants accessed and completed the survey using a URL.

Food shape manipulation was measured by a Likert-type scale ("1 = *square shape*" to "7 = *circular shape*"). Control variables such as familiarity [37], quality of pictures, and visual appearance of pictures [58] were also measured in the questionnaire. The calorie content estimation was self-reported (e.g., "How many calories do you think the cake has?") [58]. Participants were also presented with a reference picture that showed the weight and calorie content of a different type of cake (triangle) [32]. Participants provided their demographic information: age, gender, height, weight, hunger level [58], and educational background [30] at the end of this study. The experiment process lasted approximately 10 minutes. The researchers thanked the participants and paid them the rewards at the end of the experiment. No hypothesis-related information was provided during the experiment.

4.4. Results

4.4.1. Manipulation Check and Control Variables. Data were analyzed using SPSS 21 software. Similar to the results of the pretest, the control variables such as familiarity (F (1, 78) = .06; $p = 0.815$), quality of picture (F (1, 78) = 0.02; $p = 0.876$), and visual appearance (F (1, 78) = 0.02; $p = 0.896$) did not differ significantly between the two groups. Food shape as the independent variable was manipulated successfully ($M_{square} = 1.65$; $M_{circular} = 5.55$; F (1, 78) = 98.46; $p < 0.001$).

4.4.2. Calorie Content Estimation. The results of a one-way ANOVA estimation concerning food shape and calorie content revealed that food shape influenced calorie content estimation significantly and that consumers thought the square food had more calories than the circular food ($M_{square} = 3256.40$; $M_{circular} = 3199.65$; F (1, 78) = 4.31; $p < 0.05$).

The results of Study 1 showed that food shape affected calorie content estimation. The square-shaped food was estimated to have a higher calorie content than circular-shaped food equal in size. However, the electronic pictures displayed in Study 1 may have led to visual errors because of the perspective effect of plain graphics. Moreover, the mechanism of the effect of food shape on calorie content estimation had not been explored until now. To eliminate errors and to expand external validity, Study 2 chose different real objects to examine the mechanism of food shape on calorie content estimation by field experimentation. In Study 2, we examined the mediation effect of perceived weight and explored the relationships between food shape, the hedonic effect, and calorie content estimation.

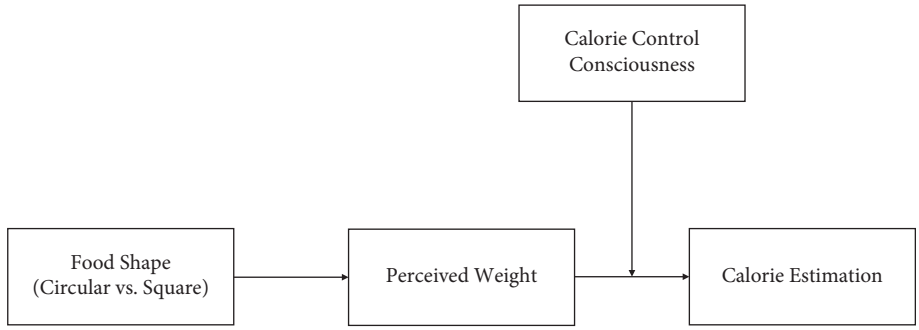

Figure 1: Research model.

5. Study 2

5.1. Participants and Experimental Design. Similar to Study 1, Study 2 was designed as a one-way factor experiment (food shape: circular vs. square) between two groups. Responding to online advertisements we posted on the website (Wenjuanxing, https://www.wjx.cn), the largest online survey platform in China, 81 participants ($N = 81$; 38.3% female; $M_{age} = 27.10$; $SD = 3.23$) who passed the attention check joined the experiment in exchange for 20 RMB. Similar to Study 1, the respondents were divided into two groups randomly. The two groups differed only in the shape of the stimuli.

5.2. Stimuli and Pretest. The stimuli in Study 2 were biscuits that were equal in volume and appearance, with the only difference being their shape (circular or square). Similar to Study 1, a pretest was conducted to check the stimuli. The results from 61 participants ($N = 61$; 75.4% female; $M_{age} = 19.77$; $SD = 1.68$), who did not participate in the formal experiment, suggested that there were no significant differences in familiarity (F (1, 59) = .20; $p = 0.656$) and visual appearance (F (1, 59) = 1.14; $p = 0.291$). In order to avoid additional disturbance, we used white paper plates as containers for displaying the biscuits.

5.3. Procedure and Variables. The experiment was conducted in the same acoustic laboratory as Study 1. Participants were provided with the same disguised purpose of the experiment, and researchers introduced the basic procedures of the experiment to them ("The food company is preparing to launch a food product and needs your evaluation opinion. Please check the food picture and complete the questionnaire about it."). The same consent and group division procedures were followed. In the experiment, participants would visually observe (but not touch or smell) a biscuit (circular or square) presented to them and then complete the questionnaire on an iPad Air 2.

We measured food shape ("1 = *square shape*" to "7 = *circular shape*") and hedonic effect ("1 = *extreme dislike*" to "7 = *like it very much*") [37] with Likert-type scales. Control variables (similar to those in study 1) were measured again. The mediating and dependent variables were measured in an open-ended self-reported format ("How heavy do you think the biscuit is?" and "How many calories do you think the biscuit has?") [58]. Participants were presented with a reference biscuit (shape in a triangle) of which the stimuli differed and for which the weight and calorie content were provided [32]. Demographic information—including age, gender, height, weight, hunger level [58], and educational background [30]—was measured at the end of this study. The experiment lasted approximately 12 minutes. Researchers thanked the participants and paid their rewards at the end of experiment. No hypothesis-related information was provided.

5.4. Results

5.4.1. Manipulation Check and Control Variables. Data were analyzed by SPSS 21 software. Control variables did not differ significantly, and the stimuli were manipulated successfully. Specifically, there were no differences in familiarity (F (1, 79) = 2.69; $p = 0.105$) and visual appearance (F (1, 79) = .67; $p = .416$) between the two groups. Food shape as an independent variable was manipulated successfully ($M_{square} = 1.65$; $M_{circular} = 5.65$; F (1, 78) = 109.38, $p < 0.001$).

5.4.2. Calorie Content Estimation. We conducted a one-way ANOVA estimation of food shape and calorie content. Similar to study 1, the results showed that food shape influenced the calorie content estimation significantly ($M_{square} = 63.48$; $M_{circular} = 57.29$; F (1, 79) = 5.51; $p < 0.05$). This replicated the main effect and confirmed that consumers thought that square food had more calories than circular food.

5.4.3. Mediation Analyses. The result of the one-way ANOVA estimation of food shape on perceived weight showed that people perceived food in a square shape to have greater weight than food in a circular shape ($M_{square} = 16.23$; $M_{circular} = 14.57$; F (1, 79) = 4.56; $p < 0.05$). Study 2 used a bootstrap method to conduct a mediation analysis of perceived food weight [59]. We used food shape as an independent variable, estimated calorie content as a dependent variable, and food weight as a mediator. Referring to the work of Sundar and Noseworthy [60]; we chose model 4 and 5,000 draws. The confidence interval was set as 95%. The results showed the index of the indirect effect was −1.36 and

that it was significantly different from zero ($LLCI = -3.3304$, $ULCI = -.1138$). When we controlled for the perceived weight, the effect of food shape on calorie content was not significant ($LLCI = -10.0242$, $ULCI = .4794$). These results confirmed that the perceived weight mediated the main effect.

5.4.4. Hedonic Effect. A one-way ANOVA estimation of food shape and hedonic effect showed that a circular shape induced a higher hedonic effect ($M_{square} = 3.58$; $M_{circular} = 4.39$; $F\ (1,\ 79) = 5.67$; $p < 0.05$). However, the mediation of the hedonic effect examined by the bootstrap method was not significant. The result of indirect effect was not significant ($LLCI = -2.3658$, $ULCI = .8452$). As a result, the inference that food shape influences the hedonic effect, but the hedonic effect does not mediate the effect of food shape on calorie content estimation, was supported.

Study 2 verified the effect of food shape on calorie content as well as the mediation effect of perceived weight. Although we controlled for individual differences in the previous two experiments, the participants had different levels of calorie control consciousness, which may affect the calorie content estimation. In Study 3, we considered calorie control consciousness as a moderating variable and explored the moderated mediation effect by real stimuli. To expand the universality of the result, we used a type of bread to determine the moderated mediation effect.

6. Study 3

6.1. Participants and Experimental Design. Study 3 was also designed as a one-way factor experiment (food shape: circular vs. square), and we posted the recruitment advertisement on WeChat. For this round, data from 11 participants (8.9%) were excluded from our analysis, as they failed our attention check, and a total of 112 participants ($N = 112$, 46.4% female, $M_{age} = 25.73$, $SD = 4.59$) from a large southwestern public Chinese university participated in this study in exchange for 20 RMB. Participants were again divided into two groups randomly, which differed only in the shape of the stimuli.

6.2. Stimuli and Pretest. The stimuli in Study 3 were two pieces of bread customized by a bakery. One of the breads was circular, and the other was square. The two samples were only different in shape and were equal in volume and appearance. A total of 61 participants ($N = 61$; 65.6% female; $M_{age} = 22.66$; $SD = 2.83$) who did not participate in the formal experiment took part in the pretest and assessed the stimuli. There were no significant differences in familiarity ($F\ (1, 59) = .459$; $p = 0.501$) or visual appearance ($F\ (1, 59) = 1.42$; $p = 0.238$). Another piece of triangular bread with its weight and calorie content provided was used for reference. To avoid bias, the bread was presented on white paper plates.

6.3. Procedure and Variables. Similar to Study 1 and Study 2, the participants observed the objective bread and completed the questionnaires in an acoustic laboratory. The study procedures were exactly the same as that of previous experiments. The questionnaires were the same as those of Study 2, but an item examining calorie control consciousness, which was the moderating variable, was added.

Food shape ("1 = *square shape*" to "7 = *circular shape*"), the hedonic effect ("1 = *extreme dislike*" to "7 = *like it very much*") [37], the control variables, mediating variable, and dependent variable were all measured by the same methods as in studies above ("How heavy do you think the bread is?" "How many calories do you think the bread have?") [58]. We added a measurement for calorie control consciousness ("1 = I do not mind calorie control at all" to "7 = I have decided to control my calorie intake"). As in Study 1 and Study 2, participants were also presented with a triangular reference bread that provided weight and calorie content [32]. This experiment lasted for approximately 10 minutes. At the end, participants' demographic information [58] was collected, and the researchers thanked the participants and paid their rewards. No hypothesis-related information was provided in above process.

6.4. Results

6.4.1. Manipulation Check: Perceived Shape. The data were analyzed using SPSS 21 software. The results of the control variables showed that the stimuli were designed successfully. Specifically, familiarity ($F\ (1,\ 110) = 1.50$; $p = 0.223$) and visual appearance ($F\ (1, 110) = 0.20$; $p = 0.657$) did not differ significantly between the two groups. The bread shape as an independent variable was manipulated successfully ($M_{square} = 1.98$; $M_{circular} = 5.98$; $F\ (1,\ 110) = 198.74$; $p < 0.001$).

6.4.2. Calorie Content Estimation. The result of the one-way ANOVA estimation revealed that the effect of food shape on calorie content estimation was significant ($M_{square} = 29.15$; $M_{circular} = 25.23$; $F\ (1,\ 110) = 5.60$; $p < 0.05$).

6.4.3. Moderated Mediation Analysis. Our hypotheses state that food shape affects perceived weight, which, in turn, affects calorie content estimation. Moreover, calorie control consciousness moderates the mediation effect of perceived weight. The result of the one-way ANOVA estimation revealed that the effect of food shape on perceived food weight was significant ($M_{square} = 30.27$; $M_{circular} = 25.61$; $F\ (1, 110) = 8.45$; $p < 0.01$). We examined our hypothesized moderated mediation effect using PROCESS model 14 [59]. The sample size was set to 5,000 and the confidence interval at 95% [61]. The results of this model showed that perceived weight and calorie control consciousness interactively predicted calorie content estimation ($b = -.21$; $SE = .06$; $p < .01$). Controlling for perceived weight, the direct effect of food shape on calorie content estimation was no longer significant ($LLCI = -3.1889$, $ULCI = 2.2053$), while the indirect effect was significant. The mediation effect of perceived weight was stronger (weaker) when current calorie control

consciousness was low (high) (2.12, effect = − 3.91, SE = 1.48, LLCI = − 7.1255, ULCI = − 1.2991; 3.30, effect = − 2.94, SE = 1.09, LLCI = − 5.1338, ULCI = −.8965; 4.49, effect = − 1.96, *SE* = .93, *LLCI* = − 4.2787, *ULCI* = −.5719).

In summary, the moderated mediation effect was significant (effect = .82, *SE* = .48, *LLCI* = .1189, *ULCI* = 2.0863). Calorie control consciousness moderated the mediation effect of perceived weight on food shape to calorie content estimation. Specifically, the more concerned an individual is about calorie control, the weaker the mediation effect of perceived weight. The moderated mediation effect is shown in Figure 2.

Study 3 repeated the tests of the hypothesis proven in previous studies with calorie control consciousness added as the moderating variable. The results clarified the underlying mechanisms to when the effects above were stronger or weaker.

7. General Discussion

This study explored the effect of food shape on calorie content estimation through three experiments. The results of these studies indicated that food shape influences calorie content estimation. Individuals perceive food with a square shape to have more calories than food with a circular shape. Moreover, the perceived weight of food mediated the effect of food shape on calorie content estimation. Food shape also influenced the perceived hedonic effect, with a circular shape having a higher hedonic effect. However, the hedonic effect did not mediate the effect of food shape on calorie content estimation. By exploring the boundary mechanism, we found that calorie control consciousness had a moderated mediation effect, meaning that the more individuals cared about their calorie intake, the weaker the mediation effect of perceived weight between food shape and calorie estimation was. Findings from this study improve our understanding of how food shape affects calorie content estimation.

7.1. Theoretical Contributions to Current Conceptual Frameworks. This study enriches the theoretical research related to the shape of food. Shape information is widely found in products, packaging, and brand identity, so it is of great theoretical and practical importance to explore the influence of shape on consumer decisions. This study expands on the research related to food shape.

Earlier attention to food shape has focused on the influence of food shape or food packaging shape on food perception. For example, food shape affects taste perception [12–15], willingness to pay [16], expected and actual food consumption [1, 17, 18], and volume perception [1, 62]. Additionally, consumers perceive pieces of food as smaller in size relative to intact foods and are thus less likely to prefer that food [17]. Thinner, rectangular, and prism-shaped foods are perceived to be larger than thicker cube-shaped foods [18]. In addition, food shape anomalies always affect consumers' purchase intention [48].

However, less attention has been paid to the role of the shape of the food itself for calorie content estimation. In this review, we observed the significant effect of food shape on calorie estimation and suggested that the perceived weight of food played a mediating role in the relationship between shape and calories, enriching the research on the effect of shape on food perception.

Furthermore, our study complements the research on direct quantitative estimation of calories. Health perception of food is influenced by the estimation of calorie content. Previous studies have proposed many heuristics that influence consumers' estimation of food calories, such as health perception [28] and food portion size [18]. For instance, people always underestimate the calorie content of healthy foods and overestimate the calorie content of unhealthy foods [26]. The amount of food was positively correlated with the calorie content. The larger the amount of food, the higher the calorie content [18, 29]. Jiang and Lei [32] further argue that food ingredients also influence food calorie estimates. Consumers underestimate the calorie content of foods with unhealthy bases and healthy ingredients, but they are less likely to underestimate the calorie content of foods with healthy bases, regardless of whether the ingredients are healthy or unhealthy.

Participants in these studies judged calorie content based on their perceptions of the nature of the food, such as its healthiness. However, few studies have directly addressed the quantitative relationship of calorie content estimates. The present study relates food shape to calorie content estimation from a quantitative perspective, which expands our understanding of calorie content estimation.

7.2. Practical Implications for Marketing Management. Our findings provide additional guidance for decision-making in food shape design. Food manufacturers can design the shape of food products according to different marketing purposes. As food shape is a vital part of food perception, the findings from this study investigated the existing theory that food shape affects size perception, as square-shaped food looks larger than circular-shaped food. This result means that food manufacturers could design food in a square shape to increase consumers' perception of product quantity, which may make it seem more affordable. Moreover, there is a positive quantitative relationship between calorie content and food weight. According to our results, consumers refer mainly to the perceived size and weight of food to estimate the calorie content of different shapes of food. The higher the perceived weight, the more calories it is perceived to contain. If the goal of marketers is to encourage greater acceptance of small amounts of tasty snacks [63, 64], then in combination with visual shape effects, food manufacturers can design foods to be round to reduce consumers' perception of calorie content.

Currently, food manufacturers design food shapes more in terms of aesthetics and practicality, with little awareness of the impact of food shape on consumer hedonic perception and calorie content perception. This study validates other possible mechanisms of food shape and calorie content estimation from the perspective of food nature. Food shape can affect consumers' perception in many ways. This study

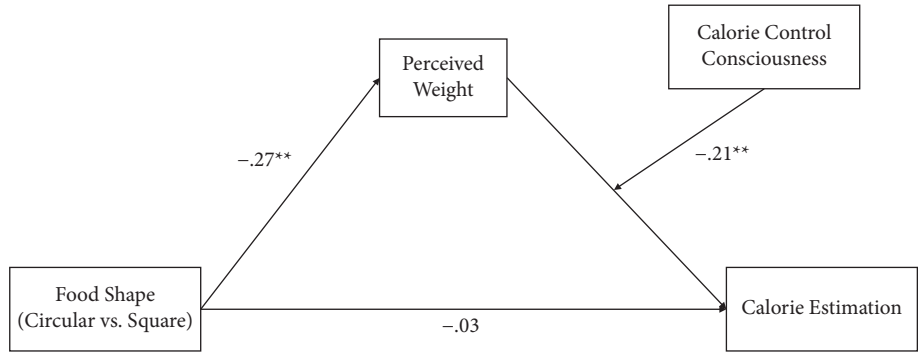

Figure 2: Moderated Mediation Effect. *Notes*: All beta values were standardized coefficients: $^{*}p < 0.05$, $^{**}p < 0.01$.

confirms that circular food evokes a higher hedonic effect than square food, but that it is perceived to have a smaller volume.

Concerning the process of calorie content estimation, food shape works through direct quantitative pathways rather than feature-aware pathways. However, the hedonic effect of the nature of food also has great application value. The relative perceived hedonic nature of a product influences consumer choices [65]. Food appearance conveys a visual impression to consumers, influencing their perception and evaluation of the product [66]. It can create hedonic value and elicit changes in consumer emotions, triggering deeper relationships [67]. Therefore, marketers can consider using different shape designs to trigger different psychological responses from consumers. Our findings facilitate the use of different designs of food shapes to influence consumers' psychological perceptions and ultimately increase consumer welfare.

The present study also considered calorie control awareness and demonstrated the effect of individual levels of awareness on calorie content estimation. Previous studies have shown that calorie estimates are influenced by food type (e.g., healthy vs. unhealthy foods) [28, 68], food quantity (e.g., portion size), added food ingredients [53], and individual factors (e.g., gender, weight, and dietary status) [27]. Moreover, attachment to different types of information leads consumers to different outcomes [69–71].

When consumers with a health orientation are confronted with burgers and salads, the first concern is the healthiness of the type of product. Further, they focus on the specific value of the calorie content. Focusing on health type estimates reflects intuitive, associative thinking, while numerical estimates reflect thoughtful, calculation-based thinking [72]. The results of this study suggest that the less people focus on calorie control, the more likely they are to consider other factors and estimate the calorie content of food based on their perception of food weight. As a result, marketers can segment, and design products based on consumer characteristics. Specifically, for those who are less conscious of calorie intake, marketers can develop strategies based on the effects described above.

7.3. Limitations and Avenues for Future Research. Despite its many contributions, this study also has some limitations. First, we only discussed the role of perceived weight and hedonic effects, but did not consider the role of other potential factors, such as perceived sweetness, perceived healthiness, and smoothness. It has been found that product healthiness is negatively related to taste [9, 38], while shape tends to lead to different taste perceptions. For example, round shapes are associated with sweetness, and angular shapes are associated with bitterness and sourness. Therefore, whether different taste sensations triggered by food shape affect health perception and then further affect calorie perception can still be explored.

Given that the current work does not include either expected or actual taste, the possible link between the effect of food shape on calorie perception and taste remains open. Furthermore, as there are indications that caloric intake is also affected by the shape of different food packages [73], future research can go beyond the perception of the food itself and consider more relevant factors that may influence food calorie estimation. It is also worth noting that several products, such as cookies and bread, were chosen as experimental stimuli in this paper, and future studies could use more diverse experimental stimuli (e.g., different foods or even containers for beverages) to further explore the effect of food shape on calorie perception.

Second, this study focused only on the shape of the food itself and the effect on the perceived calorie content. However, consumer decisions are also influenced by multiple package features, including package shape [74], nutrition labeling [75], color [76], and other design elements [77]. Therefore, our study does not shed light on the evaluative and behavioral outcomes when additional information is present in a food product, or the relative importance of multiple design elements [78]. Isolating the effects of individual package design elements is only the first but important, step in conducting more applied research using actual products. Future research could consider the interaction of food shape with the above elements.

Third, the current study did not explore at a deeper level how efforts to change consumer perceptions, loyalty, attitudes, and other dimensions could be impacted by food shape. In addition, the measurement methods in all three studies were self-reported and did not use more advanced methodological models. For example, Mircică [79] uses structural equation modeling to analyze consumers' public

trust. Bratu [80] similarly used structural equation modeling to analyze whether social media influencers can shape corporate brand reputation. Another example is Drugău-Constantin [81] who used neuroscience to investigate the factors associated with consumer behavior.

Moreover, many studies in the digital context have become hot topics. Numerous researchers have dug deeper into the relationships between consumer perceptions, loyalty, attitudes, and behaviors based on digital personal reputation and feedback systems. In addition, the relationship between customer value cocreation behaviors, digital platform operations, and behavioral economics of online platform economy decisions have all been examined ([79–84]; Mirică [85, 86]). The methodology and modeling frameworks therein are worthy of our consideration. Future research could also further explore the impact of food information on consumers and on brands by combining it with the current macro context.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request if the readers are interested in relevant data.

Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Acknowledgments

This work was supported by the National Natural Science Foundation of China (grant number: 71702119).

References

[1] J. Koo and K. Suk, "The effect of package shape on calorie estimation," *International Journal of Research in Marketing*, vol. 33, no. 4, pp. 856–867, 2016.

[2] C. A. Cole and S. K. Balasubramanian, "Age differences in consumers' search for information: public policy implications," *Journal of Consumer Research*, vol. 20, no. 1, pp. 157–169, 1993.

[3] P. R. Dickson and A. G. Sawyer, "The price knowledge and search of supermarket shoppers," *Journal of Marketing*, vol. 54, no. 3, pp. 42–53, 1990.

[4] R. A. Crockett, S. E. King, T. M. Marteau et al., "Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption," *Cochrane Database of Systematic Reviews*, vol. 2, pp. 1465–1858, 2018.

[5] S. E. Forwood, A. Ahern, G. J. Hollands, P. C. Fletcher, and T. M. Marteau, "Underestimating calorie content when healthy foods are present: an averaging effect or a reference-dependent anchoring effect?" *PLoS One*, vol. 8, no. 8, pp. 1–9, Article ID e71475, 2013.

[6] T. Kumpulainen, A. Vainio, M. Sandell, and A. Hopia, "How young people in Finland respond to information about the origin of food products: the role of value orientations and product type," *Food Quality and Preference*, vol. 68, pp. 173–182, 2018.

[7] A. V. Cardello, "Consumer expectations and their role in food acceptance," *Measurement of Food Preferences*, Springer, Berlin, Germany, 1994.

[8] R. C. D. Vale, R. Pieters, and M. Zeelenberg, "Flying under the radar: perverse package size effects on consumption self-regulation," *Journal of Consumer Research*, vol. 35, no. 3, pp. 380–390, 2008.

[9] R. Mai, C. Symmank, and B. Seeberg-Elverfeldt, "Light and pale colors in food packaging: when does this package cue signal superior healthiness or inferior tastiness?" *Journal of Retailing*, vol. 92, no. 4, pp. 426–444, 2016.

[10] X. Deng and B. E. Kahn, "Is your product on the right side? the "location effect" on perceived product heaviness and package evaluation," *Journal of Marketing Research*, vol. 46, no. 6, pp. 725–738, 2009.

[11] D. F. Yan, J. Sengupta, and S. W. Robert, "Package size and perceived quality: the intervening role of unit price perceptions," *Journal of Consumer Psychology*, vol. 24, no. 1, pp. 4–17, 2014.

[12] L. Becker, T. J. L. van Rompay, H. N. J. Schifferstein, and M. Galetzka, "Tough package, strong taste: the influence of packaging design on taste impressions and product evaluations," *Food Quality and Preference*, vol. 22, no. 1, pp. 17–23, 2011.

[13] O. Blazhenkova and M. M. Kumar, "Angular versus curved shapes: correspondences and emotional processing," *Perception*, vol. 47, no. 1, pp. 67–89, 2018.

[14] C. Velasco, S. Hyndman, and C. Spence, "The role of typeface curvilinearity on taste expectations and perception," *International Journal of Gastronomy and Food Science*, vol. 11, pp. 63–74, 2018.

[15] C. Velasco, C. Wan, K. Knoeferle, X. Zhou, A. Salgado-Montejo, and C. Spence, "Searching for flavor labels in food products: the influence of color-flavor congruence and association strength," *Frontiers in Psychology*, vol. 6, p. 301, 2015.

[16] R. A. Krishna, "Vital dimensions in volume perception: can the eye fool the stomach?" *Journal of Marketing Research*, vol. 36, no. 3, pp. 313–326, 1999.

[17] J. Sevilla and B. E. Kahn, "The completeness Heuristic: product shape completeness influences size perceptions, preference, and consumption," *Journal of Marketing Research*, vol. 51, no. 1, pp. 57–68, 2014.

[18] C. Szocs and D. Biswas, "Tasting in 2D: implications of food shape, visual cues, and oral haptic sensory inputs," *Marketing Letters*, vol. 27, no. 4, pp. 753–764, 2016.

[19] C. Velasco, A. T. Woods, O. Deroy, and C. Spence, "Hedonic mediation of the crossmodal correspondence between taste and shape," *Food Quality and Preference*, vol. 41, pp. 151–158, 2015.

[20] B. Wansink and K. Van Ittersum, "Bottoms Up! the influence of elongation on pouring and consumption volume," *Journal of Consumer Research*, vol. 3, no. 30, pp. 455–463, 2003.

[21] S. Q. Liu, V. Bogicevic, and A. S. Mattila, "Circular vs. angular servicescape: "Shaping" customer response to a fast service encounter pace," *Journal of Business Research*, vol. 89, pp. 47–56, 2018.

[22] Y. Jiang, G. J. Gorn, M. Galli, and A. Chattopadhyay, "Does your company have the right logo? How and why circular- and angular-logo shapes influence brand attribute judgments," *Journal of Consumer Research*, vol. 42, no. 5, pp. 709–726, 2016.

[23] Y. Zhang, L. Feick, and L. J. Price, "The impact of self-construal on aesthetic preference for angular versus rounded

shapes," *Personality and Social Psychology Bulletin*, vol. 32, no. 6, pp. 794–805, 2006.
[24] S. Han-Seok, A. Artin, S. Kerstin et al., "Cross-modal integration between odors and abstract symbols," *Neuroscience Letters*, vol. 3, no. 478, pp. 175–178, 2010.
[25] B. Wansink and P. Chandon, "Can "low-fat" nutrition labels lead to obesity?" *Journal of Marketing Research*, vol. 43, no. 4, pp. 605–617, 2006.
[26] R. A. Carels, J. Harper, and K. Konrad, "Qualitative perceptions and caloric estimations of healthy and unhealthy foods by behavioral weight loss participants," *Appetite*, vol. 46, no. 2, pp. 199–206, 2006.
[27] R. A. Carels, K. Konrad, and J. Harper, "Individual differences in food perceptions and calorie estimation: an examination of dieting status, weight, and gender," *Appetite*, vol. 49, no. 2, pp. 450–458, 2007.
[28] A. Chernev and D. Gal, "Categorization effects in value judgments: averaging bias in evaluating combinations of vices and virtues," *Journal of Marketing Research*, vol. 4, no. 47, pp. 738–747, 2010.
[29] M. J. Scourboutakos and M. R. L'Abbé, "Restaurant menus: calories, caloric density, and serving size," *American Journal of Preventive Medicine*, vol. 43, no. 3, pp. 249–255, 2012.
[30] P. Chandon, "How package design and packaged-based marketing claims lead to overeating," *Applied Economic Perspectives and Policy*, vol. 35, no. 1, pp. 7–31, 2013.
[31] P. Chandon and B. Wansink, "The biasing health halos of fast-food restaurant health claims: lower calorie estimates and higher side-dish consumption intentions," *Journal of Consumer Research*, vol. 34, no. 3, pp. 301–314, 2007.
[32] Y. Jiang and J. Lei, "The effect of food toppings on calorie estimation and consumption," *Journal of Consumer Psychology*, vol. 24, no. 1, pp. 63–69, 2014.
[33] S. Swithers and T. Davidson, "A role for sweet taste: calorie predictive relations in energy regulation by rats," *Behavioral Neuroscience*, vol. 122, no. 1, pp. 161–173, 2008.
[34] C. Spence and M. K. Ngo, "Assessing the shape symbolism of the taste, flavour, and texture of foods and beverages," *Flavour*, vol. 1, no. 1, pp. 1–13, 2012.
[35] M. Bar and M. Neta, "Humans prefer curved visual objects," *Psychological Science*, vol. 17, no. 8, pp. 645–648, 2010.
[36] G. Karine, D. Éric, H. C Peter, P. Sonia, B. Anne-Sophie, and P. Véronique, ""Healthy," "diet," or "hedonic". how nutrition claims affect food-related perceptions and intake?" *Appetite*, vol. 59, no. 3, pp. 877–884, 2012.
[37] P. Liang, S. Roy, M.-L. Chen, and G.-H. Zhang, "Visual influence of shapes and semantic familiarity on human sweet sensitivity," *Behavioural Brain Research*, vol. 253, no. 18, pp. 42–47, 2013.
[38] R. Raghunathan, R. W. Naylor, and W. D. Hoyer, "The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products," *Journal of Marketing*, vol. 4, no. 70, pp. 170–184, 2006.
[39] P. Rozin, C. Fischler, S. Imada, A. Sarubin, and A. Wrzesniewski, "Attitudes to food and the role of food in life in the U.S.A., Japan, Flemish Belgium and France: possible implications for the diet-health debate," *Appetite*, vol. 33, no. 2, pp. 163–218, 1999.
[40] J. L. Schlienger, C. Fischler, and E. Masson, "Manger, Français, Européens et Américains face à l'alimentation," *Médecine Des Maladies Métaboliques*, vol. 2, no. 3, p. 294, 2008.
[41] C. O. C. Werle, O. Trendel, and G. Ardito, "Unhealthy food is not tastier for everybody: the "healthy=tasty" French intuition," *Food Quality and Preference*, vol. 1, no. 28, pp. 116–121, 2013.
[42] G. Ma, "Food, eating behavior, and culture in Chinese society," *Journal of Ethnic Foods*, vol. 2, no. 4, pp. 195–199, 2015.
[43] O. Deroy and D. Valentin, "Tasting liquid shapes: investigating the sensory basis of cross-modal correspondences," *Chemosensory Perception*, vol. 4, no. 3, pp. 80–90, 2011.
[44] M. K. Ngo, R. Misra, and C. Spence, "Assessing the shapes and speech sounds that people associate with chocolate samples varying in cocoa content," *Food Quality and Preference*, vol. 22, no. 6, pp. 567–572, 2011.
[45] C. Velasco, A. Salgado-Montejo, F. Marmolejo-Ramos, and C. Spence, "Predictive packaging design: tasting shapes, typographies, names, and sounds," *Food Quality and Preference*, vol. 34, pp. 88–95, 2014.
[46] C. Velasco, X. Wan, A. Salgado-Montejo et al., "The context of colour–flavour associations in crisps packaging: a cross-cultural study comparing Chinese, Colombian, and British consumers," *Food Quality and Preference*, vol. 38, pp. 49–57, 2014.
[47] C. Machiels, "Bittersweet findings: round cups fail to induce sweeter taste," *Beverages*, vol. 4, no. 1, p. 12, 2018.
[48] N. Loebnitz, G. Schuitema, and K. G. Grunert, "Who buys oddly shaped food and why? impacts of food shape abnormality and organic labeling on purchase intentions," *Psychology and Marketing*, vol. 32, no. 4, pp. 408–421, 2015.
[49] L. Jing, E. Petit, A. C. Brit, and A. Giboreau, "The impact of tablecloth on consumers' food perception in real-life eating situation," *Food Quality and Preference*, vol. 71, pp. 168–171, 2018.
[50] E. Howlett, S. Burton, H. A. Tangari, and M. Bui, "Hold the salt! effects of sodium information provision, sodium content, and hypertension on perceived cardiovascular disease risk and purchase intentions," *Journal of Public Policy and Marketing*, vol. 1, no. 31, pp. 4–18, 2012.
[51] M. E. Oakes and C. S. Slotterback, "The good, the bad, and the ugly: characteristics used by young, middle-aged, and older men and women, dieters and non-dieters to judge healthfulness of foods," *Appetite*, vol. 38, no. 2, pp. 91–97, 2002.
[52] C. Irmak, B. Vallen, and S. R. Robinson, "The impact of product name on dieters' and nondieters' food evaluations and consumption," *Journal of Consumer Research*, vol. 38, no. 2, pp. 390–405, 2011.
[53] G. Zhu, G. Chryssochoidis, and L. Zhou, "Do extra ingredients on the package lead to extra calorie estimates?" *European Journal of Marketing*, vol. 53, no. 11, pp. 2293–2321, 2019.
[54] M. E. Oakes, "Stereotypical thinking about foods and perceived capacity to promote weight gain," *Appetite*, vol. 44, no. 3, pp. 317–324, 2005.
[55] A. Chernev, "The dieter's paradox," *Journal of Consumer Psychology*, vol. 21, no. 2, pp. 178–183, 2011.
[56] J. Petimar, F. Zhang, L. P. Cleveland, and D. Simon, "Estimating the effect of calorie menu labeling on calories purchased in a large restaurant Franchise in the Southern United States: quasi-experimental study," *BMJ*, vol. 367, 2019.
[57] D. A. Booth, "Cognitive experimental psychology of appetite," *Eating Habits*, John Wiley & Sons, Chichester, UK, 1987.
[58] D. Biswas, C. Szocs, A. Krishna, and D. R. Lehmann, "Something to chew on: the effects of oral haptics on mastication, orosensory perception, and calorie estimation," *Journal of Consumer Research*, vol. 2, no. 41, pp. 261–273, 2014.

[59] A. Hayes, "Introduction to mediation, moderation, and conditional process analysis," *Journal of Educational Measurement*, vol. 51, no. 3, pp. 335–337, 2013.

[60] A. Sundar and T. J. Noseworthy, "Place the logo high or low? using conceptual metaphors of power in packaging design," *Social Science Electronic Publishing*, vol. 78, no. 5, pp. 138–149, 2014.

[61] K. J. Preacher, D. D. Rucker, and A. F. Hayes, "Addressing moderated mediation hypotheses: theory, methods, and prescriptions," *Multivariate Behavioral Research*, vol. 42, no. 1, pp. 185–227, 2007.

[62] V. Folkes and S. Matta, "The effect of package shape on consumers' judgments of product volume: attention as a mental contaminant," *Journal of Consumer Research*, vol. 31, no. 2, pp. 390–401, 2004.

[63] Y. Cornil and P. Chandon, "Pleasure as a substitute for size: how multisensory imagery can make people happier with smaller food portions," *Journal of Marketing Research*, vol. 53, no. 5, pp. 847–864, 2016.

[64] P. J. Liu, K. L. Haws, C. Lamberton, T. H. Campbell, and G. J. Fitzsimons, "Vice-virtue bundles," *Management Science*, vol. 61, no. 1, pp. 204–228, 2015.

[65] R. Dhar and K. Wertenbroch, "Consumer choice between hedonic and utilitarian goods," *Journal of Marketing Research*, vol. 37, no. 1, pp. 60–71, 2000.

[66] L. A. Fu, Z. Z. Zhu, H. Chen, and X. B. Li, "Beauty in the eyes of its beholders: effects of design novelty on consumer preference," *Journal of Retailing and Consumer Services*, vol. 53, Article ID 101969, 2020.

[67] C. H. Noble and M. Kumar, "Exploring the appeal of product design: a grounded, value-based model of key design elements and relationships∗," *Journal of Product Innovation Management*, vol. 27, no. 5, pp. 640–657, 2010.

[68] P. J. Liu, L. H. Kelly, S. Karen, P. R. Joseph, R. B. James, and J. F. Gavan, "The primacy of "what" over "how much": how type and quantity shape healthiness perceptions of food portions," *Management Science*, vol. 65, no. 7, pp. 1–29, 2019.

[69] A. Moon and L. D. Nelson, "The uncertain value of uncertainty: when consumers are unwilling to pay for what they like," *Management Science*, vol. 66, no. 10, pp. 4359–4919, 2019.

[70] M. O' Donnell and E. Evers, "Preference reversals in willingness to pay and choice," *Journal of Consumer Research*, vol. 45, no. 6, pp. 1315–1330, 2019.

[71] F. A. Shennib, R. Catapano, and J. Levav, "Preference reversals between digital and physical goods," *Association for Consumer Research*, vol. 59, pp. 342–346, 2019.

[72] D. R. Schley, B. De Langhe, and A. R. Long, "System 1 is not scope insensitive: a new, dual-process ac-count of subjective value," *Journal of Consumer Research*, vol. 47, no. 4, pp. 566–587, 2020.

[73] A. Festila and P. Chrysochou, "Implicit communication of food product healthfulness through package design: a content analysis," *Journal of Consumer Behaviour*, vol. 17, no. 5, pp. 461–476, 2018.

[74] N. Yarar, C. Machiels, and U. R. Orth, "Shaping up: how package shape and consumer body conspire to affect food healthiness evaluation," *Food Quality and Preference*, vol. 75, no. 4, pp. 209–219, 2019.

[75] K. G. Grunert and J. M. Wills, "A review of European research on consumer response to nutrition information on food labels," *Journal of Public Health*, vol. 15, no. 5, pp. 385–399, 2007.

[76] N. Karnal, C. J. A. Machiels, U. R. Orth, and R. Mai, "Healthy by design, but only when in focus: communicating non-verbal health cues through symbolic meaning in packaging," *Food Quality and Preference*, vol. 52, pp. 106–119, 2016.

[77] C. J. A. Machiels and U. R. Orth, "Verticality in product labels and shelves as a metaphorical cue to quality," *Journal of Retailing and Consumer Services*, vol. 37, pp. 195–203, 2017.

[78] T. J. L. V. Rompay and A. T. H. Pruyn, "When visual product features speak the same language: effects of shape-typeface congruence on brand perception and price expectations," *Journal of Product Innovation Management*, vol. 28, no. 4, pp. 599–610, 2011.

[79] N. Mircică, "Restoring public trust in digital platform operations: machine learning algorithmic structuring of social media content," *Review of Contemporary Philosophy*, vol. 19, pp. 85–91, 2020.

[80] S. Bratu, "Can social media influencers shape corporate brand reputation? Online followers' trust, value creation, and purchase intentions," *Review of Contemporary Philosophy*, vol. 18, pp. 157–163, 2019.

[81] A. Drugău-Constantin, "Is consumer cognition reducible to neurophysiological functioning?" *Economics, Management, and Financial Markets*, vol. 14, no. 1, pp. 9–14, 2019.

[82] S. Graessley, J. Horak, M. Kovacova, K. Valaskova, and M. Poliak, "Consumer attitudes and behaviors in the technology-driven sharing economy: motivations for participating in collaborative consumption," *Journal of Self-Governance and Management Economics*, vol. 7, no. 1, pp. 25–30, 2019.

[83] J. C. Hollowell, Z. Rowland, T. Kliestik, J. Kliestikova, and V. V. Dengov, "Customer loyalty in the sharing economy platforms: how digital personal reputation and feedback systems facilitate interaction and trust between strangers," *Journal of Self-Governance and Management Economics*, vol. 7, no. 1, pp. 13–18, 2019.

[84] D. Meilhan, "Customer value co-creation behavior in the online platform economy," *Journal of Self-Governance and Management Economics*, vol. 7, no. 1, pp. 19–24, 2019.

[85] C. O. Mirică, "The behavioral economics of decision making: explaining consumer choice in terms of neural events," *Economics, Management, and Financial Markets*, vol. 14, no. 1, pp. 16–20, 2019.

[86] G. H. Popescu and F. C. Ciurlău, "Making decisions in collaborative consumption: digital trust and reputation systems in the sharing economy," *Journal of Self-Governance and Management Economics*, vol. 7, no. 1, pp. 7–12, 2019.