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# “It was(n’t) me”

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Attributions for food intake of healthy (versus unhealthy)  
snacks

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## **Abstract**

*Background:* There is evidence that people have a tendency to blame external factors for their food intake when they believe that they have eaten more than usual. This study examines how intake evaluation ('ate less', 'ate about the same', 'ate more') and snack type (healthy versus unhealthy) influence people's attributions for their snack intake.

*Methods:* In a supposed sensory test, participants ( $n = 190$ ) were asked to eat until they had eaten enough of a large portion of either sponge cake (85-96 grams) or cucumber (200-231 grams). Participants were asked to compare the amount they ate with what they would normally eat as a snack using the following intake evaluations 'ate less', 'ate about the same', 'ate more' and to indicate the influence of seven internal (i.e. hunger, fullness) and seven external factors (i.e. portion size, surroundings) on their intake.

*Findings:* Participants ate on average 75.5 grams of cake ( $SD = 17.9$ ) and 125.4 grams of cucumber ( $SD = 58.3$ ). Actual intake did not differ across intake evaluation categories ( $p = 0.07$  for cucumber and  $p = 0.49$  for sponge cake). When intake evaluation increased, ratings of influence for external and internal factors increased as well. Attribution to internal factors did not differ by snack type, while external factors did; ratings were higher after consuming sponge cake compared to cucumber. Participants in the intake evaluation group 'ate more' that were also in the sponge cake condition, did not report higher ratings of influence of external factors than participants in the 'ate more' cucumber condition.

*Discussion:* When people eat an unhealthy snack they report a higher influence of external factors compared to when eating a healthy snack, regardless of whether they think they have eaten less, the same or more than usual.

*Keywords:* food intake; attributions; healthiness; external cues; portion size

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# 1. Introduction

Over the past decades, rates of obesity have increased tremendously. In 2016, 39% of men and 40% of women were overweight worldwide (WHO, 2018). Being overweight or obese can have serious health consequences, like an increased risk at cardiovascular diseases, different types of cancer and type 2 diabetes (e.g. Lavie, Milani & Ventura 2009; Zhang, Rexrode, van Dam, Li & Hu, 2008). An important cause of the obesity epidemic and related diseases are diets containing large amounts of (saturated) fat, salt and sugar (Moubarac, Parra, Cannon, & Monteiro, 2014). Although internal cues like hunger and satiety influence our food intake, external cues in the eating environment can have significant impact as well (Herman & Polivy, 2008; Wansink, 2004). These external cues can include sensory cues (e.g. sight, smell or taste of food) and normative cues (social or environmental indicators of the type or amount of food one should eat) (Herman & Polivy, 2008). Normative cues could for example include the presence of others and what they are eating (Vartanian, Herman, & Wansink, 2008) or portion size (Rolls, Morris, & Roe, 2002).

Of normative cues, portion size in particular has received a great deal of attention. Numerous studies have shown that increasing portion size increases energy intake (e.g. Diliberti, Bordi, Conklin, Roe, & Rolls, 2004; Rolls, Roe, Kral, Meengs, & Wall, 2004; Wansink, Painter, & North, 2005). The portion size effect is furthermore shown among men and women (Rolls et al., 2002; Rolls, Roe, Kral, et al., 2004) overweight and normal weight individuals (Rolls et al., 2002) and children and adults (Birch, Savage, & Fisher, 2015; Diliberti et al., 2004). Moreover, its effect occurs for foods that differ in their caloric content (Fisher, Liu, Birch, & Rolls, 2007; Rolls, Roe, & Meengs, 2010; Spill, Birch, Roe, & Rolls, 2010), palatability (Wansink & Kim, 2005) and category (e.g. snack versus non-snack, sweet versus savoury; liquids versus solids) (Rolls et al., 2002; Rolls, Roe, Kral, et al., 2004; Spill et al., 2010; van Kleef, Shimizu, & Wansink, 2013).

Although people eat significantly more food when exposed to larger portion sizes, it seems that they often do not realize the effect it has on their food intake (Vartanian et al., 2008; Vartanian, Reily, Spanos, Herman, & Polivy, 2017; Wansink, 2004). However, one recent study by Keenan, Childs, Rogers, Hetherington, and Brunstrom (2018) suggests that women can identify whether they had consumed more or less than intended, especially when they received a larger portion and consumed more than they thought they would. In this study, women were asked how much pasta with tomato sauce they intended to eat for lunch, whereafter they had to scoop a bowl of pasta to consume from a larger or smaller portion of pasta. Afterwards they were asked to indicate whether they thought they had eaten more or less pasta than they intended to eat. Even though 77% of the participants from the large portion condition correctly identified that their intake was higher, they still underestimated their intake by 25% on average. The question therefore remains whether people are aware of the magnitude of the portion size effect and whether they realize that portion size, rather than their own feelings of hunger and satiety, is the cause of increasing their food intake.

A study conducted by Vartanian et al. (2008) showed that people affected by the eating behaviour of others tend to attribute their food intake to internal motivations (hunger and satiety) rather than the normative cue. Participants also tend to identify their internal ratings of hunger and satiety as more influential than portion size when manipulating the portion sizes of pasta, except when they indicated to have eaten more than they normally would (Vartanian, Reily, Spanos, Herman, et al., 2017). This suggests that realizing that one ate more than they normally would, increases the possibility to attribute (over)eating to external factors, like portion size. Vartanian, Reily, Spanos, Herman, et al. (2017) argued that this might be due to the fact that participants who ate more than usual felt bad about this. Therefore, participants could be more comfortable attributing overeating to an external cue like portion size, rather than their own greediness.

However, eating certain types of food does not necessarily have to lead to negative feelings. As healthy foods are often associated with more positive feelings (Chapman & Maclean, 1993; Desmet & Schifferstein, 2008; Harrison & Jackson, 2009), eating those foods might result in positive rather than negative feelings. On the other hand, eating unhealthy foods might evoke pleasurable feelings at first, but afterwards feelings might turn quite negative, as unhealthy foods are also associated with guilt and contempt (Burnett & Lunsford, 1994; Chapman & Maclean, 1993; Desmet & Schifferstein, 2008; Rousset, Deiss, Juillard, Schlich, & Droit-Volet, 2005). The negative versus positive feelings associated with different types of food could result in increased external attribution. This effect could be then expected to reinforce when eating more than usual of those foods.

So far, no studies have examined whether there are differences in attributing the perception of eating behaviour to internal versus external factors for foods that differ in their healthiness. Examining these differences can give further insights in the reasons when and why people attribute their intake to internal signals of hunger and satiety or normative cues like portion size. Thus, the research question of this study is:

*In what way does food intake of healthy versus unhealthy foods affect people's internal and external attributions to eating behaviour?*

In order to answer this research question, an experiment will be conducted in which participants receive either a large portion of a healthy (versus unhealthy) food. Participants will be asked to taste and rate the food on different sensory aspects (e.g. taste and texture). After tasting the food, questions will be asked about whether they think they have eaten less, the same or more than they normally would and how several internal and external cues impacted their food intake.

The present study can give more insight to how people attribute their eating behaviour and under which conditions individuals are inclined to attribute behaviour to external versus internal cues. Understanding under which conditions individuals acknowledge the impact of external cues, can be used to create awareness of the impact of external cues on eating behaviour in these conditions. This subsequently creates opportunities to develop strategies to counteract the (negative) influences of external cues. A strategy could be to shift the focus from external to internal cues before the start of an eating episode by using for example by mindfulness exercises (Baer, 2015). This can stimulate the individual to listen more to internal cues when eating while limiting the impact of external cues, preventing (perceived) overeating. This can subsequently reduce negative feelings that arise after (perceived) overeating, that could (especially among restrained eaters) lead to negative cycles of overeating (overeating, feeling guilty, eating even more); the 'what the hell effect' (Herman & Polivy, 1983). When these effects are present to a larger extent for unhealthy foods, shifting the attention back to internal cues can be even more effective in preventing overeating of unhealthy foods.

## 2. Theoretical framework

### 2.1 The influence of internal signals and external cues on food intake

Every human is equipped with an appetite control system, which affects our food intake, motivation, selection and preference (Blundell et al., 2010). The appetite control system is regulated by feelings of satiation and satiety, which denote (respectively) the inhibition of further eating *within* an eating episode or *in between* eating episodes (Blundell et al., 2010). These feelings of satiation and satiety are triggered by sensory, cognitive and physiological cues (post-ingestive and post-absorptive cues) in the body before, during and after a meal (see figure 1). Right after the start of consumption, feelings of satiation are triggered by sensory signals and cognitive processes that affect both the perceived quality of the meal (in terms of reward and pleasure) and learned expectations of how satiating the food will be. For example, increased thickness of dairy products increased expected satiation of the product (Hogenkamp, Stafleu, Mars, Brunstrom, & de Graaf, 2011). Moreover, physiological cues like for example the stretch of the stomach or the release of several hormones can also affect satiation and therefore food intake.

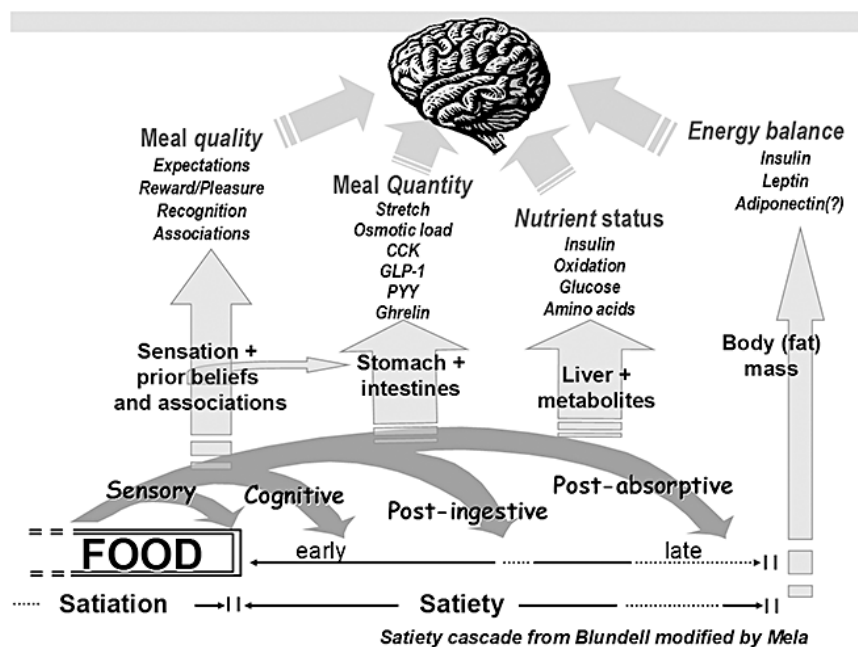


Figure 1. The satiety cascade model as adapted by Mela (2006)

When looking at the satiety cascade model, people could be expected to reach energy balance in the long term by avoiding hunger and uncomfortable feelings of overeating. However, food intake is not only affected by internal signals of satiety and satiation, but also by a range of external cues (for a review see Wansink, 2004). Sometimes, external cues are so powerful that they overrule the appetite control system. External cues like for example the smell or sight of food can undermine satiety in the sense that they can increase hunger levels or desire to eat after exposure to the cue (Cornell, Rodin, & Weingarten, 1989; Ferriday & Brunstrom, 2008; Lambert, Neal, Noyes, Parker, & Worrel, 1992; Oakes & Slotterback, 2000). Similarly, external cues like a large portion, distraction or a pleasant atmosphere can make a person continue eating even though their feelings of satiation tell them that they have had enough (Klesges, Bartsch, Norwood, Kautzman, & Haugrud, 1984; Ogden et al., 2013; Zlatevska, Dubelaar, & Holden, 2014).

Especially the influence of portion size on food intake has received a lot of attention in the last couple of decades. Its effect has been demonstrated many times and is robust across a range of environmental and individual factors (Zlatevska et al., 2014). Doubling the size of the portion increases intake by on average 35% (Zlatevska et al., 2014), which suggests that internal cues of satiation are overruled by this external cue. As food intake increases when given a larger portion, people could be expected to feel stronger feelings of satiation after consuming a larger portion. Interestingly, this is often not the case (see table 1).

Table 1. Overview of studies that investigated ratings of hunger and satiety when increasing portion size

<i>Researchers</i>	<i>Subjects</i>	<i>Design</i>	<i>Food type</i>	<i>Intake increase in largest versus smallest portion (g)</i>	<i>Ratings of hunger, fullness, satiation and/or satiety</i>
Burger, Fisher, and Johnson (2011)	30 adults	Within subjects design	Pasta dish	26%	Did not differ
Diliberti et al. (2004)	172 adults	Between subjects design	Pasta entrée	43%	Did not differ
Flood, Roe, and Rolls (2006)	33 adults	Between subjects design	Cola	18%	Did not differ
Kral, Roe, and Rolls (2004)	45 women	Within subjects design	Lunch entrée	56%	Did not differ
Levitsky and Youn (2004)	13 young adults	Between subjects design	Soup, pasta, bread sticks and ice-cream	Increased <sup>1</sup>	Did not differ
Marchiori, Corneille, and Klein (2012)	88 young adults	Between subjects design	M&M's	112%	Did not differ
Reily and Vartanian (2016)	164 female students	Between subjects design	Pasta dish	26,3%	Did not differ
Rolls et al. (2002)	51 adults	Between-subjects design with repeated measures within each group	Macaroni and cheese entrée	30%	Did not differ
Rolls, Roe, Kral, et al. (2004)	60 young adults	Within subjects design	Packages of potato chips	178%	Ratings of hunger decreased significantly with increasing package size

<sup>1</sup> No exact data available (only in terms of increased calorie intake)

Rolls, Roe, and Meengs (2006a)	32 adults	Within subjects crossover design	All food and drinks for 2 consecutive days in 4 weeks	26%	Ratings were lowest in the smallest portion condition, but did not differ between the medium and largest portion condition
Rolls, Roe, and Meengs (2006b)	24 young women	Crossover	All food and drinks for 2 consecutive days in 3 weeks	13,3%	Did not differ
Rolls, Roe, and Meengs (2007)	23 adults	Within subjects crossover design	All food and drinks for two periods 11 consecutive days	20%	Daily ratings of fullness increased by 11%, ratings of hunger decreased by 9%
Rolls, Roe, Meengs, and Wall (2004)	75 young adults	Within subjects design	Turkey sandwich	18% <sup>2</sup>	Did not differ
Rosenthal and Raynor (2017)	20 adults	Between subjects design	Macaroni with cheese and a salad with dressing	27,5%	Did not differ
Scheibehenne, Todd, and Wansink (2010)	96 adults	Between subjects design	Goulash or risotto lunch	36%	Did not differ
van Kleef, Shimizu, and Wansink (2012)	68 young adults	Between subjects design	Pasta	71%	Subjects felt more satiated after the meal in a large-sized bowl vs a medium-sized bowl
Vermote et al. (2018)	4231 students (intake measurements) 33 students interview	Between subjects design	Fries	10%	Did not differ
Wansink et al. (2005)	54 adults	Between subjects design	Soup	73%	Did not differ
Zuraikat, Roe, Privitera, and Rolls (2016)	50 adults	Crossover design	Pasta dish	16%	Did not differ
Zuraikat, Roe, Sanchez, and Rolls (2018)	102 women	Crossover design	Meal consisting of 7 different foods on four different occasions	27%	Hunger ratings decreased by 39,4%, fullness ratings increased by 5,9% between largest and smallest portion condition

<sup>2</sup> As almost all participants consumed the smallest (6 inch) sandwich completely, the food intake increase between the second smallest (8 inch) and largest sandwich (12 inch) was calculated



Only five out of twenty studies found that ratings of fullness, hunger, satiation or satiety were significantly different even though food intake significantly increased when receiving a large portion. This indicates that food intake of individuals does not always associate with subjective feelings of hunger and satiety. For the within-subjects and cross over design studies, 4 out of 10 showed differences in ratings of hunger and fullness, accounting for most of the differences found across all studies. Still, for 3 out of 4 within-subjects and 3 out of 6 crossover studies no difference in hunger and fullness ratings were found between conditions. Moreover, even in these studies where changes in hunger and satiety are observed, these changes are not proportionate to the corresponding increases in food intake. It seems therefore that individuals find it hard to internally notice differences in how much they have eaten. This might be due to external influences (e.g. distraction, portion size, bowl size) being more determinant for individuals' food intake than internal signals of hunger and satiety<sup>3</sup>.

## *2.2 Awareness of eating more than usual or intended*

Although food intake does not always associate with subjective feelings of hunger and satiety and individuals seem to find it hard to internally notice how much they have eaten, they could still be aware of the fact that their intake increased due to example visual cues in their environment (e.g. they saw that the portion they consumed was more than usual). In the study of Wansink and Sobal (2007), participants were asked whether they thought they had eaten (or served themselves<sup>4</sup>) less, the same or more than their typical amount after they were offered spaghetti, chex mix or popcorn. For each food, an environmental cue linked to portion size like package size, plate size or serving bowl was doubled in size to create three exaggerated environmental cue conditions. The control conditions consisted of a normal sized package, plate or bowl (half the size of the ones in the exaggerated environmental cue conditions). On average, participants in the exaggerated environmental cue conditions consumed 31% more food than those in the control groups. However, only 8% of the participants in the exaggerated conditions indicated to have eaten more than they would normally eat, 75% of the participants indicated that they had eaten about the same and 19% indicated to have eaten less. It seems therefore, assuming that the control group and intervention group on average had a similar usual intake, that participants were not aware that their intake increased after exposure to the environmental cue. However, this study does not report the intake evaluations (whether they think they have eaten less, the same or more than usual) of the control group. When most participants in the control groups would have indicated to have eaten less than usual, the increase in consumption in the exaggerated environmental cue conditions compared to the control group could then be explained by differences in intake evaluations, rather than unawareness of increased intake. On the other hand, when the distribution of intake evaluation groups in the control group was similar to the exaggerated environmental cue conditions, it is likely that individuals were indeed unaware of their increase in food intake compared to usual.

When women in the study of Keenan et al. (2018) had to indicate whether they had eaten more or less than they intended to eat, 77% identified correctly that they had eaten more, although they still underestimated their intake by 25%. Van Kleef et al. (2012) found that men and women in general overestimated their calorie intake, but participants who were given a large bowl overestimated their calorie intake by 41%, while participants who were given a medium sized bowl overestimated it by 61%.

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<sup>3</sup> Note that for some individuals these effects might occur to a smaller extent. Different studies have shown that the ability to perceive and rely on internal signals of hunger and satiety for self-regulation seems to be higher for some individuals and lower for others (Spiegel, 1973). An experiment with children and adults shows that children seem to compensate for the caloric preload, while adults still consumed 100 kcal more in caloric preload condition (Lipps, Birch, & Deysler, 1986). Cecil et al. (2005) found that children adjusted their caloric intake after a preload and younger children did so more effectively. This might also be one of the reasons why the portion size effect was generally weaker among children in the review of Zlatevska et al. (2014).

<sup>4</sup> In one of the conditions, participants only served food (spaghetti) for themselves but did not actually consume it.

Similarly, Zuraikat et al. (2018) found that participants estimates of energy intake increased 7% when comparing the smallest and largest portion, while their intake increased by 25%. Individuals might therefore be aware of the fact that they have eaten more than usual, but seems to be unaware of the amount they have overeaten and tend to underestimate this amount.

### 2.3 Awareness and acknowledgement of the impact of external cues on eating behaviour

Although it seems that individuals tend to underestimate the amount they have overeaten, they could still be aware of external cues in their environment and/or acknowledge that external cues made them eat more than they would normally eat. The question is thus whether people are aware or acknowledge the impact of external cues on food intake. Vartanian et al. (2008) conducted two experiments that both indicated that participants were not aware or did not acknowledge the influence of external cues on their eating behaviour. In the first experiment, female undergraduate students had access to food while watching television together. Although the amount consumed by the students was highly correlated, only 3 out of 122 reported to be influenced by the amount that others ate. In the second experiment, participants were told to rate the taste of cookies, after they were inadvertently exposed to a consumption norm that indicated how many cookies previous participants had eaten. Afterwards, they had to indicate whether several factors had influenced them to eat as much as they did. Even though participants were highly influenced by the consumption norm (eating less when the norm was low and eating more when the norm was high), in the questionnaire the factor “how much others ate” was the second-lowest-rated factor of all (after medical conditions). Instead, ratings of hunger and taste were the most important determinants of food intake according to participants. Moreover, in the study of Wansink and Sobal (2007), only 4% of all participants in the exaggerated environmental cue conditions (e.g. large portion, large plate or bowl) indicated that the environmental cue had influenced their eating behaviour, while food intake was 31% higher in the environmental cue conditions compared to the control condition.

In other studies however, participants did acknowledge the external cue in some of the conditions. Vartanian, Spanos, Herman, and Polivy (2017) found that only pre-loaded participants acknowledged the impact of the social norm cue, although their intake was not different from the control condition. In this study, female undergraduates took part in a pizza taste-test after they had been food-deprived for 18 hours or given a meal replacing preload. The participants were exposed to either a social norm cue conflicting with their hunger level (deprived participants were exposed to a low-intake norm and preloaded participants to a high-intake norm) or no social norm cue. Deprived participants exposed to the social norm cue (low-intake) ate less than deprived participants who were not exposed to a cue, but denied being influenced by the social norm cue. Even though pre-loaded participants exposed to the social norm (high intake) did not eat more than the participants in the control condition, they did believe that the social norm cue had made them eat more. Similarly, Vartanian, Reily, Spanos, Herman, et al. (2017) also found that only some of the participants acknowledged the impact of an external cue on their food intake. In this study, participants were served a large or a small portion of pasta for lunch. After eating the pasta, participants had to indicate whether they thought they had eaten less, the same or more than they normally would. Participants rated the influence of the amount of food available as least influential when they ate less than they normally would, followed by the ‘ate the same’ and ratings were the highest for the ‘ate more’ group. However, only the participants in the large portion condition who reported to have eaten more than usual acknowledged that it had significantly influenced their food intake. Thus, in both studies only individuals who thought they had eaten *more than usual* indicated that the external cue had an influence on their intake. Others denied that this external cue affected their food intake and reported that levels of hunger and satiety mostly determined their eating behaviour (Vartanian, Reily, Spanos, Herman, et al., 2017; Vartanian, Spanos, et al., 2017).

Similarly, in other studies where participants were asked which factors caused them to eat as much as they did, levels of hunger and satiety were also identified as the most important determinants (Cavanagh, Vartanian, Herman, & Polivy, 2014; Wansink & Sobal, 2007). Food intake is therefore not always associated with feelings of hunger and satiety (see table 1), but seem to be the most important determinants used to explain food intake. On the other hand, external cues (like portion size or presence of others) that have significant impact on eating behaviour of individuals are often not acknowledged. Vartanian, Reily, Spanos, McGuirk, et al. (2017) found that when predicting the eating behaviour of others, participants still tend to overestimate the impact of the internal cue (e.g. high hunger), but do take external cues into account when those cues are inhibitory (e.g. eating companion who eats less). This is in contrast with individuals who acknowledge the influence of the external cue; when the cue is trying to increase consumption (and they thought they ate more than usual). However, in the research of Vartanian, Reily, Spanos, McGuirk, et al. (2017) individuals had to *predict* the behaviour of *other* individuals, while in the studies of Vartanian, Reily, Spanos, Herman, et al. (2017) and Vartanian, Spanos, et al. (2017) individuals *themselves* were asked to explain their eating behaviour *afterwards*. Because of the difference in perspective (you versus me) and the difference in timing (before versus afterwards) it is perhaps not surprising that these studies found contrasting results. Nonetheless, it shows that individuals tend to focus on internal factors when it comes to explaining eating behaviour and that they are not always consistent in their attribution of eating behaviour towards internal versus external cues.

#### *2.4 Underlying processes of the attribution of overeating to external versus internal cues*

The question is why individuals use external cues to explain their behaviour to a larger extent when they think they have eaten more than usual. In other words, what causes the difference in attributing behaviour to different factors.

A theory that illustrates why individuals explain behaviour in a certain way, is the attribution theory (Kelley & Michaela, 1980). According to this theory, attribution of behaviour arises from three antecedents: information, beliefs and motivation. The antecedents lead to the perceived cause(s), where external causes (environmental factors) and internal causes (own abilities) are distinguished. Finally, people explaining their own behaviour in a certain way triggers reactions in the form of behaviour, affect and expectancy (see figure 2). As indicated in the figure, a rough distinction can be made between attribution and attributional theories. Researchers interested in cognitive processes mainly focussed on the link between antecedents and attributions (attribution theories), while others interested in the link between attributions and consequences mainly focussed on attributional theories (Kelly & Michaela, 1980). As this paper investigates the attribution of overeating, mainly the link between the antecedents of the action (overeating) and attributions (internal and external) are examined.

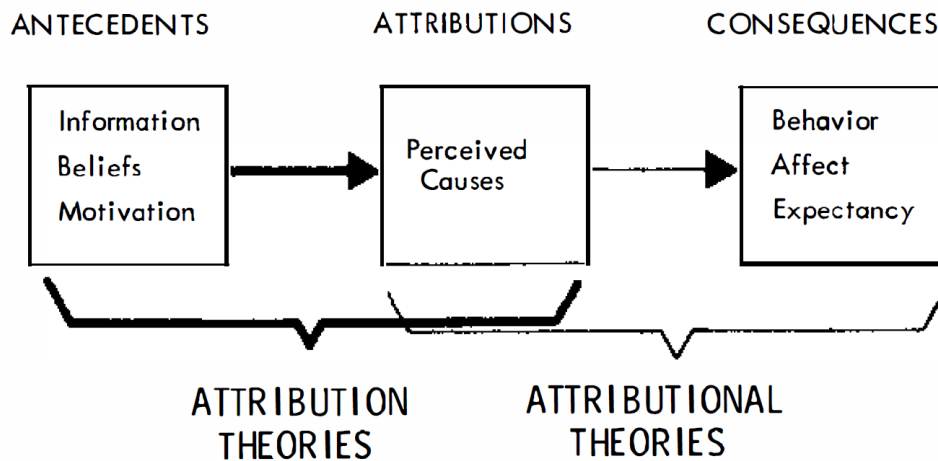


Figure 2. The attribution theory (Kelley & Michela, 1980)

More research on the distinction between external and internal attribution has demonstrated that individuals tend to explain their behaviour by an external cue when their behaviour could reflect negatively on themselves and by an internal cue when this behaviour is positive (Bradley, 1978; Zuckerman, 1979). This phenomenon is also known as the self-serving bias (Zuckerman, 1979). As Vartanian, Reily, Spanos, Herman, et al. (2017) already argued, it could be that participants in their study who thought they had eaten more than usual felt bad about this. Therefore, they might have been more comfortable attributing this to an external factor (portion size), rather than (only) their own greediness to protect their self-esteem. On the other hand, individuals who ate the same as usual or less than usual probably felt rather neutral, content or even proud after the amount of food they consumed as they stuck to their norms, resulting in attributing their food intake to internal factors (e.g. how hungry they were).

The difference in contrasting feelings (negative versus positive or neutral) after consuming more, the same or less than usual, can be explained by the cognitive dissonance theory. According to the cognitive dissonance theory (Festinger, 1957), two beliefs, behaviours or opinions that are in conflict with each other can create discomfort. Consider for example that a snack or a meal is given to an individual. After consuming the food, the individual probably has an idea whether he consumed more, less or the same as usual (regardless of whether this idea is correct). Dependent on the belief of the individual (i.e. I should stick to my normal consumption pattern) and the current eating behaviour (eating more, the same or less) the behaviour can be incongruent or congruent with his beliefs. When the individual for example thinks he consumed the same as usual and his opinion is that he should consume as much as he normally does, no dissonance or discrepancy between the belief and behaviour exist. The same applies when the individual really does not care how much he eats and consumes more, less or the same, because there cannot be incongruence when there is no initial belief. When the individual believes he should consume more than or the same as usual and actually consumes less, there is a discrepancy between his belief or opinion and his behaviour. However, for most people eating less would probably have stronger benefits than the discomfort of the discrepancy (e.g. staying healthy and slim, losing weight, being able to eat more later that day) or they might stop eating because eating more could cause uneasy physical sensations in their stomach (feeling too full). As the positive feelings of these benefits probably overrule the negative feelings of dissonance, eating less or the same as usual would (according to the attribution theory) be attributed internally rather than externally.

Meanwhile, when an individual believes he should eat the same or less than normal but actually consumes more, it might be harder to resolve the discomfort that arises. Feelings of guilt might appear

as one failed to act on their beliefs. Indeed, when female participants in the study of Ruddock and Hardman (2018) believed they had overeaten, ratings of guilt were highest compared to the control and undereating condition. The individual may try to reduce the dissonance by changing one or more of the beliefs or rationalizing their behaviour by changing the perception of action (Festinger, 1957). For example, this individual can say that he was more hungry than usual and therefore needed a larger amount of food. Although this might reduce the discomfort slightly, negative feelings are likely to still predominate the positive feelings (Festinger, 1957). Even when a person does not care whether he or she eats more than usual, negative feelings might arise from uneasy physical sensations in their stomach after overeating (feeling too full). In both cases negative feelings seem to be dominant, resulting in the tendency to attribute their behaviour externally, as participants did in the study of Vartanian, Reily, Spanos, Herman, et al. (2017).

As individuals tend to focus more on the internal factors (e.g. hunger) than external factors (e.g. portion size) when explaining their eating behaviour (Cavanagh et al., 2014; Vartanian, Reily, Spanos, Herman, et al., 2017; Vartanian, Spanos, et al., 2017; Wansink & Sobal, 2007), it is unlikely that even when individuals believe they had eaten more, this behaviour will only be explained by external factors. Indeed, Vartanian et al. (2008) found that the more people ate, the higher the reported influence of both internal (i.e. hunger) and external (i.e. the amount of food available) factors on their food intake. Therefore, both internal and external attribution is expected to increase when perceived intake is increasing.

### *2.5 Differences in types of food*

In the study of Vartanian, Reily, Spanos, Herman, et al. (2017) the attributions for food intake were measured for pasta. Although pasta does not have a very specific image in terms of healthiness, it is relatively calorie-dense. Therefore it might be that after eating more pasta than usual, feelings of guilt or uneasy sensations in the stomach are stronger than positive feelings of feeling satiated. This resulted in an external attribution (portion size) when asking why the participants had eaten more than usual (Vartanian, Reily, Spanos, Herman, et al., 2017).

However, the effect might be stronger or weaker for foods that are perceived as healthy versus unhealthy as their image is different. Several studies have examined the perception of unhealthy foods and found that they are associated with pleasure, fun, enjoyment and satisfaction (Chapman & Maclean, 1993; Harrison & Jackson, 2009), but also with weight gain, guilt, negative emotions, contempt and fear (Burnett & Lunsford, 1994; Chapman & Maclean, 1993; Desmet & Schifferstein, 2008; Harrison & Jackson, 2009; Rousset et al., 2005). Healthy foods on the other hand, are primarily associated with weight loss, positive emotions and feeling happy, relaxed and stress free (Chapman & Maclean, 1993; Desmet & Schifferstein, 2008; Harrison & Jackson, 2009). After eating healthy foods, negative feelings might therefore remain absent because of the positive characteristics of and associations with this food. When this healthy food is also low in caloric value, probably no fear of gaining weight exists, making eating this food favourable for those concerned about their weight. Indeed, consumers eat on average 35% more when the food is seen as healthy and therefore more appropriate to eat (Provencher, Polivy, & Herman, 2009). Correspondingly, consumers' estimates of appropriate portion sizes are significantly larger when the food is perceived as healthy (Faulkner et al., 2014). Therefore, healthy foods might result in less negative feelings compared to unhealthy foods, decreasing the extent to which this behaviour is attributed externally (Kelley & Michaela, 1980).

Although unhealthy foods might evoke pleasurable associations at first, after these foods the negative aspects might become more visible and predominate the positive ones. After eating a portion of unhealthy foods, negative feelings like guilt could appear. Especially among restraint eaters, feelings of guilt can dominate after eating unhealthy foods (Wardle et al., 1992). However, feelings of guilt are

not reserved for restraint eaters, also unrestraint eaters can feel guilty after eating unhealthy foods (Steenhuis, 2009; Wardle et al., 1992), resulting in increased external attribution for unhealthy foods.

Even though external attributions for healthy versus unhealthy foods are expected to differ, as eating healthy foods decrease external attribution and unhealthy foods increase external attribution, this does not have to be the case for internal attribution. This is due to the fact that internal attributions might increase for healthy foods, but will not decrease for unhealthy foods as people use internal cues more than external cues to explain their food intake (Cavanagh et al., 2014; Vartanian, Reily, Spanos, Herman, et al., 2017; Vartanian, Spanos, et al., 2017; Wansink & Sobal, 2007).

## 2.6 Eating more of healthy versus unhealthy foods

As perceived food intake (eating more, the same or less) and healthiness of the food are both argued to have an effect on external attribution, combining these two factors could reinforce this effect. As feelings of guilt significantly increased after overeating (compared to undereating or eating the same) when testing this among women (Ruddock & Hardman, 2018), overeating of unhealthy foods could increase negative feelings. Furthermore, negative feelings could arise after eating more than usual of unhealthy foods due to uneasy feelings in the stomach, resulting in increased external attribution. For healthy foods, eating more than usual could increase positive feelings (pride) because they ate more of healthy foods, and/or evoke negative feelings because of the negative feelings of overeating (uneasy feelings in the stomach, guilt of eating too much). However, as consumers eat on average 35% more when the food is healthy and therefore more appropriate to eat (Provencher et al., 2009), it is likely that overeating of healthy foods will evoke significantly less negative feelings compared to eating more of unhealthy foods, resulting in decreased external attribution compared to unhealthy foods.

## 2.7 Conceptual framework

In summary, this chapter described how external cues like portion size affect our food intake and sometimes overrule our internal appetite control system. Although people eat significantly more when given a larger portion, they often do not seem to realize it and do not acknowledge the impact of the external cue on their food intake. However, when individuals are aware of the fact that they have consumed more than usual and served a larger portion, they do acknowledge that their eating behaviour was affected by portion size (Vartanian, Reily, Spanos, Herman, et al., 2017). This could be due to the fact that people tend to attribute behaviour that could reflect negatively on themselves (eating more) to external cues like portion size, while attributing positive behaviour to internal cues (e.g. hunger levels). As individuals are however inclined to attribute eating behaviour internally, increased perceived food intake is expected to also increase internal attribution. Moreover, there could be a difference in the perceived acceptability and negativity/positivity of eating more of healthy versus unhealthy foods, due to the different characteristics or associations with these foods. As healthy foods are in general perceived as more positive, eating healthy foods is expected to decrease external attribution. On the other hand, eating unhealthy foods is expected to increase external attribution. Moreover, the combination of eating more and healthiness or unhealthiness of the food, is expected to reinforce these effects. To test the impact of the healthiness and perceived intake of the food on the attribution of the behaviour, the following hypotheses are formulated:

H1: Increased perceived intake *increases* external attribution.

H2: Increased perceived intake *increases* internal attribution.

H3: Increased unhealthiness of the food *increases* external attribution.

H4: Increased unhealthiness and increased perceived intake *increase* external attribution to a larger extent than unhealthiness of the food or increased perceived intake separately.

The theoretical findings and the hypotheses are summarized in the framework below.

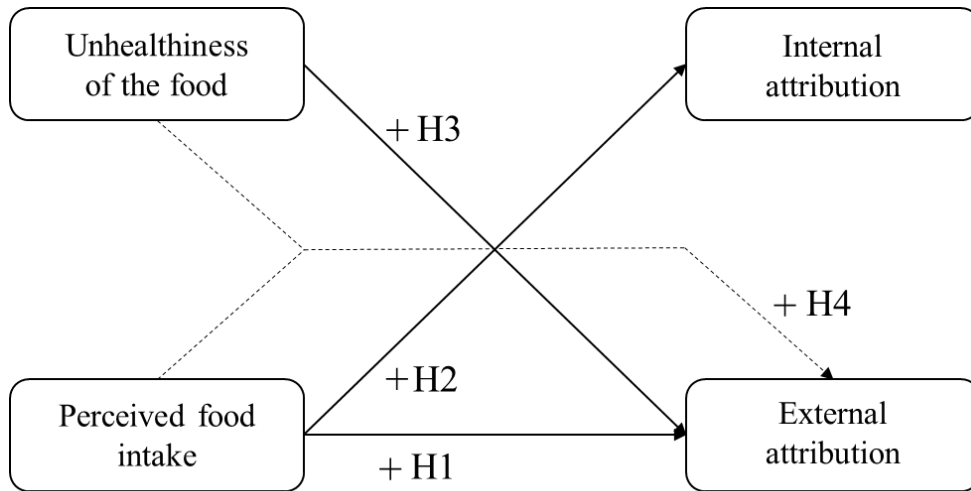


Figure 3. The conceptual model illustrating how healthiness of food and perceived food intake affects internal and external attribution.

To test these hypotheses, the current study examines attributions for perceived intake, similar to the study of Vartanian, Reily, Spanos, Herman, et al. (2017). Same as their study, only females are asked to participate. This is due to gender differences in eating behaviour (e.g. food choice, food intake) and feelings of guilt after eating (e.g. Rolls, Fedoroff & Guthrie, 1991; Beardsworth et al., 2002), making it hard to compare females and males. However, rather than using one external and one internal factor for attribution of perceived intake, 7 external and 7 internal factors are used to measure the influence of external versus internal factors on food intake.

In the study of Vartanian, Reily, Spanos, Herman, et al. (2017), the participants who had a higher perceived food intake and were in the large portion condition, rated the external cue ('the amount of food available') as more influential than did participants in any other group. Therefore, only large portions are used in this study. As studies have shown that also many individuals are not aware of the fact that they have eaten more than usual, a group of participants automatically ends up in the group that perceives to have eaten less or the same as usual. Moreover, participants receive either a healthy (cucumber) or unhealthy (sponge cake) food in this study to examine the influence of healthiness of the food on attributions, resulting in a healthy versus unhealthy between-subjects design. These two foods are selected because they are generally perceived as healthy versus unhealthy, they are low versus high in caloric density, easy to prepare and are foods that can be easily cut into one large piece.

## 3. Method

### 3.1 Participants

Participants were Dutch women ( $n = 191$ ) who were either students or women recruited through advertising (flyers, posters, emails). One participant was excluded because she received a second portion of the food, after she accidentally spoiled the first one. Two participants were excluded because they mentioned to never eat cucumber as a snack, which meant that they could not compare the amount they ate during the study to the amount that would normally eat. Some of the data of several participants was inconclusive or missing<sup>5</sup>, they were however included in the analysis as excluding these participants did not change the pattern of results. This resulted in a final sample of 188 participants with a mean age of 21.18 ( $SD = 2.57$ ).

### 3.2 Study design

A healthy versus unhealthy between-subjects design was used. Participants received a large portion of cucumber (200-231 grams,  $M = 216.2$  grams) or sponge cake (85-96 grams,  $M = 92.3$  grams). There are three intake evaluation categories ('ate less', 'ate the same' and 'ate more'), that were not manipulated; participants automatically ended up in one of those three conditions after evaluating their eating behaviour during the study.

### 3.3 Pre-test of portion sizes

The portion sizes of the cake and cucumber were determined by a pre-test among ten individuals of similar demographics as the main study. In this pre-test, participants were given an almost whole cucumber or sponge cake (the edge was sliced off on one side to make it easier for the indication and measuring of the portion) and were asked to indicate what they thought would be a large portion of cucumber and sponge cake. They were given a knife and asked to lower the back of the knife at the point where they would cut the cucumber/sponge cake for a large portion, without actually cutting it or making any incisions. Avoiding incisions or cuts enabled reusing the cucumber and sponge cake; making sure every participant saw a cucumber and sponge cake that was exactly the same size. The size of the portion indicated by the participant was then determined by using a ruler to measure the length of the portion of cucumber and the thickness of the slice of sponge cake. A piece of 20 centimetre of cucumber/sponge cake was weighted and used to determine the weight per millimetre. Consequently, the weight per millimetre of this cucumber and sponge cake was used to calculate the corresponding weight for the indications of the participants<sup>6</sup>. The average of these indications (90 grams for sponge cake, 226 grams for cucumber) was used to determine the approximate weight of the portions in the main study<sup>7</sup>. The results of the pre-test are included in appendix 1.

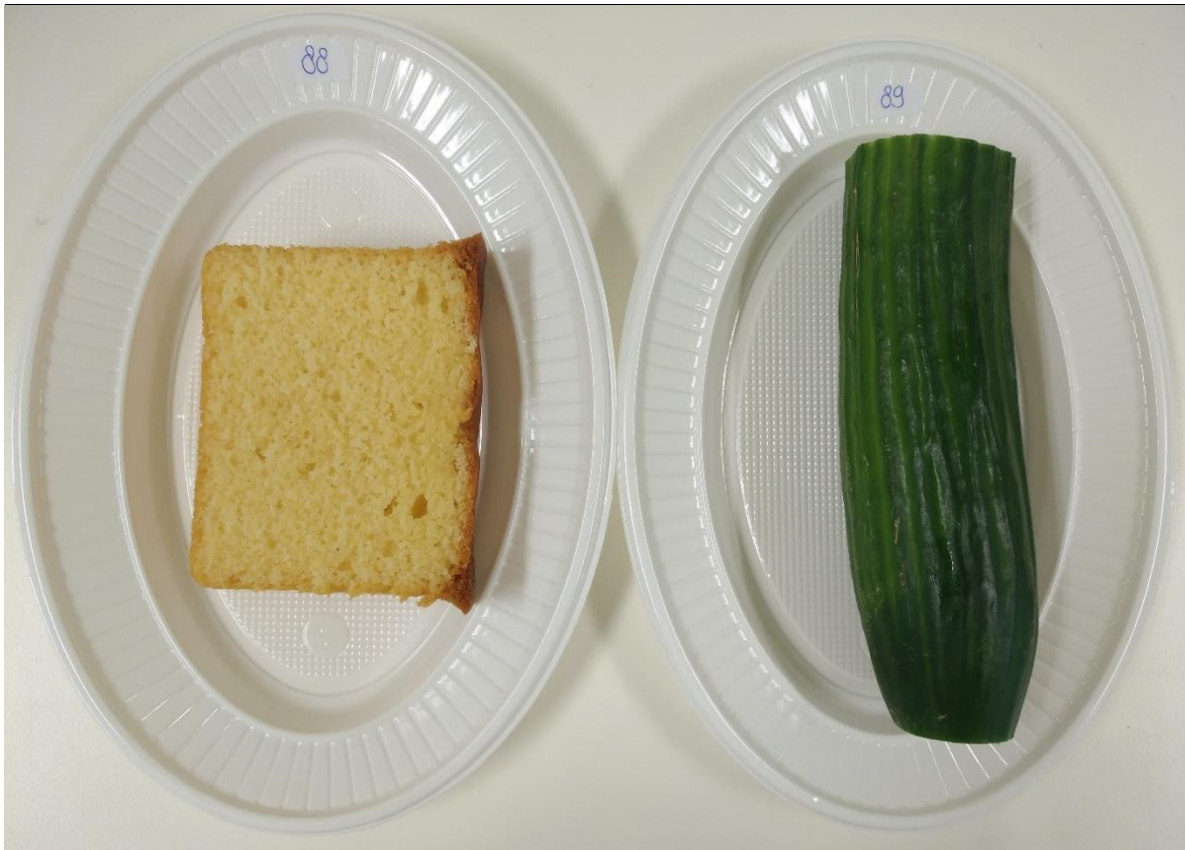
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<sup>5</sup> The answer to the question when they had last eaten was inconclusive for 8 participants. For one participant the measurement of how much she had eaten was missing.

<sup>6</sup> Two participants indicated that the whole cucumber would be a large portion for them. In that case, the weight of the portion was determined by the weight of the whole cucumber (and not based on calculation).

<sup>7</sup> Note that the eventual weight for cucumber was in general a bit lower during the main study. As cucumbers are often not heavier than 420-450 grams in total, portions were slightly smaller to be able to use one cucumber for two portions and avoid food waste.





### *3.4 Experimental procedure*

The study took place in the sensory lab on campus, in a time span of three consecutive days between 10 AM and 5 PM. The whole experimental procedure was similar to the one used in the study of Vartanian, Reily, Spanos, Herman, et al. (2017), except for the fact that only one portion condition (large portion) and two types of foods (cucumber versus sponge cake) were presented instead of a pasta lunch. Furthermore, all questions were asked in Dutch as only Dutch participants participated in this study. English translations of the questions are presented in this chapter.

Upon arrival, participants were asked whether they have any allergies or intolerances and whether they have a problem with eating cucumber or sponge cake, depending on the condition they were in. They signed informed consent and were asked how often they consumed cucumber or sponge cake as a snack. This question was asked to make sure they consumed it at least once and could compare their intake with their usual intake and to be able to check whether there were any group differences in consumption frequency of cucumber and sponge cake. After that, they were asked to write down the time when they had last eaten and rate their hunger and fullness levels in an online questionnaire on a computer (see Appendix 2 for the questionnaires). As cover story, participants were told that we were interested in the sensory specific satiety (decline in pleasantness) of foods and that it was therefore important that they would eat as much as they liked and rate the first and last bite on sensory properties of the food (e.g. sweetness and texture), liking and taste. Each participant was then provided with a large portion of cucumber and sponge cake. Portions were prepared maximum one hour before participation in a separate room, to avoid dehydration of the food and to make sure every participant received a portion of cucumber or sponge cake that was equally appealing. Participants then tasted and rated the first bite of the food on sensory properties (e.g. sweetness, texture), liking and how good the food tasted. Ratings were measured by using a slider with 'not at all' and 'extremely' on the anchors. Thereafter, they were asked to eat as much of the food until they had eaten enough. Once they had eaten enough, they were

asked to call the researcher by pushing a button. The researcher then filled in the number of the participant (to match the amount of food they had eaten afterwards) and participants were left alone to make the ratings of the final bite of the food.<sup>8</sup>

After the tasting, participants re-rated their hunger and fullness levels and indicated whether they thought they had eaten more, the same or less than they would normally consume of cucumber versus sponge cake. Furthermore, participants rated the influence of 7 external and 7 internal factors on their food intake. Other questions about demographics, dietary restrained eating, intuitive eating and what they think the study was about were included in the questionnaire as well. Lastly, participants were thanked for their participation and chose a small gift as a reward for participation.

### 3.5 Measures

#### *Perceived food intake*

Perceived food intake was measured by asking participants to compare the amount of cucumber or sponge cake they ate with what they would normally eat when consuming cucumber or sponge cake (as a snack). Participants rated their intake on a scale from 1 (much less than I normally eat) to 5 (much more than I normally eat). Just like Vartanian, Reily, Spanos, Herman, et al. (2017), these ratings were used to form three intake evaluation categories (ate less than normal = 1 or 2, ate about the same =3, ate more than normal = 4 or 5).

#### *External and internal influences on food intake*

The influence of external and internal factors on food intake was measured by asking participants to rate the extent to which different factors influenced their food intake on a 9-point scale from -4 (made me eat less than I normally would) to +4 (made me eat more than I normally would). The influence of 14 different factors was measured, consisting of 7 internal factors and 7 external factors. These factors were selected because they are argued to be either external or internal and made sense in the context of the sensory research. The order in which the factors were presented was randomized for each participant.

The external factors consisted of:

- The difficulty of the task
- The amount of food available
- The surroundings in which I ate
- What was expected of me
- The time of the day
- Presence of the researcher
- Presence/absence of other participants

The internal factors consisted of:

- Whether I was in the mood for the food
- My mood during the study
- The time I took to eat the food
- Whether I was in the mood for eating
- My self-control to eat until I had eaten enough
- How hungry I was
- How full I was

#### *Food intake*

Each participant in the study received a plate with a portion of cucumber or sponge cake and a plate number. Each portion of cucumber and sponge cake was weighted before serving and weight was written down matching the corresponding plate number. After the participant was finished with the study, the leftovers of the food were weighted again to calculate food intake (weight start minus weight end). As the participants had to call the researcher by pushing a button after they had eaten enough of the food, the researcher was able to fill in the correct plate number in the questionnaire. This was done to match

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<sup>8</sup> Some participants already ate the full portion of food before rating the last bite. However, as we were not interested in the sensory specific satiety of the foods, this was not taken into account during the data analyses.

participants' food intake with the questionnaire and to avoid mistakes when participants would fill in plate numbers themselves.

#### *Covariates*

To make sure groups were not different in their restrained or intuitive eating behaviour, an intuitive and a dietary restrained eating scale were included in the questionnaire.

#### Intuitive eating

Intuitive eating was measured using the six reflective items of the Multidimensional Internally Regulated Eating Scale (MIREs) (Palascha, van Kleef, de Vet, & van Trijp, in preparation).

1. I have a general tendency to eat in response to my internal hunger and satiety
2. In deciding about eating, I just follow what my body tells me
3. I don't make much of an issue out of my eating
4. I have a carefree eating style
5. I have a positive and relaxed relationship with food
6. I savour my food without any sabotaging thoughts

These items were translated to Dutch and were scored on a 7-point scale, ranging from 1 (completely untrue for me) up to 7 (completely true for me). Intuitive eating showed a moderate to high level of consistency as judged by Cronbach's alpha ( $\alpha = 0.750$ ).

#### Dietary restrained

Dietary restraint was measured by means of the Dutch Restrained Eating Scale (Van Strien, Frijters, Van Staveren, Defares, & Deurenberg, 1986).

1. When you have put on weight, do you eat less than you usually do?
2. Do you try to eat less at meal times than you would like to eat?
3. How often do you refuse food or drink offered because you are concerned about your weight?
4. Do you watch exactly what you eat?
5. Do you deliberately eat foods that are slimming?
6. When you have eaten too much, do you eat less than usual the following day?
7. Do you deliberately eat less in order not to become heavier?
8. How often do you try not to eat between meals because you are watching your weight?
9. How often in the evenings do you try not to eat because you are watching your weight?
10. Do you take into account your weight with what you eat?

Participants answered the questions on a 5-point scale (never, seldom, sometimes, often, very often). Dietary restrained showed a high level of consistency as judged by Cronbach's alpha ( $\alpha = 0.857$ ).

### *3.6 Data analysis*

The data was first explored by checking for outliers and normality of the dependent variable for each group of the independent variables and homogeneity of variances. For one variable (time since they had last eaten) data was non-normal and several outliers were visible when looking at the boxplot. Excluding these participants (time last eaten > 600 minutes ago), did not change the main pattern of results. Results are therefore presented including the outliers in the following chapter. Moreover, the assumption of homogeneity of covariance matrices was violated for both external and internal factors, as assessed by

Box's M test ( $p < 0.001$ ). As group sizes for intake evaluation were not equal because participants assessed this themselves (see table 4 in results for a detailed overview of group sizes), variances of the groups were checked. Larger groups had the least variance. Therefore, Pillai's criterion instead of Wilk's Lambda was used to evaluate multivariate significance. For three out of thirteen dependent variables<sup>9</sup>, the assumption homogeneity of variances was violated. As for most variables assumption of homogeneity was not violated and the main focus of the study were the multivariate tests, data was not transformed to correct for the unequal variances.

As a randomization check, 2 (snack type) x 3 (intake evaluation) ANOVA's were conducted to examine whether there were any differences between the experimental groups in age, how often they consumed the food, minutes since they had last eaten, scores on restrained and intuitive eating and ratings of initial hunger, fullness, liking of the food or how good the food tasted. P-values were only considered significant when they were  $< 0.05$  for all tests described in this paper<sup>10</sup>.

An ANOVA of intake evaluation on food intake was conducted to examine whether participants who indicated to have eaten the same as usual, ate more than the 'ate less' group and ate less than the 'ate more' group. This ANOVA was conducted for the cucumber and sponge cake group separately, because the amount of food presented in grams was very different and thus hard to compare.

As participants rated 7 different external and 7 internal factors during the study, the correlation of the internal factors and the correlation of the external factors was examined. A Pearson's correlation test showed that external factors were low to moderate positively correlated (see table 2). However, the correlation of one factor ('the difficulty of the task') was low for most factors. Therefore, this factor was deleted from the MANOVA for external factors. Another Pearson's correlation test showed that internal factors were moderate to high positively correlated (see table 3).

As most correlations for both internal and external factors were now moderate to high, two 2 (snack type) x 3 (intake evaluation) MANOVA's were conducted, one for all internal factors and one for all external factors. According to hypothesis 1, the MANOVA on external factors would show a main effect of intake evaluation, in which the influence of external factors was expected to be highest in the 'ate more' group, followed by the 'ate the same' group and lowest in the 'ate less group'. Another main effect of snack type was expected, where external ratings for food intake would be higher for the sponge cake compared to the cucumber group (H3). Moreover, according to hypothesis 4, the analysis would show an interaction effect of 'intake evaluation' and 'snack type', where participants in the intake evaluation group 'ate more' that were also in the sponge cake condition, would report higher ratings of influence of external factors than participants in the 'ate more' cucumber condition. No interaction effect between the 'ate less' and 'ate the same' groups and 'snack type' would exist.

The MANOVA on internal factors was expected to show a main effect of intake evaluation, in which the influence of internal factors was expected to be highest in the 'ate more' group, followed by the 'ate the same' group and lowest in the 'ate less group' (H2). No main effect of snack type and interaction effect were expected for internal factors.

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<sup>9</sup> The assumption of homogeneity of variances was violated for the external variable 'Presence/absence of other participants' ( $p = 0.01$ ) and the internal factors 'my mood during the study' ( $p < 0.001$ ) and 'my self-control to eat until I had eaten enough' ( $p = 0.01$ )

<sup>10</sup> Except for the Box's M test, which is only considered significant when  $p < 0.001$ .

Table 2. Pearson's correlations for external factors

		The difficulty of the task	The amount of food available	The surroundings in which I ate	What was expected of me	The time of the day	Presence of the researcher	Presence/absence of other participants
The difficulty of the task	Correlation	1	-	-	-	-	-	-
	P-value							
The amount of food available	Correlation	0.139	1	-	-	-	-	-
	P-value	0.057						
The surroundings in which I ate	Correlation	0.247	0.232	1	-	-	-	-
	P-value	0.001	0.001					
What was expected of me	Correlation	0.103	0.348	0.324	1	-	-	-
	P-value	0.161	0.000	0.000				
The time of the day	Correlation	0.048	0.425	0.199	0.182	1	-	-
	P-value	0.512	0.000	0.006	0.012			
Presence of the researcher	Correlation	0.162	0.159	0.339	0.173	0.058	1	-
	P-value	0.026	0.029	0.000	0.018	0.427		
Presence/absence of other participants	Correlation	0.041	0.197	0.337	0.150	0.115	0.228	1
	P-value	0.573	0.007	0.000	0.040	0.117	0.002	

Table 3. Pearson's correlations for internal factors

		Whether I was in the mood for the food	How full I was	My mood during the study	The time I took to eat the food	Whether I was in the mood for eating	My self-control to eat until I had eaten enough	How hungry I was
Whether I was in the mood for the food	Correlation	1	-	-	-	-	-	-
	P-value							
How full I was	Correlation	0.414	1	-	-	-	-	-
	P-value	0.000						
My mood during the study	Correlation	0.336	0.255	1	-	-	-	-
	P-value	0.000	0.000					
The time I took to eat the food	Correlation	0.407	0.298	0.227	1	-	-	-
	P-value	0.000	0.000	0.002				
Whether I was in the mood for eating	Correlation	0.568	0.717	0.356	0.290	1	-	-
	P-value	0.000	0.000	0.000	0.000			
My self-control to eat until I had eaten enough	Correlation	0.389	0.305	0.374	0.443	0.408	1	-
	P-value	0.000	0.000	0.000	0.000	0.000		
How hungry I was	Correlation	0.446	0.855	0.298	0.233	0.759	0.324	1
	P-value	0.000	0.000	0.000	0.001	0.000	0.000	

## 4. Results

### 4.1 Preliminary analyses

First of all, group sizes of intake evaluation and snack type were assessed. Although participants in the cucumber condition were rather equally distributed across intake conditions, this was not the case for the sponge cake condition (see table 4). Furthermore, a 2 (snack type) x 3 (intake evaluation) ANOVA's on age, consumption frequency, minutes since participants had last eaten, scores on restrained and intuitive eating and ratings of pre- and post-meal hunger and fullness, liking of the food or how good the food tasted did not reveal any interaction effects ( $F_s < 1.61, p > 0.20$ ). It did however reveal one main effect of snack type on how often they consumed the food  $F(1, 182) = 34.62, p < 0.001$ , partial  $\eta^2 = 0.16$ , where participants consumed sponge cake ( $M = 2.60$ ) more often than cucumber ( $M = 1.75$ ). No other main effects of snack type were found ( $F_s < 3.23, p > 0.07$ ). Also, one main effect of intake evaluation was found for how tasty the food was,  $F(2, 182) = 3.27, p = 0.04$ , partial  $\eta^2 = 0.04$ , where participants in the 'ate less' group rated the food as significantly less tasty than in the 'ate the same' groups. The other groups did not significantly differ ( $p_s > 0.14$ ). No other main effects of intake evaluation were found ( $F_s < 2.56, p > 0.08$ ). Correcting for consumption frequency and tastiness of the food did not change the pattern of results.

Table 4. Frequencies and percentages of participants in each intake evaluation category, separate for snack type conditions

Snack type	Intake evaluation category		
	Less than usual (%)	About the same (%)	More than usual (%)
Cucumber	20 (21.5)	37 (39.8)	36 (38.7)
Sponge cake	10 (10.5)	27 (28.4)	58 (61.1)
Total	30 (16.0)	64 (34.0)	94 (50.0)

### 4.2 Food intake

Participants consumed on average 125.4 ( $SD = 58.3$ ) grams of cucumber and 75.5 ( $SD = 17.9$ ) grams of sponge cake. They completed on average 58.0% of the portion of cucumber opposed to 82.7% of the portion of sponge cake. An ANOVA of intake evaluation on food intake, showed no main effect of intake evaluation for cucumber,  $F(2, 89) = 2.76, p = 0.07$ , partial  $\eta^2 = 0.06$ , or for sponge cake,  $F(2, 92) = 0.73, p = 0.49$ , partial  $\eta^2 = 0.02$ . This indicates that even though intake evaluations of participants were different, their actual intake did not differ significantly (see figures 4 and 5).

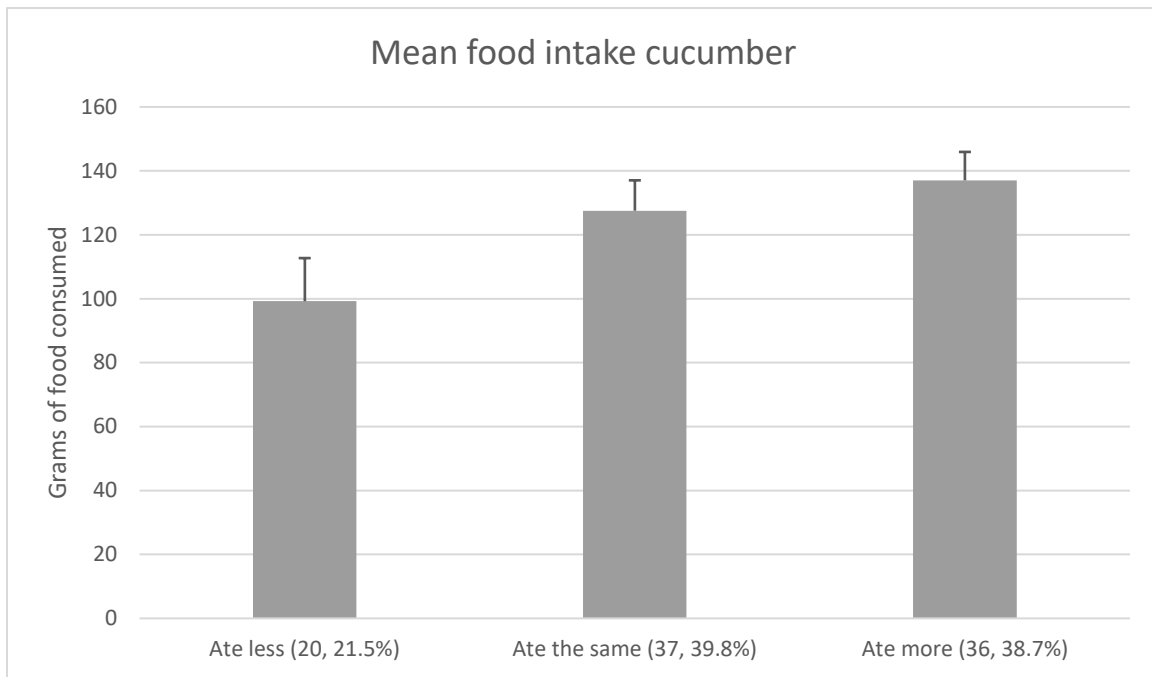


Figure 4. Mean food intake of cucumber by intake evaluation category. Error bars represent standard errors.

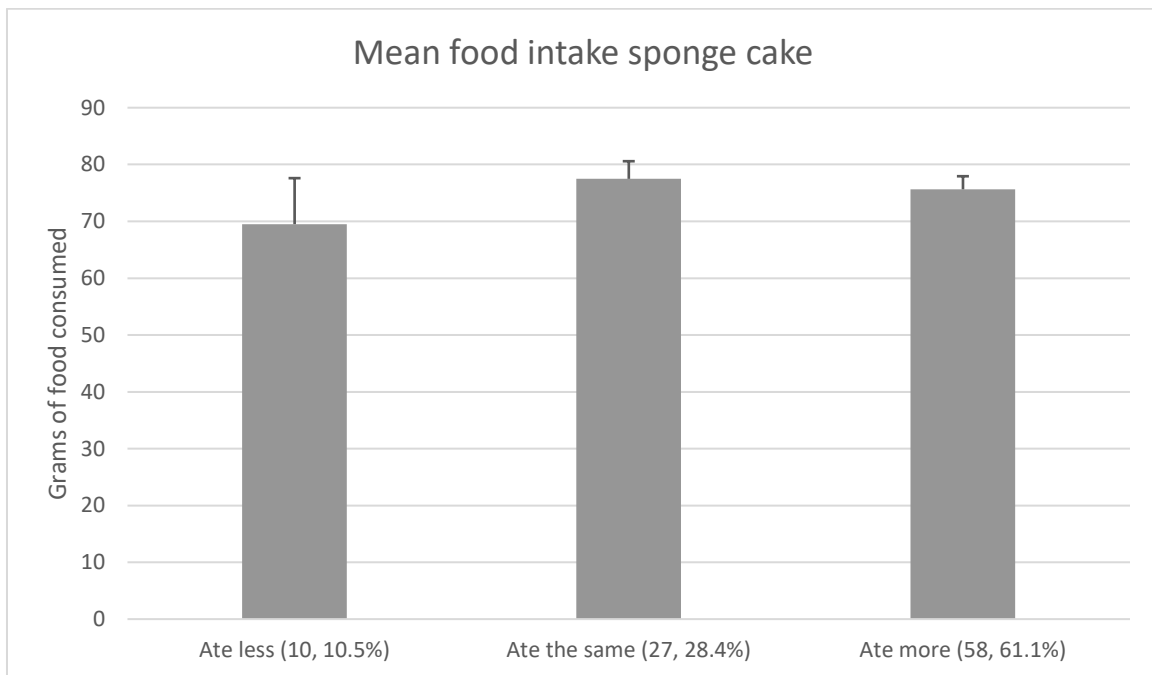


Figure 5. Mean food intake of sponge cake by intake evaluation category. Error bars represent standard errors.

### 4.3 Attributions for food intake

#### 4.3.1 External attributions for food intake

##### *External factor: interaction effects (H4)*

A 2 (snack type) x 3 (intake evaluation) MANOVA on external factors was conducted. In contrast to expectations, multivariate tests showed no interaction effect,  $F(12, 356) = 0.62, p = 0.83$ ; Pillai's Trace = 0.04; partial  $\eta^2 = 0.02$ . Moreover, tests of between subjects effect also did not show any interaction effects ( $F_s < 2.26, p > 0.10$ ) for each external factor separately. This means that hypothesis 4 is rejected; there is no evidence that increased unhealthiness and increased perceived intake increase external attribution to a larger extent than unhealthiness of the food or increased perceived intake (separately).

##### *External factor: main effect snack type (H3)*

Multivariate tests revealed a main effect of snack type on ratings of external factors,  $F(6, 177) = 2.49, p = 0.02$ ; Pillai's Trace = 0.78; partial  $\eta^2 = 0.08$ . When calculating mean scores for all external factors together, the mean for cucumber ( $M = 0.14$ ) is lower than the mean of sponge cake ( $M = 0.57$ ) (see table 5). Therefore, the ratings of influence of external factors are higher in the sponge cake compared to cucumber conditions; hypothesis 3 is confirmed.

Table 5. Means and standard deviations for each external factor

	<i>Snack type</i>		<i>Intake evaluation</i>		
	<i>Cucumber</i>	<i>Sponge cake</i>	<i>Ate less</i>	<i>Ate the same</i>	<i>Ate more</i>
<i>External factor</i>	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
The amount of food available	0.92 (1.68)	2.01 (1.72)	-0.27 (1.76)	1.22 (1.58)	2.20 (1.47)
The surroundings in which I ate	-0.58 (1.33)	-0.18 (1.50)	-1.07 (1.60)	-0.55 (1.36)	-0.04 (1.34)
The time of the day	0.46 (1.59)	1.06 (1.73)	-0.43 (1.43)	0.56 (1.67)	1.29 (1.54)
Presence/absence of other participants	-0.26 (0.85)	0.13 (.90)	-0.23 (0.57)	-0.31 (0.75)	0.16 (1.01)
Presence of the researcher	-0.11 (0.56)	0.02 (1.02)	-0.07 (0.98)	-0.11 (0.80)	0.01 (0.80)
What was expected of me	0.49 (1.17)	0.72 (1.39)	0.10 (1.06)	0.67 (1.22)	0.94 (1.37)
<b>Total</b>	<b>0.14 (0.65)</b>	<b>0.57 (0.60)</b>	<b>-0.28 (0.72)</b>	<b>0.21 (0.54)</b>	<b>0.66 (0.64)</b>

Tests of between subjects effects also showed one main effect of snack type on 'amount of food available' when analysing external factors separately (see table 6). Pairwise comparisons indicated that ratings of to what extent (negative versus positive) participants were influenced by the 'amount of food available', were higher for the sponge cake group ( $M = 2.01$ ) compared to the cucumber group ( $M = 0.94$ ).



*External factors: main effects intake evaluation (H1)*

Multivariate tests also revealed an overall main effect of intake evaluation,  $F(12, 356) = 4.88, p < 0.001$ ; Pillai's Trace = 0.28; partial  $\eta^2 = 0.14$ . Comparing the total mean scores of external attribution of the 'ate less', 'ate the same' and 'ate more' groups (see table 5), shows that 'ate less' participants provided the lowest ratings of the influence of external factors, followed by the 'ate the same' group and lastly the 'ate more' group. Although we cannot be sure which groups exactly differ significantly from one another, ratings of influence seem to be increasing when food intake increases; hypothesis 1 seems to be confirmed.

Also when analysing external factors separately, almost all external factors show a main effect of intake evaluation (see table 6). Not all intake evaluation groups differ significantly from one another. However, for the intake evaluation groups that do differ significantly from one another, ratings of influence increase when food intake evaluation increases; in line with hypothesis 1 (see appendix 3 for the results of the post hoc tests for each external factor).

Table 6. Main effects snack type and intake evaluation for each external factor

<i>External factor</i>	<i>Main effect snack type</i>			<i>Main effect intake evaluation</i>		
	<i>F</i>	$\eta^2$	<i>p</i>	<i>F</i>	$\eta^2$	<i>p</i>
The amount of food available	10.77	0.06	<b>0.001</b>	22.71	0.20	<b>&lt; 0.001</b>
The surroundings in which I ate	2.14	0.01	0.15	4.95	0.05	<b>0.01</b>
The time of the day	2.47	0.01	0.12	10.63	0.11	<b>&lt; 0.001</b>
Presence/absence of other participants	3.76	0.02	0.05	4.49	0.05	<b>0.01</b>
Presence of the researcher	3.22	0.02	0.07	0.49	0.01	0.62
What was expected of me	2.69	0.02	0.10	3.35	0.04	<b>0.04</b>

*4.3.2 Internal attributions for food intake*

*Internal attributions: interaction effects*

A 2 (snack type) x 3 (intake evaluation) MANOVA on internal factors was conducted. As expected, multivariate tests showed no interaction effect,  $F(14, 354) = 0.58, p = 0.88$ ; Pillai's Trace = 0.05; partial  $\eta^2 = 0.02$ . Analysing all internal factors separately using tests of between subjects effects also showed no interaction effects ( $F_s < 1.19, p > 0.30$ ).

*Internal attributions: main effect snack type*

As expected, multivariate tests showed no overall main effect of snack type,  $F(7, 176) = 1.59, p = 0.14$ ; Pillai's Trace = 0.06; partial  $\eta^2 = 0.06$ . However, tests of between subjects revealed one main effect of snack type on 'my mood during the research' (see table 8). Comparing the mean of 'my mood during the research' of cucumber ( $M = 0.08$ ) and sponge cake ( $M = 0.60$ ), showed that participants indicated that mood was significantly more important for eating more of sponge cake than cucumber.

Table 7. Means and standard deviations for each internal factor

	<i>Snack type</i>		<i>Intake evaluation</i>		
	<i>Cucumber</i>	<i>Sponge cake</i>	<i>Ate less</i>	<i>Ate the same</i>	<i>Ate more</i>
<i>Internal factor</i>	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
My mood during the study	0.08 (0.63)	0.60 (1.09)	0.03 (0.77)	0.30 (0.75)	0.47 (1.05)
Whether I was in the mood for the food	0.62 (1.79)	1.19 (1.45)	-0.57 (1.81)	1.02 (1.50)	1.31 (1.43)
How hungry I was	0.56 (1.91)	1.19 (1.92)	-0.93 (1.96)	0.89 (1.83)	1.45 (1.64)
The time I took to eat the food	-0.12 (1.67)	0.00 (1.42)	-0.87 (1.28)	-0.20 (1.73)	0.30 (1.39)
Whether I was in the mood for eating	0.77 (1.70)	1.26 (1.64)	-0.53 (1.80)	1.00 (1.60)	1.53 (1.38)
My self-control to eat until I had eaten enough	0.16 (1.10)	0.38 (1.35)	-0.43 (1.10)	0.23 (1.04)	0.52 (1.31)
How full I was	0.30 (1.86)	0.75 (1.85)	-0.77 (1.96)	0.45 (1.67)	0.99 (1.78)
<b>Total</b>	<b>0.34 (1.09)</b>	<b>0.77 (1.12)</b>	<b>-0.58 (0.92)</b>	<b>0.53 (0.98)</b>	<b>0.94 (1.03)</b>

*Internal attributions: main effect intake evaluation (H2)*

Multivariate tests revealed an overall main effect of intake evaluation,  $F(14, 354) = 3.63, p < 0.001$ ; Pillai's Trace = 0.25; partial  $\eta^2 = 0.13$ . Comparing the total mean scores of internal attribution of the 'ate less', 'ate the same' and 'ate more' groups (see table 7), shows that 'ate less' participants provided the lowest ratings of the influence of internal factors, followed by the 'ate the same' group and lastly the 'ate more' group. Although we cannot be sure which groups exactly differ significantly from one another, ratings of influence seem to be increasing when food intake increases; hypothesis 2 seems to be confirmed.

Also, tests of between subjects revealed a significant main effect of intake evaluation for all internal factors separately, except for 'my mood during the study' (see table 8). Not all intake evaluation groups differ significantly from one another. However, for the intake evaluation groups that do differ significantly from one another, ratings of internal influence increase when food intake evaluation increases; in line with hypothesis 2 (see appendix 3 for the results of the post hoc tests for each internal factor).

Table 8. Main effects snack type and intake evaluation for each internal factor

<i>Internal factor</i>	<i>Main effect snack type</i>			<i>Main effect intake evaluation</i>		
	<i>F</i>	$\eta^2$	<i>p</i>	<i>F</i>	$\eta^2$	<i>p</i>
My mood during the study	7.36	0.04	<b>0.01</b>	1.70	0.02	0.19
Whether I was in the mood for the food	2.19	0.01	0.14	13.70	0.13	< <b>0.001</b>
How hungry I was	1.46	0.01	0.23	16.25	0.15	< <b>0.001</b>
The time I took to eat the food	0.27	0.001	0.61	7.19	0.07	<b>0.001</b>
Whether I was in the mood for eating	1.54	0.01	0.22	15.89	0.15	< <b>0.001</b>
My self-control to eat until I had eaten enough	0.09	0.001	0.76	7.45	0.08	<b>0.001</b>
How full I was	0.69	0.004	0.41	8.67	0.09	< <b>0.001</b>

## 5. Conclusion and discussion

The aim of this study was to investigate how intake evaluation ('ate less', 'ate about the same' and 'ate more') and snack type (healthy versus unhealthy) influence participants' explanations for food intake. This was tested in a supposed sensory test, in which participants were told to eat until they had enough of a large portion of cucumber versus sponge cake. Participants were asked to compare the amount they ate with what they would normally eat as a snack using the following intake evaluations 'ate less', 'ate about the same', 'ate more' and to indicate the influence of seven internal (e.g. hunger, fullness) and seven external factors (e.g. portion size, surroundings) on their intake. The study showed that (when served a large portion of food) individuals are more inclined to attribute eating behaviour to external factors when this food is unhealthy. For attribution to internal factors, healthiness of the food had no effect. Furthermore, as perceived intake evaluation increased, attribution to external and internal factors also increased. Increased unhealthiness and increased food intake evaluation did not increase external attribution to a larger extent than did increased unhealthiness or increased food intake evaluation separately.

Consistent with expectations, individuals reported a higher influence of external factors when eating sponge cake compared to cucumber. It was argued that eating unhealthy foods evoke significantly more negative feelings (e.g. guilt) and less positive feelings compared to healthy foods. These negative feelings in turn increase external attribution, as individuals are looking for an excuse for their behaviour because their behaviour could reflect negatively on themselves. On the other hand, for internal factors this difference was expected to be absent as individuals generally use internal cues to explain their behaviour. Indeed, no main effect of snack type on internal factors was found. However, when looking at the separate analyses for internal factors, a main effect of snack type on the influence of 'my mood during the study', was observed, where ratings of influence were higher for sponge cake compared to cucumber. Many papers report influence of mood and/or emotions on eating behaviour (e.g. food choice) of individuals (e.g. Canetti, Bachar, & Berry, 2002; Lyman, 1982). This could explain why a main effect of snack type was observed for this internal factor, while it was absent for all other internal factors.

Although ratings of the influence of external and internal factors increased as intake evaluation was higher, it remained unclear for which groups ('ate less', 'ate the same', 'ate more') this difference was significant. This was due to the inability of conducting post hoc tests for the multivariate tests. When analysing the external and internal factors separately, not all intake evaluation groups differed significantly from one another. However, for the ones that did differ significantly, ratings of influence were higher as perceived intake increased, indicating that the direction of the difference was consistent with the hypothesis for all factors.

Also, no interaction effect of snack type and perceived intake evaluation was observed. This effect was expected as eating more of an unhealthy food (sponge cake) was expected to increase negative feelings due to overeating and eating unhealthy. On the other hand, eating more of a healthy food could evoke positive feelings due to eating healthy and negative or positive feelings for overeating (e.g. uneasy sensations in the stomach versus pride). However, this difference appeared not to be strong enough to evoke an interaction effect between snack type and perceived food intake.

There are however some limitations of this study that should be taken into account. First of all, this study measured, but did not manipulate the extent to which participants thought had eaten more than usual. This was done to keep the study relatively simple and natural (only manipulating one variable) and to prevent literally asking the impact of several external factors that were manipulated. Moreover, manipulating more variables could have decreased the credibility of the cover story. However, not manipulating intake evaluation resulted in unequal intake evaluation groups for both cucumber and sponge cake. Especially the 'ate more' sponge cake group was larger than the others. This could have affected results in a way that the difference in attribution was not only due to snack type, but also due

to the differences in manipulation groups. However, then the expectation would be that internal attributions differed for snack type as well, but this was not the case. Therefore, it is assumed that the difference in size of groups may have reinforced, but not caused the effect of snack type on external attribution. On the other hand, the differences in group sizes might have also negatively affected the disclosure of an interaction effect between snack type and intake evaluation, as a larger group that accounts for the differences in snack type, will also contribute to differences in intake evaluation. Second, this study did not measure positive or negative feelings after eating (feelings of guilt, shame, pride, negative sensations in the stomach, self-evaluations), while these were argued to explain the relationships between healthiness of the food or food intake evaluation and attributions. Although this study provides evidence for the relationship between those variables, it does not demonstrate how these relationships are established. Third, although correlations for internal variables were all moderate to high, some correlations between external factors were quite low. This could be due to the tendency to explain eating behaviour using internal factors rather than external factors (Cavanagh et al., 2014; Vartanian, Reily, Spanos, Herman, et al., 2017; Vartanian, Spanos, et al., 2017; Wansink & Sobal, 2007), which could have made differences in attribution to internal factors smaller. However, trying to increase correlation by conducting a pre-test to see which external factors are used to a larger extent to explain behaviour than others might be problematic. This is due to the fact that external variables depend a lot more on situational factors than internal factors which means that for each study (and situation) the outcomes can be very different.

Overall, this study provides evidence for the relationship between healthiness of the food and perceived intake on attributions for food intake. In contrast to the study of Vartanian, Reily, Spanos, Herman, et al. (2017) that measured the influence of one external and one internal variable, this study took several internal and external factors and measured their reported influence together. This was done to make sure differences in attribution were really due to either internal or external factors, increasing the reliability of the outcome. It therefore enlarges the body of evidence that external and internal factors are used to explain food intake to a larger extent when eating more than usual. Moreover, this study assessed food intake evaluation as well as snack type. It therefore also provided preliminary evidence for the fact that not only food intake evaluation, but also the healthiness of food can affect attribution; external attribution increases when the food is unhealthy.

Future research is needed to address questions that remained unanswered by this research. First of all, this study did not examine the cause of the relationship between intake evaluation or snack type and attribution, although it was argued that it could be due to negative or positive feelings after eating. Adding questions about feelings of e.g. guilt, pride, positive/negative emotions and importance to stick to their normal consumption pattern, could provide clearance to how these variables have an impact on attribution. Furthermore, this study was conducted using snacks to create an unhealthy and healthy condition. As snacks are more an addition to, rather than a replacement of daily eating behaviour, the pattern of results might be different for whole meals. Third, conducting this study among groups with different demographics might give different results. This study was conducted among female students, however, when conducting this study among for example male students different results could be observed due to differences in eating behaviour and feelings of guilt after eating (e.g. Rolls, Fedoroff & Guthrie, 1991; Beardsworth et al., 2002). Lastly, possibilities of using the findings of this study in practice should be examined. These could include for example testing the efficacy of strategies like shifting the focus back from external to internal cues before the start of an eating episode by mindfulness exercises, to decrease external attribution and (perceived) overeating. Future research is needed to address these topics and better understand how individuals attribute their eating behaviour and, importantly, how these findings could effectively be used in practice.

## 6. References

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## 7. Appendix 1: Results pre-test

Table 9. Size of large portions of cucumber versus sponge cake

<i>Participant</i>	<i>Age</i>	<i>Sponge cake (large portion)</i>			<i>Cucumber (large portion)</i>		
		<i>Cm</i>	<i>Gram</i>	<i>Kcal</i>	<i>Cm</i>	<i>Gram</i>	<i>Kcal</i>
1	23	2.8	89.88	330.76	28	394.80	55.27
2	24	2.5	80.25	295.32	15.5	218.55	30.60
3	21	2.5	80.25	295.32	7	98.70	13.82
4	23	3.7	118.77	437.074	18.5	260.85	36.52
5	23	2.8	89.88	330.76	28	394.8	55.27
6	23	2.6	83.46	307.13	16.5	232.65	32.57
7	23	2.9	93.09	342.57	12.7	179.07	25.07
8	22	3.5	112.35	413.45	12	169.20	23.69
9	21	2.4	77.04	283.51	15.5	218.55	30.597
10	23	2.2	70.62	259.88	7.2	101.52	14.21
<b>Average</b>	22.6	2.8	89.56	329.58	16.09	226.87	31.76

Nutritional value sponge cake: 368 kcal / 100 gram

Nutritional value cucumber: 14 kcal / 100 gram

## 8. Appendix 2: Questionnaires

### 8.1 Questionnaire manipulation group cucumber

---

#### Start of Block: Introductievragen

Q31 Beste deelnemer,

Alvast bedankt voor je deelname aan dit onderzoek. Deze vragenlijst zal gaan over sensorische eigenschappen van komkommer. Het invullen van de vragenlijst zal ongeveer 15 minuten duren. Er zijn geen foute antwoorden, wil je invullen wat er als eerste in je opkomt?

Als je geen komkommer lust of wilt eten kun je niet meedoen aan de studie. Je kunt je op elk moment tijdens het onderzoek terugtrekken van deelname zonder verdere gevolgen. Wageningen Universiteit garandeert dat je gegevens anoniem verwerkt worden en alleen voor onderzoeksdoeleinden gebruikt worden. Vragen kun je altijd stellen door op de knop onder het rode lampje te drukken of achteraf contact op te nemen met Houkje Adema (houkje.adema@wur.nl).

Door op het pijltje naar rechts te klikken geef je aan het bovenstaande te hebben gelezen en ermee instemt.

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Page Break

Q33 Lust je komkommer?

- Ja (1)
- Nee (2)

*Skip To: End of Survey If Lust je komkommer? = Nee*

Q57 Hoe vaak eet je komkommer als tussendoortje?

- Wekelijks (1)
- Maandelijks (2)
- 5 - 11 keer per jaar (3)
- 1 - 4 keer per jaar (4)
- Minder dan 1 keer per jaar (5)
- Nooit (6)

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Page Break

Q9 Hoe laat heb je voor het laatst iets gegeten? Vul een tijd in (.. : .. uur).

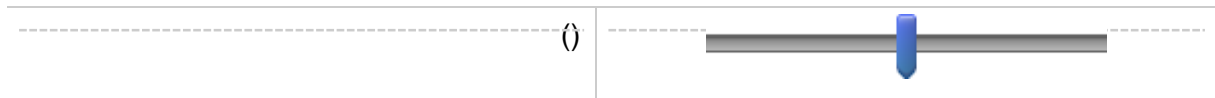
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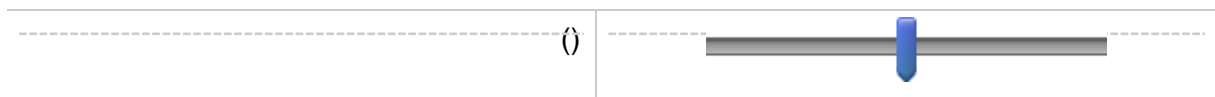
Q10 Hoe hongerig voel je je nu?

Helemaal niet hongerig      Heel erg hongerig



Q80 Hoe vol voel je je nu?

Helemaal niet vol      Heel erg vol



---

Page Break

Q8 Lees de volgende tekst alsjeblieft goed door!

Je krijgt straks een portie komkommer. In dit onderzoek willen we de sensorische

eigenschappen van komkommer op twee verschillende momenten meten: bij aanvang en aan het einde van het consumptiemoment.

Om de verschillen tussen de momenten goed te kunnen meten, vragen we je om de **eerste** hap én de **laatste** hap komkommer op verschillende sensorische eigenschappen te beoordelen. Tussen deze meetmomenten eet je zoveel komkommer tot je genoeg hebt gehad.

Om de komkommer van de onderzoeker te krijgen druk je op de knop onder het rode lampje (recht voor je), zodat het rode lampje gaat branden. Als je de komkommer hebt ontvangen, druk je op het pijltje naar rechts (in de vragenlijst) om te beginnen met het sensorische onderzoek.

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End of Block: Introductievragen

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Start of Block: Sensorische beoordeling

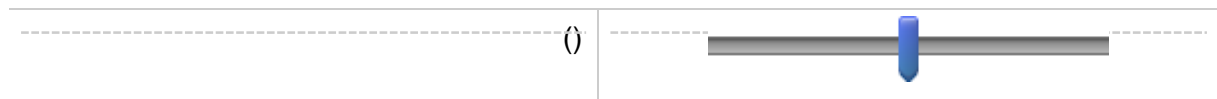
Q13 Neem nu een **eerste** hap van de komkommer en beoordeel deze door de vragen op deze pagina in te vullen.

---

Q73 Hoe zoet vind je de komkommer?

Helemaal niet zoet

Heel erg zoet

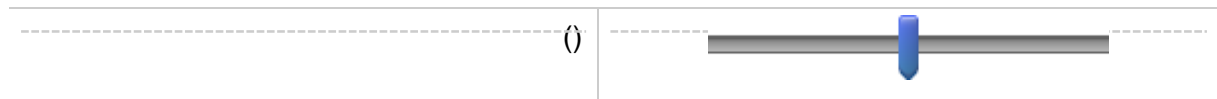


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Q74 Hoe bitter vind je de komkommer?

Helemaal niet bitter

Heel erg bitter



---

Q75 Hoe zuur vind je de komkommer?

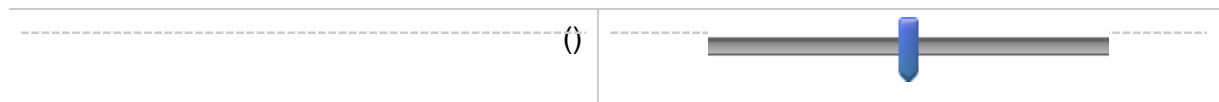
Helemaal niet zuur

Heel erg zuur



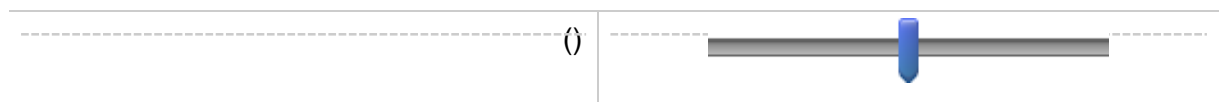
Q76 Hoe sappig vind je de komkommer?

Helemaal niet sappig Heel erg sappig



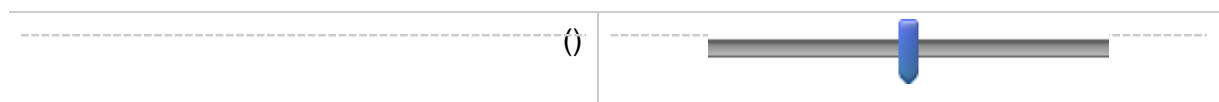
Q77 Hoe zacht of hard vind je de komkommer?

Heel erg zacht Heel erg hard



Q78 Hoe lekker vind je de komkommer?

Helemaal niet lekker Heel erg lekker



Q79 Wat is je algemene waardering van de komkommer?

Heel erg slecht Heel erg goed



Page Break

Q56 Eet nu zoveel komkommer tot je genoeg hebt gehad.

Dit is belangrijk omdat we geïnteresseerd zijn in de verschillen in waardering aan het **begin** en aan het **einde** van het consumptiemoment. Neem hier dus de tijd voor!

Als je genoeg hebt gegeten, druk dan op de knop voor je zodat het rode lampje gaat branden. De onderzoeker komt dan bij je zodat je verder kunt met het onderzoek.

Page Break



Q32 Vraag de onderzoeker om de volgende vraag in te vullen door op de knop te drukken onder het rode lampje. **Ga dus nog niet verder met de vragenlijst!**

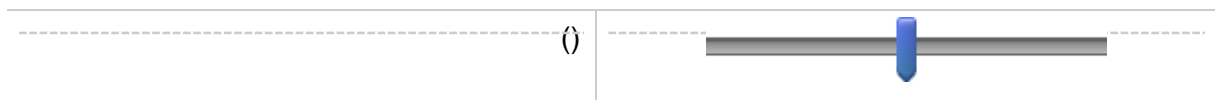
Page Break

Q27 Neem nu de **laatste** hap van de komkommer en beoordeel deze door de vragen op deze pagina in te vullen.

Q52 Hoe zoet vind je de komkommer?

Helemaal niet zoet

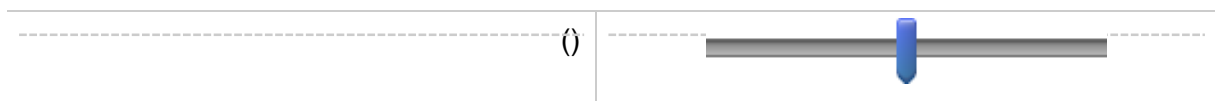
Heel erg zoet



Q67 Hoe bitter vind je de komkommer?

Helemaal niet bitter

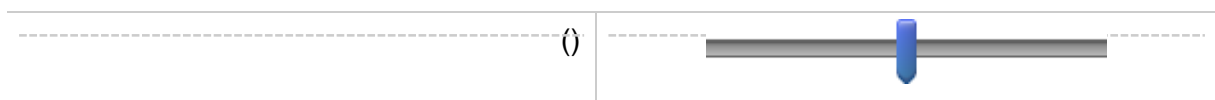
Heel erg bitter



Q68 Hoe zuur vind je de komkommer?

Helemaal niet zuur

Heel erg zuur



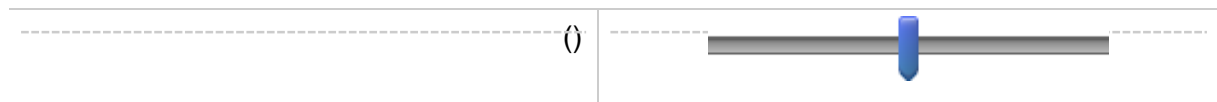
Q69 Hoe sappig vind je de komkommer?

Helemaal niet sappig Heel erg sappig



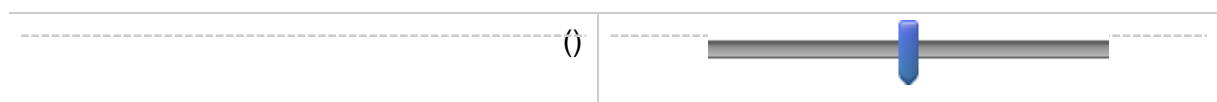
Q70 Hoe zacht of hard vind je de komkommer?

Heel erg zacht Heel erg hard



Q71 Hoe lekker vind je de komkommer?

Helemaal niet lekker Heel erg lekker



Q72 Wat is je algemene waardering van de komkommer?

Heel erg slecht Heel erg goed



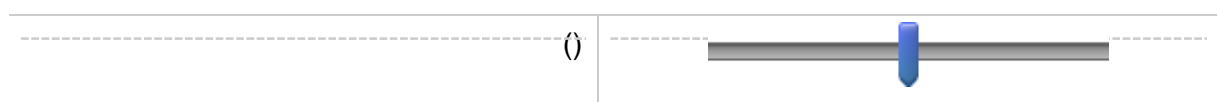
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End of Block: Sensorische beoordeling

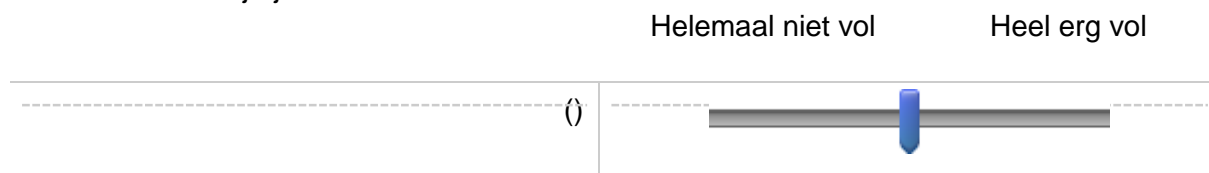
Start of Block: Ratings food intake and factors

Q81 Hoe hongerig voel je je nu?

Helemaal niet hongerig Heel erg hongerig



Q82 Hoe vol voel je je nu?



Page Break

---

Q34 Vergelijk de hoeveelheid komkommer die je tijdens dit **sensorische onderzoek** hebt gegeten met de hoeveelheid komkommer die je **normaal** zou eten (als je komkommer als tussendoortje eet).

Is de hoeveelheid komkommer die je in dit sensorische onderzoek hebt gegeten:

	Veel minder dan normaal (1)	(2)	Hetzelfde als normaal (3)	(4)	Veel meer dan normaal (5)
De hoeveelheid komkommer die ik tijdens dit onderzoek heb gegeten is... (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Page Break

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Q38 Vergelijk de hoeveelheid komkommer die je in dit **sensorische onderzoek** hebt gegeten met de hoeveelheid komkommer die je je had **voorgenomen** om te eten nadat je wist wat de opdracht was.

Is de hoeveelheid komkommer die je in dit sensorische onderzoek hebt gegeten:



	Veel kleiner dan ik me had voorgenomen (1)	(2)	Hetzelfde als ik me had voorgenomen (3)	(4)	Veel meer dan ik me had voorgenomen (5)	Niet van toepassing (6)
De hoeveelheid komkommer die ik tijdens dit onderzoek heb gegeten is... (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Q37 In hoeverre hebben de volgende factoren **invloed** gehad op de **hoeveelheid die je hebt gegeten** tijdens het sensorische onderzoek?

	Zorgde ervoor dat ik veel minder at dan normaal (1)	(2)	(3)	(4)	Had geen invloed op de hoeveelheid die ik at (5)	(6)	(7)	(8)	Zorgde ervoor dat ik veel meer at dan normaal (9)
Hoeveel zin ik had in komkommer (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Hoeveel  
honger ik had  
(2)

De  
moeilijkheid  
van de  
opdracht (3)

De  
hoeveelheid  
komkommer  
die ik kreeg  
(4)

De omgeving  
waarin ik de  
komkommer  
at (5)

Hoe vol ik was  
(6)

De tijd die ik  
nam om de  
komkommer  
te eten (7)

Mijn humeur  
tijdens het  
onderzoek (8)

Wat er van mij  
verwacht werd  
tijdens het  
onderzoek (9)

De aan- of  
afwezigheid  
van andere

deelnemers  
(10)

Hoeveel zin ik  
had om te  
eten (11)

Het tijdstip  
van het  
onderzoek  
(12)

De  
aanwezigheid  
van de  
onderzoeker  
(13)

Mijn  
zelfbeheersing  
tijdens het  
eten (14)

#### End of Block: Ratings food intake and factors

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#### Start of Block: Demographics en covariates

Q54 De volgende vragen gaan over voedingsgedrag. Geef aan in welke mate de volgende stellingen voor jou van toepassing zijn.

-----  
Q35 Wanneer je iets zwaarder bent geworden, eet je dan minder dan gewoonlijk?

- Nooit (1)
- Zelden (2)
- Soms (3)
- Vaak (4)
- Heel vaak (5)

---

Q39 Probeer je minder te eten tijdens maaltijden dan je eigenlijk zou willen?

- Nooit (1)
- Zelden (2)
- Soms (3)
- Vaak (4)
- Heel vaak (5)

---

Q40 Hoe vaak weiger je eten of drinken omdat je bang bent dat je zwaarder wordt?

- Nooit (1)
- Zelden (2)
- Soms (3)
- Vaak (4)
- Heel vaak (5)

---

Q41 Houd je exact bij wat je eet?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
-

Q42 Eet je opzettelijk producten waarvan je afvalt?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q43 Wanneer je teveel hebt gegeten, eet je dan de daarop volgende dagen minder?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q44 Eet je opzettelijk minder om te voorkomen dat je zwaarder wordt?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
-

Q45 Hoe vaak probeer je geen tussendoortjes te nemen omdat je op je gewicht let?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q46 Hoe vaak probeer je 's avonds niet te eten omdat je op je gewicht let?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q47 Hou je rekening met je gewicht wanneer je eet?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Page Break

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Q36 Ik heb de neiging om te eten als reactie op mijn interne signalen van honger/verzadiging

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
- 

Q44 Bij beslissingen over eten volg ik alleen wat mijn lichaam mij vertelt

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
-

Q45 Ik maak geen groot probleem rondom eten

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
- 

Q46 Ik heb een zorgeloze eetstijl

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
-



Q47 Ik heb een positieve en ontspannen relatie met eten

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
- 

Q48 Ik geniet van mijn eten zonder saboterende gedachten

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
- 

Page Break

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Q34 Wat is je leeftijd?

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Q37 Waar denk je dat dit onderzoek over ging?

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Q58 Als je nog opmerkingen hebt voor de onderzoekers, schrijf deze dan hieronder.

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Page Break

Q54 Aan Wageningen Universiteit worden vaker studies verricht waarvoor wij op zoek zijn naar deelnemers. Mogen wij je hiervoor af en toe (maximaal 1 keer per maand) benaderen per e-mail? Zo ja, schrijf hieronder je e-mailadres (alleen als je nog niet in bestand staat, niet-wur adres is ook oke):

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Page Break

Q56 Bedankt voor je bijdrage aan het onderzoek! Graag op de knop drukken onder het rode lampje zodat de onderzoeker weet dat je klaar bent. Daarna kun je je spullen pakken en op de gang wachten voor je bedankje:)  
Klik op het pijltje naar rechts om de vragenlijst te versturen.

**End of Block: Demographics en covariates**

---

Start of Block: Introductievragen

Q31 Beste deelnemer,

Alvast bedankt voor je deelname aan dit onderzoek. Deze vragenlijst zal gaan over sensorische eigenschappen van cake. Het invullen van de vragenlijst zal ongeveer 15 minuten duren. Er zijn geen foute antwoorden, wil je invullen wat er als eerste in je opkomt?

Als je geen cake lust of wilt eten kun je niet meedoen aan de studie. Je kunt je op elk moment tijdens het onderzoek terugtrekken van deelname zonder verdere gevolgen. Wageningen Universiteit garandeert dat je gegevens anoniem verwerkt worden en alleen voor onderzoeksdoeleinden gebruikt worden. Vragen kun je altijd stellen door op de knop onder het rode lampje te drukken (recht voor je op de muur) of achteraf contact op te nemen met Houkje Adema (houkje.adema@wur.nl).

Door op het pijltje naar rechts te klikken geef je aan het bovenstaande te hebben gelezen en ermee instemt.

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Page Break

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Q33 Lust je cake?

- Ja (1)
- Nee (2)

*Skip To: End of Survey If Lust je cake? = Nee*

Q57 Hoe vaak eet je cake?

- Wekelijks (1)
- Maandelijks (2)
- 5 - 11 keer per jaar (3)
- 1 - 4 keer per jaar (4)
- Minder dan 1 keer per jaar (5)
- Nooit (6)

---

Page Break

Q9 Hoe laat heb je voor het laatst iets gegeten? Vul een tijd in (.. : .. uur).

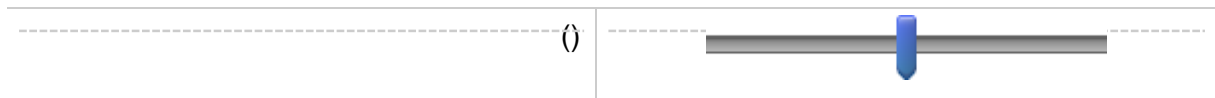
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Page Break

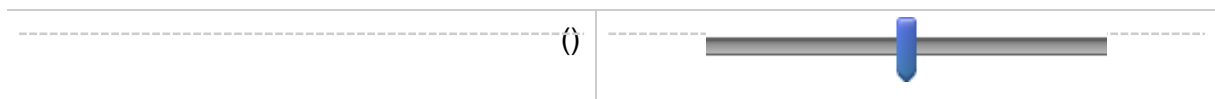
Q10 Hoe hongerig voel je je nu?

Helemaal niet hongerig Heel erg hongerig



Q80 Hoe vol voel je je nu?

Helemaal niet vol Heel erg vol



---

Page Break

Q8 Lees de volgende tekst alsjeblieft goed door!

Je krijgt zo meteen een portie cake. In dit onderzoek willen we de sensorische eigenschappen van cake op twee verschillende momenten meten: bij aanvang en aan het einde van het consumptiemoment.

Om de verschillen tussen de momenten goed te kunnen meten, vragen we je om de **eerste** hap én de **laatste** hap cake op verschillende sensorische eigenschappen te beoordelen. Tussen deze meetmomenten eet je zoveel cake tot je genoeg hebt gehad.

Om de cake van de onderzoeker te krijgen druk je op de knop onder het rode lampje (recht voor je). Als je de cake hebt ontvangen, druk je op het pijltje naar rechts om te beginnen met het sensorische onderzoek.

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Page Break

End of Block: Introductievragen

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Start of Block: Sensorische beoordeling

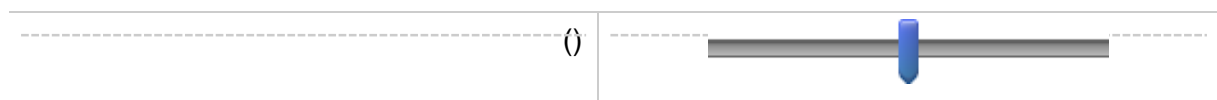
Q13 Neem nu een **eerste** hap van de cake en beoordeel deze door de vragen op deze pagina in te vullen.

---

Q73 Hoe zoet vind je de cake?

Helemaal niet zoet

Heel erg zoet



---

Q74 Hoe bitter vind je de cake?

Helemaal niet bitter

Heel erg bitter



Q75 Hoe zuur vind je de cake?

Helemaal niet zuur

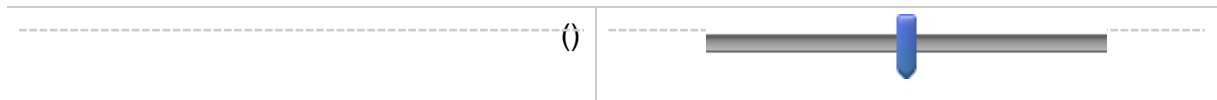
Heel erg zuur



Q76 Hoe smeugig vind je de cake?

Helemaal niet smeugig

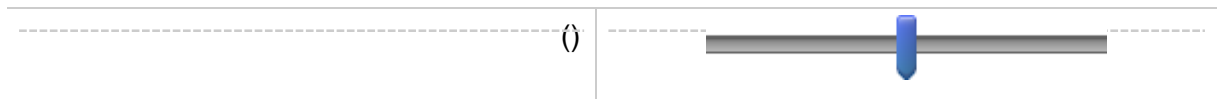
Heel erg smeugig



Q77 Hoe kruimelig vind je de cake?

Helemaal niet kruimelig

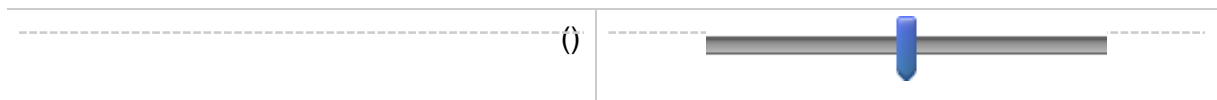
Heel erg kruimelig



Q78 Hoe lekker vind je de cake?

Helemaal niet lekker

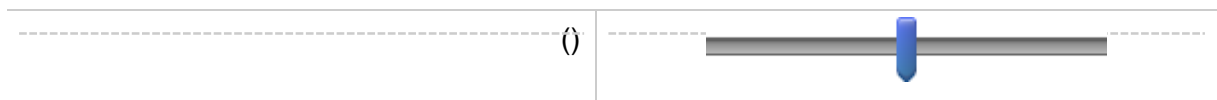
Heel erg lekker



Q79 Wat is je algemene waardering van de cake?

Heel erg slecht

Heel erg goed



Page Break

Q56 Eet nu zoveel cake tot je genoeg hebt gehad.

Dit is belangrijk omdat we geïnteresseerd zijn in de verschillen in waardering aan het **begin** en aan het **einde** van het consumptiemoment. Neem hier dus de tijd voor!

Als je genoeg hebt gegeten, druk dan op de knop voor je zodat het rode lampje gaat branden. De onderzoeker komt dan bij je zodat je verder kunt met het onderzoek.

---

Page Break



Q32 Vraag de onderzoeker om de volgende vraag in te vullen door op de knop te drukken onder het rode lampje. **Ga dus nog niet verder met de vragenlijst!**

---

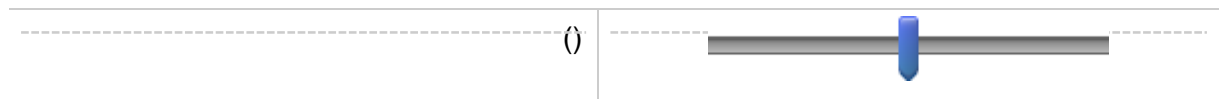
Page Break

Q27 Neem nu de **laatste** hap van de cake en beoordeel deze door de vragen op deze pagina in te vullen.

Q52 Hoe zoet vind je de cake?

Helemaal niet zoet

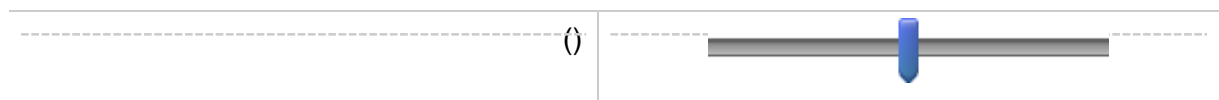
Heel erg zoet



Q67 Hoe bitter vind je de cake?

Helemaal niet bitter

Heel erg bitter



Q68 Hoe zuur vind je de cake?

Helemaal niet zuur

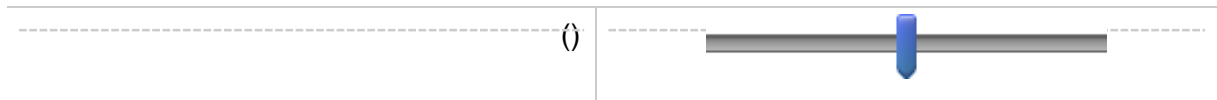
Heel erg zuur



Q69 Hoe smeuïg vind je de cake?

Helemaal niet smeuïg

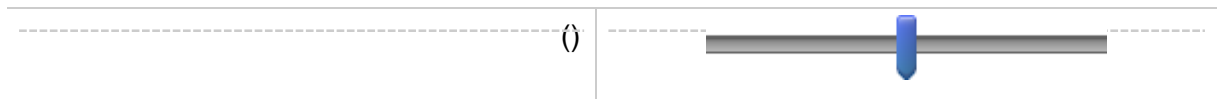
Heel erg smeuïg



Q70 Hoe kruimelig vind je de cake?

Helemaal niet kruimelig

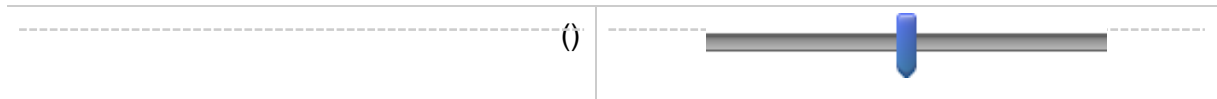
Heel erg kruimelig



Q71 Hoe lekker vind je de cake?

Helemaal niet lekker

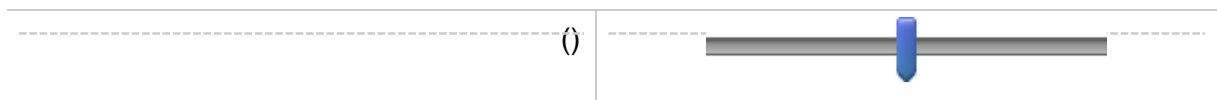
Heel erg lekker



Q72 Wat is je algemene waardering van de cake?

Heel erg slecht

Heel erg goed



Page Break



End of Block: Sensorische beoordeling

Start of Block: Ratings food intake and factors

Q81 Hoe hongerig voel je je nu?

Helemaal niet hongerig Heel erg hongerig



Q82 Hoe vol voel je je nu?

Helemaal niet vol Heel erg vol



Page Break

Q34 Vergelijk de hoeveelheid cake die je tijdens dit **sensorische onderzoek** hebt gegeten met de hoeveelheid cake die je **normaal** zou eten.

Is de hoeveelheid cake die je in dit sensorische onderzoek hebt gegeten:

	Veel minder dan normaal (1)	(2)	Hetzelfde als normaal (3)	(4)	Veel meer dan normaal (5)
De hoeveelheid cake die ik tijdens dit onderzoek heb gegeten is... (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Page Break

Q38 Vergelijk de hoeveelheid cake die je in dit **sensorische onderzoek** hebt gegeten met de hoeveelheid cake die je had **voorgenomen** om te eten nadat je wist wat de opdracht was.

Is de hoeveelheid cake die je in dit sensorische onderzoek hebt gegeten:

	Veel kleiner dan ik me had voorgenomen (1)	(2)	Hetzelfde als ik me had voorgenomen (3)	(4)	Veel meer dan ik me had voorgenomen (5)	Niet van toepassing (6)
De hoeveelheid cake die ik tijdens dit onderzoek heb gegeten is... (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Page Break



Q37 In hoeverre hebben de volgende factoren **invloed** gehad op de **hoeveelheid die je hebt gegeten** tijdens het sensorische onderzoek?

	Zorgde ervoor dat ik veel minder at dan normaal (1)	(2)	(3)	(4)	Had geen invloed op de hoeveelheid die ik at (5)	(6)	(7)	(8)	Zorgde ervoor dat ik veel meer at dan normaal (9)
Hoeveel zin ik had in cake (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hoeveel honger ik had (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

De moeilijkheid van de opdracht (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De hoeveelheid cake die ik kreeg (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De omgeving waarin ik de cake at (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hoe vol ik was (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De tijd die ik nam om de cake te eten (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mijn humeur tijdens het onderzoek (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wat er van mij verwacht werd tijdens het onderzoek (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De aan- of afwezigheid van andere deelnemers (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hoeveel zin ik had om te eten (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Het tijdstip van het onderzoek (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
De aanwezigheid van de onderzoeker (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Mijn  
zelfbeheersing  
tijdens het  
eten (14)

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End of Block: Ratings food intake and factors

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Start of Block: Demographics en covariates

Q54 De volgende vragen gaan over voedingsgedrag. Geef aan in welke mate de volgende stellingen voor jou van toepassing zijn.

-----

Q35 Wanneer je iets zwaarder bent geworden, eet je dan minder dan gewoonlijk?

- Nooit (1)
- Zelden (2)
- Soms (3)
- Vaak (4)
- Heel vaak (5)

-----

Q39 Probeer je minder te eten tijdens maaltijden dan je eigenlijk zou willen?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
-

Q40 Hoe vaak weiger je eten of drinken omdat je bang bent dat je zwaarder wordt?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q41 Houd je exact bij wat je eet?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q42 Eet je opzettelijk producten waarvan je afvalt?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
-

Q43 Wanneer je teveel hebt gegeten, eet je dan de daarop volgende dagen minder?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q44 Eet je opzettelijk minder om te voorkomen dat je zwaarder wordt?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q45 Hoe vaak probeer je geen tussendoortjes te nemen omdat je op je gewicht let?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
-

Q46 Hoe vaak probeer je 's avonds niet te eten omdat je op je gewicht let?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Q47 Hou je rekening met je gewicht wanneer je eet?

- Nooit (1)
  - Zelden (2)
  - Soms (3)
  - Vaak (4)
  - Heel vaak (5)
- 

Page Break

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Q36 Ik heb de neiging om te eten als reactie op mijn interne signalen van honger/verzadiging

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
-

Q44 Bij beslissingen over eten volg ik alleen wat mijn lichaam mij vertelt

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
- 

Q45 Ik maak geen groot probleem rondom eten

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
-



Q46 Ik heb een zorgeloze eetstijl

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
- 

Q47 Ik heb een positieve en ontspannen relatie met eten

- Helemaal niet waar voor mij (1)
  - Redelijk niet waar voor mij (2)
  - Een beetje niet waar voor mij (3)
  - Neutraal (4)
  - Een beetje waar voor mij (5)
  - Redelijk waar voor mij (6)
  - Heel erg waar voor mij (7)
-

Q48 Ik geniet van mijn eten zonder saboterende gedachten

- Helemaal niet waar voor mij (1)
- Redelijk niet waar voor mij (2)
- Een beetje niet waar voor mij (3)
- Neutraal (4)
- Een beetje waar voor mij (5)
- Redelijk waar voor mij (6)
- Heel erg waar voor mij (7)

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Page Break



Q34 Wat is je leeftijd?

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Q37 Waar denk je dat dit onderzoek over ging?

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Q58 Als je nog opmerkingen hebt voor de onderzoekers, schrijf deze dan hieronder.

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Page Break

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Q54 Aan Wageningen Universiteit worden vaker studies verricht waarvoor wij op zoek zijn naar deelnemers. Mogen wij je hiervoor af en toe (maximaal 1 keer per maand) benaderen per e-mail? Zo ja, schrijf hieronder je e-mailadres (alleen als je nog niet in bestand staat, niet-wur adres is ook oke):

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Page Break

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Q56 Bedankt voor je bijdrage aan het onderzoek! Graag op de knop drukken onder het rode lampje zodat de onderzoeker weet dat je klaar bent. Daarna kun je je spullen pakken en op de gang wachten voor je bedankje:)  
Klik op het pijltje naar rechts om de vragenlijst te versturen.

**End of Block: Demographics en covariates**

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## 9. Appendix 3: Post hoc tests intake evaluation for tests of between subjects effects

### 9.1 Post hoc tests intake evaluation external factors

Table 10. Post hoc tests intake evaluation for each external factor separately

Factor	Intake evaluation (IE)		Mean difference	Std. Error	P-value
	IE 1	IE 2			
<i>The amount of food available</i>	'Ate less'	'Ate the same'	-1.49	0.337	< <b>0.001</b>
	'Ate the same'	'Ate more'	-0.98	0.247	< <b>0.001</b>
	'Ate more'	'Ate less'	2.47	0.319	< <b>0.001</b>
<i>The surroundings in which I ate</i>	'Ate less'	'Ate the same'	-0.52	0.307	0.211
	'Ate the same'	'Ate more'	-0.50	0.225	0.067
	'Ate more'	'Ate less'	1.02	0.291	<b>0.002</b>
<i>The time of the day</i>	'Ate less'	'Ate the same'	-1.00	0.347	<b>0.013</b>
	'Ate the same'	'Ate more'	-0.72	0.254	<b>0.013</b>
	'Ate more'	'Ate less'	1.72	0.329	< <b>0.001</b>
<i>Presence/absence of other participants</i>	'Ate less'	'Ate the same'	0.08	0.192	0.91
	'Ate the same'	'Ate more'	-0.47	0.140	<b>0.003</b>
	'Ate more'	'Ate less'	0.39	0.181	0.079
<i>What was expected of me</i>	'Ate less'	'Ate the same'	-0.57	0.282	0.108
	'Ate the same'	'Ate more'	-0.26	0.207	0.408
	'Ate more'	'Ate less'	0.84	0.267	<b>0.006</b>

### 9.2 Post hoc tests intake evaluation internal factors

Table 11. Post hoc tests intake evaluation for each internal factor separately

Factor	Intake evaluation (IE)		Mean difference	Std. Error	P-value
	IE 1	IE 2			
<i>Whether I was in the mood for the food</i>	'Ate less'	'Ate the same'	-1.58	0.336	< <b>0.001</b>
	'Ate the same'	'Ate more'	-0.29	0.246	0.461
	'Ate more'	'Ate less'	1.88	0.319	< <b>0.001</b>
<i>How hungry I was</i>	'Ate less'	'Ate the same'	-1.82	0.389	< <b>0.001</b>
	'Ate the same'	'Ate more'	-0.56	0.285	0.127
	'Ate more'	'Ate less'	2.38	0.369	< <b>0.001</b>
<i>The time I took to eat the food</i>	'Ate less'	'Ate the same'	-0.66	0.334	0.118
	'Ate the same'	'Ate more'	-50	0.245	0.104
	'Ate more'	'Ate less'	1.16	0.317	<b>0.001</b>
<i>Whether I was in the mood for eating</i>	'Ate less'	'Ate the same'	-1.53	0.339	< <b>0.001</b>
	'Ate the same'	'Ate more'	-0.53	0.248	0.084
	'Ate more'	'Ate less'	2.07	0.321	< <b>0.001</b>
<i>My self-control to eat until I had eaten enough</i>	'Ate less'	'Ate the same'	-1.53	0.339	< <b>0.001</b>
	'Ate the same'	'Ate more'	-0.29	0.193	0.300
	'Ate more'	'Ate less'	0.95	0.250	<b>0.001</b>
<i>How full I was</i>	'Ate less'	'Ate the same'	-1.22	0.393	<b>0.006</b>
	'Ate the same'	'Ate more'	-0.54	0.288	0.153
	'Ate more'	'Ate less'	1.76	0.373	< <b>0.001</b>