THE EFFECT OF PROVIDED PORTION SIZE AND FAMILIARITY OF FOOD ON CONSUMERS' RANGE OF ACCEPTABLE PORTION SIZES

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Abstract

Background and objective

People's energy intake has been shown to be affected by environmental and internal cues. One of the most influential environmental factor is the food portion size. The portion size effect indicates that people will eat more without notice when served a larger portion size compared to a smaller one. However, it is not clear yet whether people have an acceptable range of portion sizes and whether the size of this range is fixed or not. The aim of this study is to understand the effect of provided portion size on the ideal and range of acceptable portion sizes. We also aim to understand whether this effect is different for familiar versus unfamiliar snacks and whether individual's confidence mediates the portion size decisions.

Methodology

A between-subjects experiment was carried out using an online administrated questionnaire. 125 participants were randomly assigned to one of the 2 (large portion vs. small portion) X 2 (familiar snack vs. unfamiliar snack) conditions. Subjects were exposed to a picture of the food and then indicated their ideal portion size, and maximum and minimal acceptable portion size. In addition, respondents filled in questions about their confidence in the portion size decision and several background variables.

Results

Results of the experiments show a significant effect of portion size and familiarity on both indicated ideal portion size and acceptable range size. In the larger portion conditions, subjects indicated to prefer 39% larger ideal portion sizes and 97% larger acceptable range size than that of small portion conditions. As for the familiarity, subjects from unfamiliar snack conditions indicated more than two times higher (205%) of ideal portion size and 78.6% larger acceptable range size than that of unfamiliar conditions. The mediator role of confidence was found significant in the portion size effect. While for the familiarity, the mediation role of confidence was not found.

Discussion

Overall, this study replicates the portion size effect and also shows that the range of acceptable portion sizes is malleable. Results also suggest that large portion sizes make people less confident in what appropriate amounts of foods are. As a result, they go for larger portion sizes. Future research could carry out this experiment in real eating situations and with more variety of foods Also, researcher could exam how interventions aimed at reducing this uncertainty may offset the portion size effect.

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1 Introduction

Overweight is a worldwide problem. In 2005, the overweight people made up about 23.2% of world population (Kelly, Yang, Chen, Reynolds, & He, 2008). By 2008, 1.46 billion adults were overweight and 502 million adults were obese (Finucane et al., 2011). Additionally, the overweight rate and the prevalence of obesity is increasing particularly in Asia, America, Europe and Australia (Cremieux, 2015; Ramachandran, Chamukuttan, Shetty, Arun, & Susairaj, 2012; Walls et al., 2012; Webber et al., 2012). According to Wild et al. (2004), the worldwide obesity and overweight population will increase to 44% and 45% by 2030. More specifically, Walls et al. (2012) predicted that the obesity prevalence in Australia would increase to 65% by 2025. The study of Wang et al. (2011) shows that by 2030 the obesity population is projected to rise to 65 million and 11 million in the United states (US) and United Kingdom (UK) correspondingly (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011). Excess bodyweight is regarded as an severe factor that affects people's health. Research has shown that risk of death will significantly increase with an increasing in the body mass index (BMI) alone (Haslam & James, 2005). In addition to the risk of mortality, obese and overweight people are predisposed to co-morbidities and complications related to blood pressure, insulin and cardiovascular tissues (Pischon et al., 2007). It is well established that overweight and obesity are strongly associated with hypertension (high blood pressure), cardiovascular disease (heart and blood vessels disease) and type 2 diabetes (Kenchaiah et al., 2002; Stumvoll, Goldstein, & van Haeften, 2005; Wilson, D'Agostino, Sullivan, Parise, & Kannel, 2002; Wolf et al., 1997).

According to WHO (2006), the increased consumption of energy-dense food rich in sugar and fat has caused the world wide obesity rates to triple in the past ten years. In terms of energy intake, the increasing portion sizes of meals and snacks have contributed to this problem. Evidence showed that the portion size of all food categories (except bread) in American restaurants, shops and recipes in cookbooks have been increasing since the 1970s (Young & Nestle, 2002). From US national survey, Scholars found that the food portion sizes and obesity rates increased in parallel in the past 45 years (Rolls, 2003). Experiments have shown that people unintentionally eats more when served a larger portion of food (Wansink, 2004). This tendency is summarized as the *portion size effect* (Brienza, Elserafi, & Herman, 2010). A meta-analysis has found that consumption increased on average 35% when the food portion doubled (Zlatevska, Dubelaar, & Holden, 2014). The portion size effect is robust and has been found viable in relation to a variety of foods, contexts, subject groups and even the serving method. It was observed in both snacks and entrees (Geier, Paul, & Gheorghe, 2006; Rolls, Morris, & Roe, 2002). It has been found in both male and female, adults and children, normal weight and overweight subjects (Birch, Engell, & Rolls, 2000; Rolls et al., 2002). Portion size effect was reported from within-subject and between subject design, in self-serving meals and in given meals, in controlled experiments and real life observations (Diliberti, Bordi, Conklin, Roe, & Rolls, 2004; Rolls et al., 2002; Rolls, Roe, Meengs, & Wall, 2004). It appears to be a strong tendency among all kinds of people treating all kinds of food. As a result of the larger portion size, people are unintentionally consuming more calories than before.

Many explanations have been put forward for the *portion size effect*. One of the theories is the *unit bias heuristic* proposed by Geier et al (2006). They explained that people tend to eat one unit of food regardless of its size. Scholars found that people considered eating one large chocolate more appropriate than in five small pieces (van Kleef, Kavvouris, & van Trijp, 2014). Additionally, Herman and Polivy (2005) have found that participants count the number of food items rather than the size when making decisions about intake volume. Furthermore, Wansink (2004) proposed that the *portion size effect* is mediated by consumption norms. For eaters, consumption norms generate from environmental factors including package size, portion size and the number of units. The portion size as one of the perceptual indicators provides a normative benchmark. By this benchmark, eaters unknowingly decide their intake volume. In other words, People expect that the amount served is appropriate. A large portion implicitly suggests that it is appropriate to consume more. For example, when participants were served bigger size of cookies, they also reported that the bigger sized cookies was of more appropriate for consumption (Kerameas et al., 2015)

According to Wansink, there is a mindless margin. People unconsciously eat more or less within the range (Berry, Beatty, & Klesges, 1985; Wansink, 2007). There seems to be a wide range of portion sizes that are all considered acceptable (Herman & Polivy, 1983). However, Herman et al. (2015) stated that there is a lack of knowledge on what determines this range of acceptable portion sizes. In other words, the authors state that it is still unclear whether the appropriateness of a particular portion size is malleable or fixed. Although it has been shown that individuals consume more when presented with more food, it is unclear whether the range of acceptable portion sizes (i.e. the largest still acceptable size minus the smallest still acceptable size) is also affected by the served portion size. Thus, this study explicitly focuses on the acceptable range size. We expect that the acceptable range size of a portion size will be larger when the served portion is larger.

Moreover, we expect this effect to particularly occur when the presented food is unfamiliar. Expected satiation (within-meal feelings of fullness) and expected satiety (between-meals feelings of fullness) are strong determinants of meal size (Brunstrom, 2014). As a result of consumers' accumulating experience and memory of eating a specific food, familiarity increases the knowledge about how much satiety and satiation one can expect (Brunstrom, Shakeshaft, & Alexander, 2010; Brunstrom, Shakeshaft, & Scott-Samuel, 2008; Hardman, McCrickerd, & Brunstrom, 2011). In contrast, unfamiliar or novel foods are perceived to be more risky and this may lead to increased uncertainty about what to expect. Thus, we propose a larger range size of acceptability in portion sizes for unfamiliar foods compared to familiar foods, as consumers have no frame of reference of how much is appropriate to eat.

According to Schioth (2015), consumer with similar expectations may be different in confidence level. Research has shown that confidence generates from previous experience and knowledge and therefore from familiarity. Many studies about the relationship of familiarity and certainty have been found in the domain of branding and search behavior. Confidence was included as predictor of intention in buyers' behavior model (Harward, Sheth, 1969). But little research has been done in terms of food consumption and portion size decision. Thus this study will test the mediator role of confidence.

Therefore, *the objective* of this study is to examine the effect of a served portion size of food (large versus small) and the familiarity of the served food (unfamiliar versus familiar) on the size of the acceptable range size and ideal portion size of how much one would reasonably eat. Additionally, this study will test the mediation effect of confidence between portion size, familiarity and ideal portion size, and acceptable range size.

In this thesis, a between-subject experiment will be conducted. The experiment includes a questionnaire with pictures of snacks to Dutch consumers. The first factor that we manipulate is the served portion size of a sweet snack (large versus small). The second factor that we manipulate is the familiarity of the presented snack (a for Dutch people unfamiliar snack versus a well-known milk chocolate bar). A better understanding of the factors determining the acceptability of food portion sizes will help to develop more effective interventions that encouraging consumers to eat less of relatively unhealthy foods and more of relatively healthy foods.

2 Theoretical background

2.1 The portion size effect

Definition and evidence

The *portion size effect* refers to those variations in portion size that produce corresponding variations in food intake (Herman, Polivy, Pliner, & Vartanian, 2015). In simpler terms, bigger portion sizes increase consumption, while smaller portion sizes reduce consumption. Across a wide range of studies, the *portion size effect* has been demonstrated among a variety of participants and food categories.

The *portion size effect* was found in almost all kinds of participants in terms of gender, age and body mass index. The experiment in Rolls et al. (2002) demonstrated this phenomenon in male and female, normal weight and overweight participants. Subjects were given 500g, 625g, 750g or 1000g macaroni and cheese for free consumption once per week. After four weeks of experiment, subjects in the largest portion treatment had consumed 30% more energy compared to the smallest portion treatment. The result was significant in both gender and all body mass index participants. In addition to adults, the portion size effect was also found among children (Fisher, Rolls, & Birch, 2003). Researchers provided preschool children age-appropriate portions or doubled portions of a lunch entree in different weeks. On average, consumption was 25% larger in the doubled treatment than the reference condition. Another between-subject design experiment found similar result in a broader age range in children. The experiment done by Fisher observed portion size effect among 2 to 9 years old children. In the experiment, children were grouped by preschool, entry to school and elementary school according to their age. An age-appropriate or double sized dinner meal to was provided to each child and the intake was measured. On average, subjects who were served double portion consumed 29% more than that of reference size in all age groups (Fisher, 2007).

As for the food categories, the portion size effect was observed in almost all daily food and drinks, including entree and snack, packaged and not packaged, high and low energy density, palatable and unpalatable, healthy and unhealthy (Kral, Roe, & Rolls, 2004; Rolls, Roe, Kral, Meengs, & Wall, 2004; Rolls, Roe, & Meengs, 2007; van Kleef, Bruggers, & de Vet, 2015). Rolls, Roe and Meengs (2007) tested the entree, snacks and caloric beverages. The experiment took 2 periods. In each period, participants were given meals, snacks and drinks either in standard or 50% increased portion size. Each period occupied 11 consecutive days and between these periods there was a 2 weeks' washout time. The portion size effect was found significant in all meal categories (breakfast, lunch, and dinner), snacks and drinks. The large portion led to a 25% higher energy intake for female and 14% for male. As for the effect of packaging size, Rolls et al. asserted that larger packaged food increased energy intake (Rolls, Roe, Kral, et al., 2004). 60 subjects joined this research and they were served unlabeled packaged chips which varied in net weight (28, 42, 85, 128 or 170g). The largest package resulted in 100.05% more of energy intake than the smallest package. The portion size effect also appeared in varied energy density food (Kral et al., 2004). Kral et al. recruited 39 subjects to test the portion size effect on lunches with

different energy density. The 3 portion sizes and 2 energy density versions made up for 6 treatments. They provided breakfast, lunch and dinner in one day of a week, for six weeks. In the end the researchers observed the portion size effect in both energy density lunches. Despite considerable research on unhealthy snacks, scholars also tested the portion size effect on vegetables. Van Kleef and colleagues (2015) provided cucumber to primary school pupils. In line with the typical portion size effect, they reported that children ate on average 54% more cucumber when being given a larger portion.

Mechanisms of the Portion size effect

Dish-ware size influence

Dish-ware size influence means that the presence of dish-ware size effects food amount estimation. Indeed, it is regarded as the *Delboeuf Illusion* in the food domain. The *Delboeuf Illusion* is that the visual illusion of one objective is being influenced by a reference object (Nicolas, 1995). In Figure1, the black spots are exactly the same size but the right one inside a smaller circle is more likely to be perceived bigger than the other one. In terms of a meal, dish-ware acts as the circle and the food acts as the black spot.

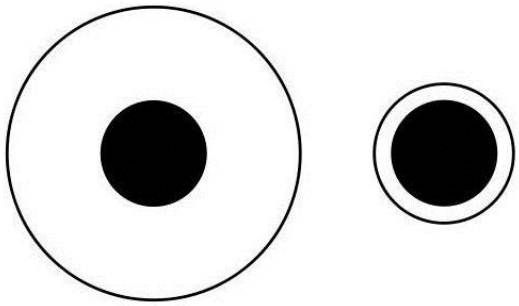

Figure1 The Delboeuf Illusion. Source Van Ittersum 2012

Van Ittersum and Wansink firstly demonstrated that the Delboeuf Illusion existed in the food domain. Dish-ware can lead to significant estimation bias on the available food amount (Van Ittersum & Wansink, 2012). In the beginning of their experiment, participants were showed a 9 cm diameter petri dish filled with soup. In the first part of the experiment, the research team randomly allocated participants a plate whose diameter varied from 12 cm to 36 cm. Then the participants were asked to fill it with a same amount of soup as in the petri bowl. In the next procedure, participants were showed a random size plate with same soup diameter. Then asked to estimate the difference between this soup and the petri dish soup. The result found a noteworthy opposite results of the self-served size and the perceived size. When participants were given large bowls, they served 5% to 13.1% larger portion size than that of the control group. When the participants were given smaller bowls, subjects served 3.8% to 11.5% less. While in the estimation part, the bias reversed. Participants perceived the soup portion size 8.9% larger when given small bowls and 8.6% smaller when given big bowls. In other words, people underestimated the amount of food when they are holding a large dish ware. In a real life case, such estimation bias may lead to over-consumption.

However, Robinson et al. (2014)'s meta-analysis found that few experiments shows a significant difference between large and small dish-ware in terms of food intake. In the 9 experiments they used, five reported no significant effect, three reported significant and one reported mixed findings. Though there are several limitations of these experiments, the authors stated that it is still premature to adopt dish-ware influence for intake control (Robinson et al., 2014)

Unit bias and segmentation effect

Unit bias was firstly proposed by Geier et al. (2006). The *Unit bias* suggested that people would consume a fixed number of units regardless of the single unit size. Consumer regarded one portion irrespective of its appropriate size and have strong tendency to finish the portion. Geier et al. manipulated an experiment to demonstrate this tendency. The researchers placed bowls of free tootsie rolls, pretzel and M&M in public access area. The snack bowls were filled with 240g tootsie rolls either in 3g size or 12g. The pretzel was kept in original size (3 oz.) or cut into halve size (1.5 oz.). As for the M&M, 1 lb. of M&M filled a bowl on the front desk of an apartment building. And a normal size or four time's larger size spoon was attached to the bowl. The three test was carried out independently in three locations. The results from the 3 experiments showed a consistent pattern: people consumed more when offered larger units. The authors stated that such tendency was a general feature in human choice (Geier et al., 2006).

Furthermore, Kerameas et al. (2015) argued that this effect ought to be explained by *segmentation effect*. The *segmentation effect* is defined as separation of food into subunits resulting in less intake. According to Kerameas et al., the segmentation effect is different from unit bias in two ways. Firstly, the segmentation effect is independent of the portion size effect. Secondly, segmentation effect does not require subject to eat only one single unit (Kerameas, Vartanian, Herman, & Polivy, 2015). To test their hypothesis, the research team manipulated an experiment with different cookies size treatments and cookie amount treatments with cookies in 10g, 30g and 90g. In the large portion treatment, participants were given 90g cookies in two conditions: (L1) either three 30g cookies or (L2) one 90g cookie. In the small portion treatment, participants were given either (S1) three 10g cookies or (S2) one 30g cookie. The authors claimed that if the unit bias drove food intake then subjects would eat one unit regardless of provided amount. Also, the authors predicted that if the food intake was driven by segmentation effect, subjects would eat more than one cookie but less than a single large cookie. The result showed that (a) most participants ate more or less than one unit, (b) the participants consumed less in the separated units' condition than in the single unit condition (condition1 <condition2), (c) the portion size effect was significant (treatment L > treatment S). The researchers concluded that the segmentation effect was the reason leading people to eat less in small portion size situations. The possible explanation is that smaller units provided a norm of appropriate consumption. Furthermore, the authors pointed that the participants did not blindly follow the unit number but rectify their norms based on the size of each unit.

However, the unit size bias does not always lead to difference in consumption. Van Kleef and colleagues (2015) provided cucumbers in large and small units to 10 years old children and recorded their intake volume. Also, they provided large and small portions respectively with

large unit size and small unit size. As a result, the portion size increased consumption by 54% but no effect of unit size was found.

Bite size

The *bite size explanation* refers to people taking larger bites when given a large portion size of food. Fisher (2003) firstly reported this phenomenon in children. Other scholars also found it in adults (Almiron-Roig et al., 2015; Burger, Fisher, & Johnson, 2011; Fisher et al., 2003). This explanation relates to the sensory discipline. The key factor is the specific sensory satiety (Herman et al., 2015). A large bite resulted in less oral exposure time for a given food unit. In turn, the sensory specific satiety germination was delayed. As the satiety was delayed, the termination of eating was delayed. Finally, the total intake increased (Rolls, Hetherington, & Burley, 1988). Fisher (2003) examined children's intake volume and bite size among 30 pre-school age participants with standard size or double-size lunch. The result showed that children had 12% bigger bites when given double-size lunch. Later in Fisher (2007)'s experiment, 75 children were given standard size, double-sized and self-served dinner. The researchers recorded children's bite numbers and consumed amounts. The average bite size was calculated as total consumption amount /bite number (Fisher, 2007). The result demonstrated that larger portion size generated greater bite size. As the exposure time for each food unit reduced, more food is needed to activate the specific sensory satiety. Thus, the total consumption increased.

Anchoring, appropriateness and consumption norms

The *anchoring effect* refers to people making and adjusting their estimates based on a given number or existing value. The *anchoring effect* was first observed and formulated by Tversky (Tversky & Kahneman, 1974). In the well-known experiment, subjects were randomly given the numbers 25 or 65 and then asked to estimate what was the percentage of Africa countries in the UN. In the group given 25, the average number from the participants was 25%. While in the "65" group, the average answer is 45%. It strongly demonstrated the effect of initial value.

Marchiori and colleagues (2014) proposed that the portion size effect might be explained by the anchoring effect. The authors hypothesized that the served portion size acted as the anchor (initial value) (Marchiori, Papies, & Klein, 2014). Their experiment had six treatments (3*2). Three of the experimental conditions are high, low or no anchoring value (control). The other two conditions are whether the participants were given discounting instructions or not. In the anchoring treatments, subjects were asked to imagine eating in a restaurant or at home. Then they were presented with the anchor which is either a small or large portion of food. While in the non-anchoring group, subjects did not have such a step. For the condition regarding discounting instructions, subjects were shortly explained that the given anchor was randomly generated. Such procedure aimed to test if artificial intervention could reduce the influence of the anchors effect in the food domain. 128 participants were randomly assigned to these conditions. The result has shown a significant anchoring effect for consumption estimation. The group that received a high anchor consumed more (than the control group), while the group that received a low anchor consumed less. In addition, the discounting instructions did not influence the anchoring effect. The finding suggests that a given portion size may be an anchor

in food consumption judgments and the anchor in the consumption is as strong as in other cases.

Furthermore, scholars stated that the anchoring effect was consistent with the *appropriateness and consumption norm* (Herman et al., 2015). The *appropriateness and consumption norm* means that served food volume provides a norm. The norm implies to people that such portion is appropriate. At present, the *appropriateness and consumption norm* is primarily addressed by Wansink and his colleague. Wansink explained that people rely on the help of consumption norms to determine intake amount. Whereas, the norm could be influenced by environmental cues, including the given portion size (Wansink, 2004). Diliberti et al. (2004) demonstrated the appropriateness explanation in a real restaurant environment. The research team sold a standard size meal or a 150% portion size meal to consumers. After their meal, consumers were surveyed with a few questions. When comparing the meal size with their normal eating size, respondents from two treatments did not report significant difference. Participants from both groups rated the portion size as same appropriateness level as their usual meal (Diliberti et al., 2004).

However, a study was constructed challenging the appropriateness interpretation. The researchers found that a clearly given norm did not affect actual intake volume (Ueland, Cardello, Merrill, & Lesher, 2009). The researchers provided participants an identical portion size of pasta but different instructions on the portion size. In each treatment, the instruction suggested that the portion was either 50%, 100% or 150% of a normal size. Participant were asked to rate their hunger level before and after the meal, to estimate if the served pasta constituted an appropriate size. Surprisingly, no significant difference in consumption amount or hungry level after eating was found between conditions. The authors claimed that objective information did not influence consumption and the provided portion size was not associated with the appropriate norm for eating. But still, one can argue that the norms of appropriateness is so strong that the unconscious hint (the portion served) overrides eater's high level respond (based on numbers and calculation).

2.2 Familiarity

The portion size effect might work differently for familiar food and unfamiliar foods. Herman et al. (2005) stated that portion size provides a sense about how much is 'correct'. Once people discovered the 'correct' amount to eat they will stick by it. In other words, before consumers are familiar with one food, the portion size would affect their choice. In general, *familiarity* refers to the cognitive ability to apply existing knowledge and experiences with objects or stimuli (Aldridge, Dovey, & Halford, 2009). One's accumulated experience or knowledge forms schemas that represent the understanding of an object or stimuli. More specifically, familiarity may be expressed in 2 common ways which is "I know it" and "I have used/tried it". "I know it" represents the accumulated knowledge while "I have used/tried it" represents previous experience. According to Aldridge et al.(2009), the object or stimuli is organized into character related categories when it is presented to humans. When a new object matches the crucial

features from another, known object, it will be assumed to be the same and prior knowledge will be quickly retrieved (Kamas & Reder, 1995). In the food domain, Pieniak et al. (2009) found that the familiarity is a driver for consumption. In their research, they designed a questionnaire and invited 4828 respondents from 6 European countries. In the survey, respondents indicated their attitude towards traditional food and motivation for consumption in eight dimensions (namely weight control, price, ethical concern, convenience, natural content, health, sensory appeal, and familiarity). The result demonstrated the positive influence of familiarity on food choice (Pieniak, Verbeke, Vanhonacker, Guerrero, & Hersleth, 2009).

Moreover, familiarity is an important factor in self-serve portion size controlling. The pre-meal theory stated that familiarity affected portion size choice through expected satiation. Certainly, expectation is generated from accumulated knowledge and previous experience. According to Brunstrom et al. (2010), expected satiety refers to a certain portion of food delivering adequate satiety, or being large enough to stave off hunger. In other word, food with high expected satiety may have a higher energy density which is high *utility* value. Brunstrom and Rogers (2009) have demonstrated that high expected satiety of a specific food resulted in smaller portion size. In their experiment, participants were showed 8 snacks. For each snack, they indicated their proposed portion size, expected satiety, linking and food reward. The result showed that the expected satiety played an important and independent role in determining food portion size. To conclude, as the expected satiety and satiation came from accumulated knowledge and experience, familiarity affects the expected satiation and satiety. In turn, the familiarity of foods may determine portion size selection (Brunstrom et al., 2010).

2.3 Confidence regarding portion size decisions

Though consumers have similar expectations, they might be different in the confidence they have in their decision to take a certain portion size of food. In the study of pre-meal planning, Brunstrom et al. (2010) found that confidence increased with familiarity which affected portion size decisions. Schioth et al. (2015) found that confidence modulated food intake and energy compensation. Confidence was associated with less accuracy in energy compensation whereas less confident participants relied more on internal (physiology) cues. This evidence suggests that confidence might have a special role in the portion size effect and familiarity influence.

The confidence in consumer behavior studies was firstly constructed in buyer's behavior model by Howard and Sheth (1969). They stated that the confidence is the subject's belief that they can estimate the payoff or reward of buying or consuming something. In their model, confidence was positively related to intention and negatively related to motives. Because of the dual role, confidence was the central equilibrating construct in consumer behavior. In brief, confidence refers to the certainty degree of the buyer's perception affecting buyer's behavior. Howard (1989) proposed that confidence is the buyers' or consumers' subjective certainty. In other words, confidence represents the certainty degree of one's judgments. Moreover, Urbany, Dickson and Wilkie (1989) defined consumers' confidence into two types which are knowledge confidence and choice confidence. The choice confidence reflected a consumer's certainty to choose alternative sets (e.g. brand). The knowledge confidence reflected a consumer's certainty

about features, attributes, and the performance of alternatives. To conclude, confidence represents consumer's certainty of his understanding of products.

A positive relation between familiarity and certainty may be expected. Scholars have found that the prior knowledge permits individuals to have deeper understanding of attribute importance and brands discriminations (Brucks, 1985). Brucks stated that knowledge could be divided into objective and subjective knowledge. While objective is associated with understanding of product's attributes, subjective knowledge is closely related to confidence in one's decision making abilities. Moreover, the research done by Loaroche, Kim and Zhou (1996) demonstrated that the confidence towards a brand is influenced by his/her familiarity with the brand. Their model indicated that both, the buyer's attitude and confidence, were affected by knowledge of the brand, which in turn influenced buying intention. As mentioned above, scholars have noticed that existence of confidence influences the process of food portion size controlling. However, few papers were found explaining the confidence's role in energy intake control. In terms of food consumption, we proposed a mediator role of confidence for self-choose portion size and acceptable range size.

2.4 Conceptual model and hypotheses

A large body of research has demonstrated the portion size effect. Though explanations about the portion size have been put forward, there is still a lot unclear regarding the underlying mechanisms of the portion size effect. At present, the leading explanations are the *appropriateness and norm*, the *unit bias* (or *segmentation effect*), the *bite size* and the *dish-ware influence*. In particular, the *appropriateness and norm* posits that people tend to use environment cues to monitor food intake volume, hence the portion size plays a role of benchmark. In other words, the provided portion size suggests an amount appropriate for consumption (Wansink, 2004). Additionally, the anchoring effect was found robust in consumption behavior and regarded as another way of telling the same story (Marchiori et al., 2014).

Besides, a meta-analysis found that about 92% but not 100% of the self-served food is eaten (Wansink & Johnson, 2015). In addition, Danielle and Brunstrom (2008) found that people can tolerate 40% larger portions in certain treatments. Therefore, there might exist an acceptable range size for consumption. Still, few studies has considered the acceptable range size in different portion size treatments. Moreover, Schioth et al. (2015) reported a confidence issue in food expectations. The authors claimed that people might have similar expectation but might differ in confidence. Their experiment demonstrated that the confidence has impact on food intake control. Still, there is little research on acceptable range of portion sizes and how feelings of uncertainty impact this. Moreover, it is unclear whether the range of acceptable portion sizes is affected by the familiarity of the provided food.

In addition to the portion size, familiarity is another key factor in psychological judgment and reaction to food. Aldridge (2009) stated that familiarity was associated with comfort thus affecting consumption choice and amount. Another well-known mechanism is named *pre-meal*

planning made prominent by Brunstrom. His experiments demonstrated that people have the tendency to plan a meal size before the meal. The expected satiation and satiety played the key role during planning. As the expectations were highly relied on prior experience, familiarity is the basis of developing an expectation. Besides these specific studies, a large body of research indicated that the different familiarity of test food was an important factor and might lead to contrasting results (Robinson et al., 2014; Schiöth et al., 2015).

Furthermore, studies have shown that confidence influence energy intake. Schioth (2015) reported that confidence affects short-term controls of food intake. Much research of familiarity and certainty has been done in the domain of branding and searching behavior whereas little research was found related food consumption and portion size decision. Brunstrom stated that confidence may have implications on food acceptance but the study of confidence of expectation and portion size decision remained unclear (Brunstrom et al, 2010).

Thus, this study is going to test the effect of served portion size and familiarity on what consumers think are acceptable range sizes of portions to eat. Furthermore, the mediator effect of uncertainty will be tested. To make it clear, Figure 2 shows the conceptual model of this study. We propose that confidence plays a role of mediator as the larger the portion size, the more uncertain consumers are in their portion size decision. Regarding how much is acceptable, the less familiar a snack food is, the more uncertain consumers are.

The hypotheses of this study are as following:

H1. Portion size affects consumers' ideal portion size and acceptable range size. This is specifically described by:

H1a.Compared to a small provided portion size of a snack food, consumers will indicate a larger ideal portion size when the provided portion size is large (replication 'classic' portion size effect).

H1b. Compared to a small provided portion size of a snack food, consumers will have a larger acceptable range size of portion sizes when the provided portion size is large

H2. Familiarity affects consumers' ideal portion size and acceptable range size. This is specifically described by:

H2a.Compared to an unfamiliar snack food, consumers will have a larger ideal portion size in case of a familiar snack food.

H2b.Compared to an unfamiliar snack food, consumers will have a larger acceptable range size of portion sizes in case of a familiar snack food.

H3. The effect of portion size on the range of acceptable portion sizes will be particularly pronounced for an unfamiliar snack (interaction effect of familiarity and provided portion size)

H4. Consumers' confidence plays a mediator role between provided portion size and ideal portion size/acceptable range size. In other words, confidence in the decision explains why a large provided portion size leads to larger ideal portions and size ranges. This is specifically described by:

H4a. Confidence plays a mediator role between provided portion size and ideal portion size

H4b. Confidence plays a mediator role between provided portion size and acceptable range size.

H5. The confidence plays a mediator role between familiarity and portion size decisions. In other words, confidence explains why an unfamiliar snack would generate a larger size of ideal portion and acceptable range. This is specifically described by:

H5a. The confidence plays a mediator role between familiarity and ideal portion size

H5b. The confidence plays a mediator role between familiarity and acceptable range size.

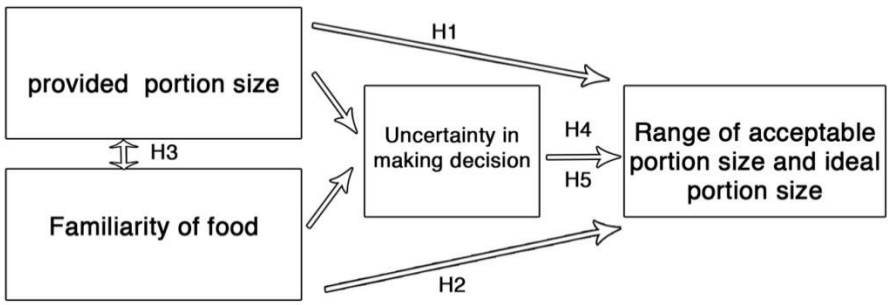

Figure2 The conceptual framework

3 Methodology

3.1 Design and procedure

The purpose of this experiment is to test the effect of food's portion size, familiarity on consumer's certainty, ideal portion size and acceptable range size. An online questionnaire were administrated using the Qualtrics survey tool. The invitation emails with the questionnaire link were sent to potential participants. As for the experiment, a between-subject design was adopted. The provided portion size and the degree of familiarity of the provided snack were the key independent variables. Each variable has two levels. Thus four conditions were made up by 2 (portion size small vs. large) X 2 (familiarity high vs. low). In the survey, subjects were randomly assigned to one of the four conditions.

Manipulation of familiarity of snacks. While chocolate is a well-known snack in Europe, Shasima (translated as caramel treats) is more popular in Asia. Shasima is made of common ingredients, including egg, cream, sugar and flour. The experiment used milk chocolate bar as high familiarity food (Verkade, supplied by United Biscuits Nederland). Shasima (Xufuji, supplied by Hsufuchi Inc.) was used as low familiarity food. In the survey, subjects were asked to what level do they know, eat and like the snack

Manipulation of provided portion size. Each of the snack had two sizes, a standard one and a tripled one. The standard chocolate was the original size in store. To be consistent with this size, two pieces of shasima were put together. Software Photoshop was used to slightly adjust the photo, to ensure the same size of chocolate and shasima. The large portion were three times bigger than a standard chocolate size, which is, three pieces for chocolate and six pieces for shasima. The margins of each unit in the picture were wiped by Photoshop. Thus, the large one looked like one unit. The snacks were displayed by a fork (length 20 cm) as reference. The photos of the snacks were taken by DSLR camera Canon 6D (65mm, 1/80s, 1/8). Information about portion sizes and nutrition content was obtained from packages (seeTable1). The snacks and portions used in this experiment are shown in Figure 3.

To help participants indicate their proposed portion size, several blocks were built by Qualtrics. The blocks were invisible but turned green when clicked. The standard size snack was equally divided into 14 blocks. Accordingly, 42 blocks were created for the large condition. An example of the blocks is shown in Figure 4.

Table 1 Portion sizes and nutrition information

Snack type	Portion size (g)	Energy (Kcal)
Chocolate-standard	75	420
Chocolate-large	225*	1260*
Shasima-standard	50	223
Shasima-large	150*	669*

*calculated

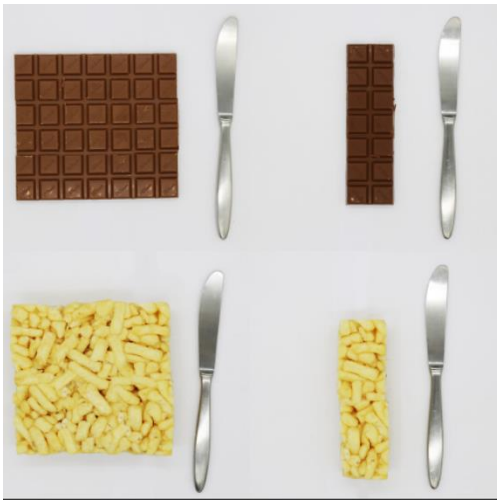

Figure 3 The picture used in four conditions.

Procedure

Participants were invited by email including the questionnaire link. The questionnaire was in Dutch (see appendix 1). When participants entered the questionnaire, firstly they were welcomed by a short introduction and an informed consent request. Then they were instructed to practice selecting blocks by clicking on the example picture.

In the next step, participants indicated their hungry and fullness level (with anchor points 'not at all' and 'extremely'). Afterwards, they randomly took one of the four conditions. At the next page, they saw a picture of the snack and were asked to imagine that they craved a snack and walked to the kitchen to get a portion. By clicking on the screen, participants indicated their ideal portion size, maximal and minimal acceptable portion size. In the following step, they were asked to indicate how confident they were when making their decisions. A 1-7 scale read as follows:' I found it difficult to indicate a portion', with 1 standing for 'extremely disagree' and 7 standing for 'totally agree'. Finally, participants filled in their gender, age, body height (CM) and weight (Kg).

3.2 Participants

In total, 154 participants joined the survey. Participants were excluded if they did not finish the survey. Data from 125 participants aged between 18 and 76 (Mean= 23, SD=7.1) was collected. The BMI of valid subjects varied from 16.3 to 40.1 (Mean=22.2, SD=3.2). Twenty-three of them were male.

3.3 Measures

Ideal portion size and acceptable range size. In the test, the participant clicked on blocks to indicate their desired amount. The participants were asked 'what would be your ideal portion size at that moment?'. The following instruction was given: 'You can simply click on the

chocolate (shamisa). Click the number of pieces of chocolate that represents for you the ideal portion at that single eating occasion'.

On the next page, participants saw the same piece of snack. They were asked 'what would be the minimal portion size that is still acceptable? Click on the number of pieces that represents the absolute minimum for you for a single eating occasion'. Then participants were asked to indicate their maximum portion size. Similarly to Ferriday and Brunstrom (2008), participants had to indicate the maximum amount of snack that they would tolerate to eat before they would opt for a smaller-than-ideal portion size. The following question was posed: 'What would be the maximum portion size that is still acceptable? Click on the number of pieces that represents the absolute maximum to eat for you on a single eating occasion'.

Figure4 Example of the virtual blocks

Confidence. The participants were asked to evaluate their *confidence* in the decision making procedure. Participants were presented with two visual analogue rating scales with the title: 'I found it difficult to give a portion size' and 'I am not sure about my portion size'. The scales were anchored with 'strongly disagree' and 'strongly agree'. More specifically, 0 refers to low uncertainty (high confidence) and 7 refers to high uncertainty (low confidence).

Familiarity. When facing the given snack (Shasima or chocolate), participants were given a short explanation about the snack. After the portion size and acceptable range size measurement, their familiarity was measured by three statements (7 visual analogue scale). The statements were 'I know it', 'sometimes I eat it' and 'it looks attractive'. All statements were anchored with the statements 'completely disagree', 'disagree', 'tend to disagree', 'neutral', 'tend to agree', 'agree', 'completely agree'.

Hungry level and BMI. The survey included several randomize check questions. Before the test, participants were asked for their hungry level. It was measured using a 100 visual analogue rating scale with the title: 'How hungry do you feel right now?' and 'How full do you feel now?'. The scales were anchored with the phrases 'not at all' and 'extremely hungry' to its two sides based on the scale of Blundell et all (2010). In the last part of the survey, participants were

asked about background questions including gender, age, height in cm and weight in kg. The BMI of each participants was calculated afterwards (weight/ [height/100]^2).

3.4 Data analysis

All data was processed by SPSS (version 20.0.0). ANOVA was used to check whether the randomization of participants across conditions was successful regarding feelings of hunger and fullness, liking, age, gender and BMI. The acceptable range size was calculated as maximal acceptable portion size minus minimal acceptable portion size. The confidence level was calculated as a summation of the scores from the following questions: 'I found it very difficult to give a proper portion size' and 'I was unsure what portion sizes I had to click'.

To determine whether familiarity and portion size had significant effect on ideal portion size and acceptable range size, analysis of covariance (ANCOVA) was used. We conducted a two (familiarity high VS low) X two (portion size standard VS large) ANCOVA. In doing so, our aim was to assess whether portion size and acceptable range size increases with provided portion size (H1) and whether familiarity reduces acceptable range size and certainty (H2). The interaction effect (H3) was also measured by SPSS.

Moreover, Mediation analysis was used to examine the mediating effect of confidence level on ideal portion size and acceptable range size (H4, 5). As the most popular ways of mediation testing, the Four-Step approach from Baron and Kenny (1986) was used. If a partial mediation was found, the Sobel test would be applied.

4 Result

4.1 Descriptive information and randomization check

The average BMI of the sample was 22.2 (SD=3.2, ranging from 16.3 to 40.2). The hungry level and full level were 35.9 and 50.6 respectively. Gender was equally distributed in all conditions ($F_{3,\ 121}$=0.6, χ^2=1.7, P=0.6). Participants did not show significant differences in hungry or full levels across conditions (all P>0.25). However, liking had significant difference across conditions. ANOVA with portion size and familiarity as independent variable and liking as dependent variable revealed a main effect of familiarity (P<0.01) in that participants facing shasima (unfamiliarly snack) rated lower liking level (Mean=3.4, SD=1.7) than for familiar snack chocolate (Mean=5.7, SD=1.7). Additionally, there was a significant difference in age (Portion size: $F_{1,\ 124}$=6.4, P<0.05) between conditions. Thus, age and liking were regarded as covariates to control. Table 2 shows the mean value, SD, significance of main effect and interaction effect of variables.

Table 2 Ratings of hungry, fullness, liking and distribution of age, BMI and gender in each condition

	Large portion size (n=60)				Small portion size (n=65)						
	Familiar (n=29)		Unfamiliar (n=31)		Familiar (n=34)		Unfamiliar (n=31)		Main effect	Main effect	Main effect
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Portion size	Familiarity	Interaction effect
Hungry level	44.3	27.1	32.1	26.4	35.7	29.1	32.1	23.2	0.368	0.098	0.372
Fullness	45.0	27.8	51.0	25.0	53.5	24.2	52.4	19.3	0.255	0.576	0.420
Liking	5.5	1.8	3.5	1.6	5.8	1.6	3.3	1.8	0.986	<0.01	0.412
Age	23.6	10.3	25.0	9.4	21.4	1.9	20.9	2.5	0.013	0.701	0.460
BMI	21.7	3.2	22.8	4.2	22.3	2.5	22.0	2.6	0.889	0.511	0.240
Gender	0.1	0.3	0.2	0.3	0.2	0.4	0.2	0.3	0.617	0.434	0.338

4.2 Ideal portion size and acceptable range size

ANCOVA with familiarity and portion size as independent variable and ideal portion size as dependent variable revealed a significant key effect of provided portion size ($F_{1,123}$=5.0, P=0.028) and familiarity ($F_{1,123}$=39.0, P<0.01) on ideal portion size (seeTable3). Thus, hypothesis 1a, 2a is accepted. The ideal portion of the unfamiliar snack (Shasima, Mean=10.0, SD= 6.8) was more than two times the average ideal portion size of the familiar snack (Chocolate, Mean=4.9, SD=3.0). As for the portion size, the ideal portion size of large conditions (Mean=8.7, SD=7.3) was more than 39% higher than that of small conditions (Mean=6.2, SD=3.8). Specifically, Figure5 shows the average ideal portion size of each condition with SE=2.0. Moreover, an

interactive effect of portion size and familiarity on ideal portion size was found ($F_{1, 123}$=5.4, P<0.05). As shown in Figure5, the difference of ideal portion size between large and small portion conditions was bigger in unfamiliar treatment (Mean=4.6) than that of familiar treatment (Mean=0.1).

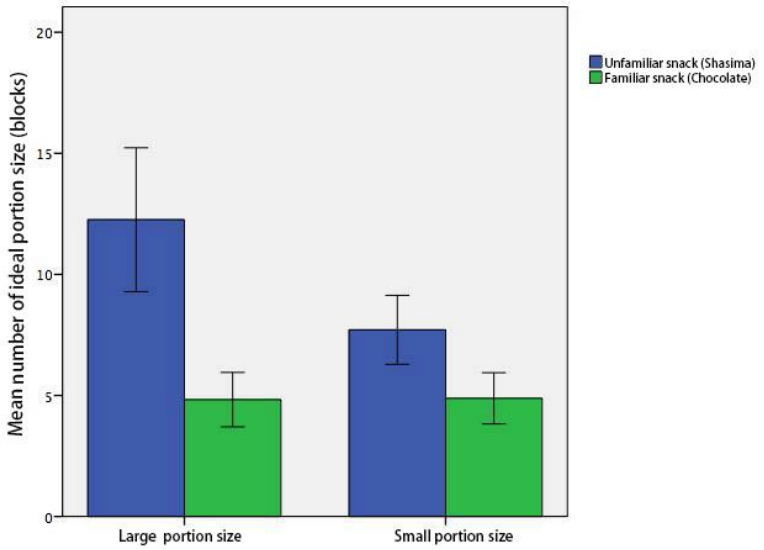

Figure5 Mean and standard error of ideal portion size in large and small conditions

As for acceptable range size, both portion size ($F_{1, 123}$=29.0, P <0.01) and familiarity ($F_{1, 123}$=16.1, P<0.01) had significant effect. Hypothesis 1b and 2b is accepted. The subjects from large portion condition (Mean=13.0, SD=9.6) indicated 96.7% larger than that from small portion size condition (Mean=6.6, SD=3.2). As for familiarity, subjects in unfamiliar snack conditions (Mean=12.5, SD=9.6) had a 78.6% higher acceptable range size than that of familiar snack conditions (Mean=7.0, SD=3.7). Figure6 exhibits the mean and standard error of acceptable range size in each conditions. Moreover, an interaction effect of familiarity and portion size ($F_{1, 123}$=30.1, P<0.01) was found. Same as the result of ideal portion size, the difference of acceptable range size between large and small portion conditions was larger in unfamiliar treatment (Mean=12.1) than that of familiar treatment (Mean=0.4). Thus hypothesis 3 is accepted.

Table 3 Ratings of uncertainty, ideal portion size and acceptable range size in each condition

	Large portion size (n=60)				Small portion size (n=65)						
	Familiar (n=29)		Unfamiliar (n=31)		Familiar (n=34)		Unfamiliar (n=31)		Main effect	Main effect	Main effect
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Portion size	Familiarity	Interaction effect
Ideal portion size	4.8	3.0	12.3	8.3	4.9	3.1	7.7	4.0	0.028	<0.01	0.022
Acceptable range	7.2	4.1	18.5	10.1	6.8	3.4	6.4	3.0	<0.01	<0.01	<0.01
Certainty	6.6	2.9	8.8	3.2	5.4	2.4	7.5	3.3	0.019	<0.01	0.962

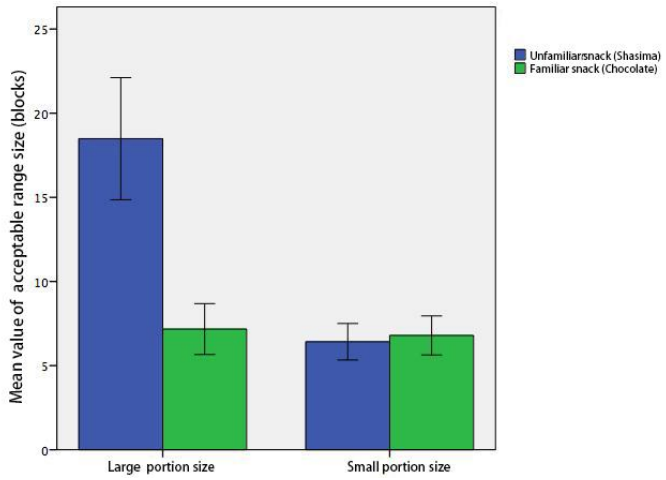

Figure6 Mean and standard error of acceptable range size in large and small conditions

4.3 Confidence

ANCOVA with portion size and familiarity as independent variable and uncertainty as dependent variable revealed the main effect of portion size ($F_{1, 124}$=5.7, P=0.019) and familiarity ($F_{1, 124}$=16.4, P<0.01) on uncertainty (seeTable3). Results showed that subjects were less confidence in unfamiliar conditions and large portion conditions. The mean rated value of uncertainty in unfamiliar conditions (Mean=8.2, SD=3.3) was 38% higher than that in familiar conditions (Mean= 6.0, SD=2.7). In large portion conditions, the average level of uncertainty (Mean=7.7, SD=3.3) was 21% higher than that of small portion conditions (Mean=6.4, SD=3.0). Specifically, Figure7 shows the difference between the unfamiliar and familiar condition, large and small conditions. However, the interaction effect of portion size and familiarity was not found (P=0.962).

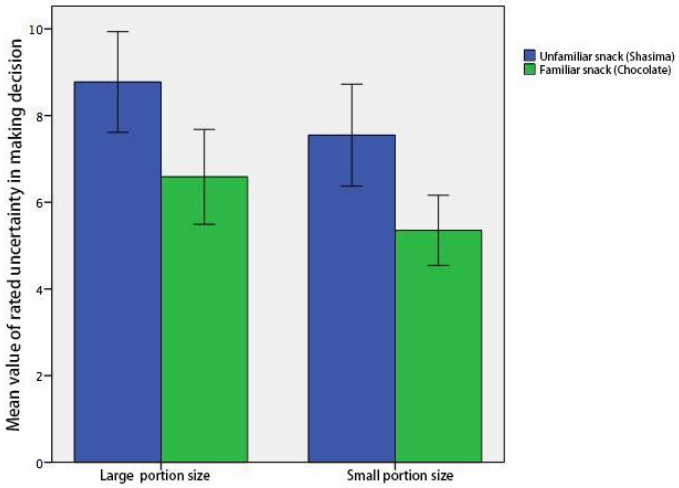

Figure7 Mean and standard error of uncertainty in large, small, unfamiliar and familiar conditions

4.4 Mediation analysis of confidence

To determine if the ideal portion size and the size of acceptable range was mediated by confidence, a mediation analysis was done. A first linear regression showed that the effect of portion size on ideal portion size is significant (β=-0.209, P=0.019). A second linear regression shows that served portion size was significantly related to confidence (β=-0.207, P=0.021). A third linear regression showed a significant effect of the confidence on indicated ideal portion size (β=-0.405, P<0.01). Fourthly, when both portion size and rated confidence value were included as predictors, the effect of portion size became insignificant (β=-0.169, P=0.059) while the effect of confidence remained significant (β=0.193, P=0.031). Thus the provided portion size influences the confidence in making decisions. As a result, their indicated ideal portion size is affected. Figure8 provides a visual representation of the mediational affect. Similar steps were applied to the size of acceptable range and for familiarity. However, the mediation effect of confidence was not found in these analyses. The result of these analyses are presented in Appendix 2. Finally, hypothesis 4a is accepted. However, hypothesis 4b, 5a, 5b is rejected.

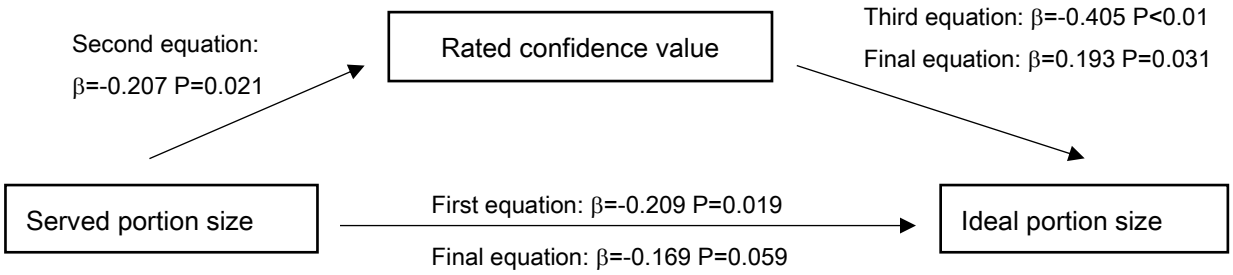

Figure 8 Mediating effect of rated confidence value

5 Discussion

Since 1970, the portion size of food and prevalence of obesity were increasing in parallel in America (Rolls, 2003). The portion size effect is believed to be one of the reasons for over-eating (Wansink, 2004). As following from this, within a range people could eat more or less without noticing, a proper application of the portion size effect might help people to reduce their intake volume effortlessly. Thus a deep understanding of the mechanism of portion size effect and the acceptable range size is necessary and helpful. Several explanations were put forward, including the dishware influence, bite size effect, unit size effect and appropriateness. However, there are few studies on the acceptable range size and how this might be affected by portion size. More specifically, it is still unclear whether the appropriateness of a particular portion size is malleable or fixed (Herman et al., 2015).

Pre-meal planning is another mechanism that affect intake volume. Scholars demonstrated that people have certain expectations on the food and these expectations affect intake volume (Brunstrom, Shakeshaft, & Alexander, 2010; Brunstrom, Shakeshaft, & Scott-Samuel, 2008; Hardman, McCrickerd, & Brunstrom, 2011). Expectations are highly related with previous experience and accumulated knowledge. Thus this pathway of intake volume control might start with familiarity.

The aim of this research was to explore the effect of portion size and familiarity on the ideal portion size and the acceptable range size. As expected, a typical portion size effect was demonstrated by this experiment. When given a large portion, participants indicated a larger ideal portion size compared to given a small portion. Moreover, when facing an unfamiliar snack, participants indicated a larger ideal portion size compared to familiar snack treatments. Besides, an interaction effect of given portion size and familiarity was found on ideal portion size and acceptable range size. In unfamiliar conditions, a typical portion size effect was found. While in familiar conditions, the portion size effect was not significant. A possible reason could be that participants have deep-rooted norms towards chocolate since they have been familiar with it for years. In other words, the portion size effect only worked in the period of forming appropriate portion norms. Once people discovered the correct amount, they will stick to that amount (Herman, Polivy, & Leone, 2005).

Only a few studies investigated the effect of portion size on acceptable range size (C. P. Herman et al., 2015). This study found that participants indicated a larger acceptable range size when served large portions of snack. More specifically, participants in the large condition of unfamiliar treatment indicated a larger acceptable range size than that of the small condition. However, the range size difference between large and small portion conditions in familiar treatments was not significant. The interaction effect of familiarity and portion size was also found. The range size of unfamiliar snack is considerable larger than that of familiar snack in the large conditions. The reason could be the same as mentioned above, which is that once people developed appropriate portions they will stick to them.

Furthermore, Schioth et al. (2015) reported that people may be different in confidence whereas they have the same expectation. Inspired by the confidence construct, a mediator role of

confidence was proposed. Results demonstrate the mediation role of confidence in typical portion size effect which is between given portion size and ideal portion size. In other words, a larger portion size decreased consumers' confidence. Consequently, consumers might rely more on external cues but less on self-judgment. This finding is in accord with the results from Schioth that participants with less confidence relies more on physiological cues. However, against expectations, the mediator role of confidence was not found between portion size and acceptable range size or familiarity and indicated portion size. Nevertheless, the data from this research is noteworthy. To our knowledge, this is the first study that attempt to connect confidence to portion size and familiarity.

This study has some implications for improving interventions to control consumption. The key message is to offer smaller portions and familiar information. Firstly, data shows that smaller portions could reduce intake. As the portion size effect is so robust, the portion size effect can help people diet with less difficulty. Currently, the most popular method of control weight is deprived diets, which means the method limits dieter's desire. But by applying the portion size effect, a dieter may have a much easier process. Since people do not realize the portion size difference, a reasonable smaller portion would not be noticed, while, the energy intake decreased. In simple terms, a smaller package size may reduce consumers' energy intake without restricting feelings. Another application would be in terms of nutritional education. As also indicated by another study, people with little knowledge once informed will be better able to estimate portion size (Huizinga et al., 2009). A deeper understanding of food and efficiently presenting familiar information on the package would increase confidence in self-judgment, which offsets part of the portion size effect.

There are a few limitations of the study that have to be acknowledged. A potential downside of using virtual pictures instead of real snacks is that participants cannot really touch or smell it. Only the visual sensory was triggered through this way. Another limitation is that the study is conducted by an online based survey. Hence, the size of the snack picture is affected by the size and settings of participants' monitors.

Though this study is has its limitations, it brought insights of acceptable range sizes and the role regarding confidence in decision making. The development of healthy portion sizes is considered to be central to obesity prevention (J. Fisher, Goran, Rowe, & Hetherington, 2015). Further research could carry out similar experiments in a real-life environment with a variety of foods. Additionally, to our knowledge, portion size related studies have tested chocolate products like chocolate chip cookies (Flood, Roe, & Rolls, 2006; Rolls, Roe, & Meengs, 2006), chocolate puddings (Burger, Kern, & Coleman, 2007), chocolate milk (J. F. Wilson, 1991), chocolate covered snacks (Brunstrom & Shakeshaft, 2009). However, there is no research directly testing chocolate bars. Although Rolls et al. (2004) included chocolate bars in their experiment, there is no information about chocolate consumption in their results. Thus more study about portion size effect could be done on chocolate to explore if there are any non-typical effects of this snack.

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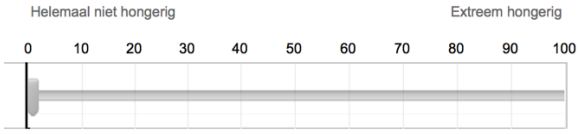
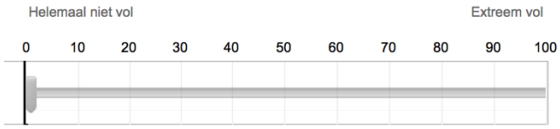
Appendix 1

The questionnaire (English included)

Q1. Hoe hongerig voelt u zich op dit moment? (How hungry do you feel right now)

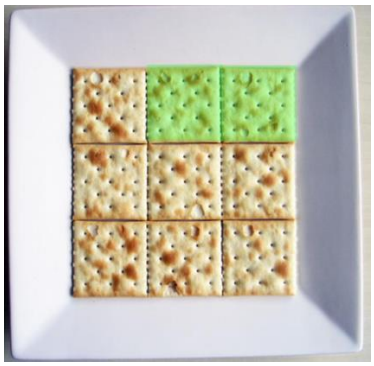


Q2. Hoe vol voelt u zich op dit moment? (How full do you feel right now)

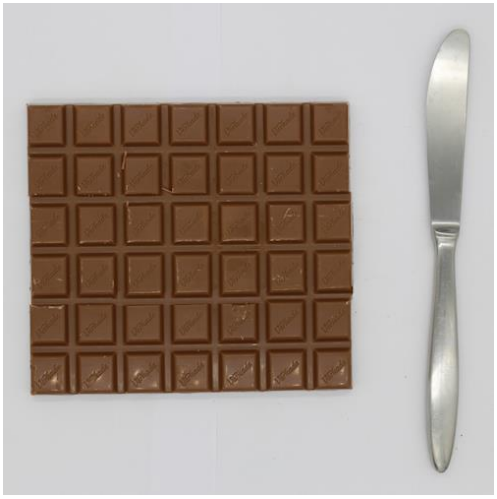


Q3. Later word je gevraagd voedselkeuzes te maken door middel van een interactieve foto zoals hieronder. Om je hiermee vertrouwd te maken, hebben we hier een voorbeeld voor je om te oefenen. Dit is slechts een oefenfoto, je antwoord op deze vraag wordt dus niet bewaard! Beweeg met je muis over de verschillende crackers. Die crackers lichten dan automatisch op. Als je op een cracker klikt, dan wordt deze groen. Dit betekent dat je de cracker hebt gekozen. Probeer dit een paar keer. Als je wat minder crackers wilt selecteren, dan moet je nog een keer klikken. De groene kleur verdwijnt dan. Als je klaar bent met oefenen, dan kun je doorgaan naar de volgende pagina.

(Later your will be asked to give choices through an interactive picture as below. To get familiarity with this, we have an example for you to practice. Move your mouse over the crackers. Blocks which automatically lights up. If you click on a cracker, it will be green. This means that you have chosen the crackers.)



Condition 1. (Q4-Q6)
Photo for condition 1:



Q4. Hieronder zie je een reep chocolade, gemaakt van onder andere cacaobonen, suiker en melk. Stel je voor dat zin hebt in chocolade en naar de keuken loopt om een portie te pakken. Wat zou op dat moment je ideale portie grootte zijn? Je kunt simpelweg op de chocolade klikken. Klik het aantal stukjes chocolade aan dat voor jou de ideale portie zou zijn voor een enkel eetmoment.

(Below you see a chocolate bar made from include cocoa beans, sugar and milk. Imagine that there is a chocolate and you walk to the kitchen to get a portion. What would that time be your ideal portion size? You can simply click on the chocolate. Click the number of pieces of chocolate that would be the ideal dose for you)

Q5. Hieronder zie je weer hetzelfde stuk chocolade. Wat zou op de minimale portie grootte zijn die nog net acceptabel is? Klik het aantal stukjes chocolade aan dat voor jou het absolute minimum is voor een enkel eetmoment.

(Below you can see again the same piece of chocolate. What would the minimum portion size that is just still acceptable? Click the number of crackers of chocolate that is the absolute minimum for you)

Q6. Hieronder zie je weer hetzelfde stuk chocolade. Wat zou op de maximale portie grootte zijn die nog net acceptabel is? Klik het aantal stukjes chocolade aan dat voor jou het absolute maximum is om te eten voor een enkel eetmoment.

(Below you can see again the same piece of chocolate. What would the maximum portion size that is just still acceptable? Click the number of pieces of chocolate that for you is the absolute maximum to eat)

Condition2 (Q7-Q9)

Photo for condition2

Q7. Hieronder zie je een reep chocolade, gemaakt van onder andere cacaobonen, suiker en melk. Stel je voor dat zin hebt in chocolade en naar de keuken loopt om een portie te pakken. Wat zou op dat moment je ideale portie grootte zijn? Je kunt simpelweg op de chocolade klikken. Klik het aantal stukjes chocolade aan dat voor jou de ideale portie zou zijn voor een enkel eetmoment.

(Below you see a chocolate bar made from include cocoa beans, sugar and milk. Imagine that there is a chocolate and you walk to the kitchen to get a portion. What would that time be your ideal portion size? You can simply click on the chocolate. Click the number of pieces of chocolate that would be the ideal dose for you)

Q8. Hieronder zie je weer hetzelfde stuk chocolade. Wat zou op de minimale portie grootte zijn die nog net acceptabel is? Klik het aantal stukjes chocolade aan dat voor jou het absolute minimum is voor een enkel eetmoment.

(Below you can see again the same piece of chocolate. What would the minimum portion size that is just still acceptable? Click the number of pieces of chocolate that is the absolute minimum for you)

Q9. Hieronder zie je weer hetzelfde stuk chocolade. Wat zou op de maximale portie grootte zijn die nog net acceptabel is? Klik het aantal stukjes chocolade aan dat voor jou het absolute maximum is om te eten voor een enkel eetmoment.

(Below you can see again the same piece of chocolate. What would the maximum portion size that is just still acceptable? Click the number of pieces of chocolate that for you is the absolute maximum to eat)

Condition 3 (Q10-Q12)

Photo of condition 3

Q10. Hieronder zie je een snack Shasima, gemaakt van onder andere bloem, eieren, suiker en room. Stel je voor dat zin hebt in deze snack en naar de keuken loopt om een portie te pakken. Wat zou op dat moment je ideale portie grootte zijn? Je kunt simpelweg op de snack klikken. Klik het aantal stukjes aan dat voor jou de ideale portie zou zijn voor een enkel eetmoment.

(Below you can see a snack Shasima made from include flour, eggs, sugar and cream. Imagine you have that sense in this snack and walks to the kitchen to get a portion. What would be your ideal portion size? You can simply click on the snack. Click the number of pieces that would be the ideal for you)

Q11. Hieronder zie je weer hetzelfde stuk Shasima. Wat zou op de minimale portie grootte zijn die nog net acceptabel is? Klik het aantal stukjes shasima aan dat voor jou het absolute minimum is voor een enkel eetmoment.

(Below you can see again the same piece of Shasima. What would the minimum portion size that is just still acceptable? Click the number of pieces shasima that is the absolute minimum for you)

Q12. Hieronder zie je weer hetzelfde stuk Shasima. Wat zou op de maximale portie grootte zijn die nog net acceptabel is? Klik het aantal stukjes shasima aan dat voor jou het absolute maximum is om te eten voor een enkel eetmoment.

(Below you can see again the same piece Shasima. What would the maximum portion size that is just still acceptable? Click the number of pieces shasima that for you is the absolute maximum to eat)

Condition 4 (Q13-Q15)

Photo for condition 4

Q13. Hieronder zie je een snack Shasima, gemaakt van onder andere bloem, eieren, suiker en room. Stel je voor dat zin hebt in deze snack en naar de keuken loopt om een portie te pakken. Wat zou op dat moment je ideale portie grootte zijn? Je kunt simpelweg op de snack klikken. Klik het aantal stukjes aan dat voor jou de ideale portie zou zijn voor een enkel eetmoment.

(Below you can see a snack Shasima made from include flour, eggs, sugar and cream. Imagine you have that sense in this snack and walks to the kitchen to get a portion. What would be your ideal portion size? You can simply click on the snack. Click the number of pieces that would be the ideal for you)

Q14. Hieronder zie je weer hetzelfde stuk Shasima. Wat zou op de minimale portie grootte zijn die nog net acceptabel is? Klik het aantal stukjes shasima aan dat voor jou het absolute minimum is voor een enkel eetmoment.

(Below you can see again the same piece of Shasima. What would the minimum portion size that is just still acceptable? Click the number of pieces shasima that is the absolute minimum for you)

Q15. Hieronder zie je weer hetzelfde stuk Shasima. Wat zou op de maximale portie grootte zijn die nog net acceptabel is? Klik het aantal stukjes shasima aan dat voor jou het absolute maximum is om te eten voor een enkel eetmoment.

(Below you can see again the same piece of Shasima. What would the maximum portion size that is just still acceptable? Click the number of pieces shasima that for you is the absolute maximum to eat.)

Q16. Geef aan in hoeverre je het eens bent met de volgende beweringen. Deze snack...

(Please indicate whether you agree with the following statements. This snack:

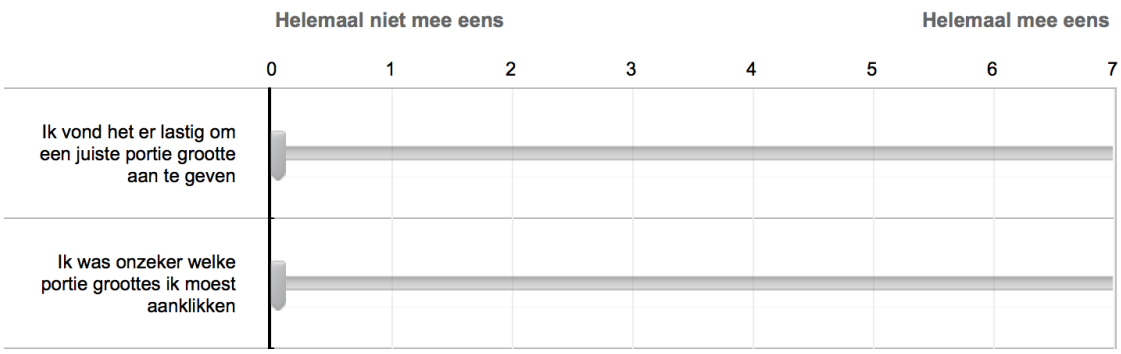
1. I know
2. I eat sometimes
3. looks attractive)

	Volledig mee oneens	Mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Mee eens	Volledig mee eens
is mij bekend	○	○	○	○	○	○	○
eet ik wel eens	○	○	○	○	○	○	○
ziet er aantrekkelijk uit	○	○	○	○	○	○	○

Q17. Geef aan in hoeverre je het eens bent met de volgende beweringen.

(Please indicate whether you agree with the following statements

1. I found it very difficult to give a proper portion size
2. I was unsure what portion sizes I had to click)



Q18. Wat is je geslacht? (What is your gender?)

Q19. Wat is je lengte in centimeters? (What is your height in cm)

Q20. Wat is je leeftijd in jaren? (How old are you)

Q21. Wat is je gewicht in kilo's? (What is you bodyweight in kg)

Appendix 2

Result of mediation analysis (linear regression analysis)

Regression	Independent variables	dependent variables	Standardized Coefficients(β)	Sig
1	portion size	ideal portion size	-0.209	0.019
2	portion size	uncertainty	-0.207	0.021
3	uncertainty	ideal portion size	-0.405	<0.01
4	portion size	ideal portion size	-0.169	0.059
	uncertainty		0.193	0.031
1	portion size	acceptable range	-0.416	<0.01
2	portion size	uncertainty	-0.207	0.021
3	uncertainty	acceptable range	0.143	0.111
4	portion size	acceptable range	-0.404	<0.01
	uncertainty		0.06	0.479
1	familiarity	ideal portion size	-0.405	<0.01
2	familiarity	uncertainty	-0.286	0.01
3	uncertainty	ideal portion size	0.288	0.1
4	familiarity	ideal portion size	-0.37	<0.01
	uncertainty		0.122	0.156
1	familiarity	acceptable range	-0.376	<0.01
2	familiarity	uncertainty	-0.286	<0.01
3	uncertainty	acceptable range	0.143	0.111
4	familiarity	acceptable range	-0.364	<0.01
	uncertainty		0.039	0.659