



WAGENINGEN UNIVERSITY & RESEARCH

INFLUENCE OF DEPICTED PORTION SIZE ON-PACK ON SERVING AND CONSUMPTION BEHAVIOUR OF ADULTS

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“Influence of depicted portion size on-pack on serving and consumption behaviour of adults”

An experimental study, investigating external cues from the food environment influencing serving and consumption behaviour of adults.

Utrecht, June 8th, 2019

Wageningen University & Research

Master - Management, Economics & Consumer studies

Specialisation: Marketing & Consumer Behaviour

MCB - 80436

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ABSTRACT

Objective: The growing portion sizes contribute among others to the growing rates of people with obesity. Nowadays large bodies of studies have been carried out concerning the food environment including external cues. However, not much was known about depicted portion sizes as an external cue influencing consumption. Hence, the objective of this paper is to contribute to the theoretical understanding of size-related external cues of the food environment, by examining the influence of depicted portion size on-pack on serving and consumption behaviour of adults.

Methods: A between-subject design was executed with three experimental groups. The depicted portion sizes on-pack were manipulated between, no depicted portion size, small depicted portion size and large depicted portion size. Each experimental group saw one of the three conditions and served and consumed one slice of bread with the offered bread spread.

Results: Adults did not serve significantly more when the on-pack sticker suggested a large portion compared to small and no depicted portion size. On average they served 18 grams of chocolate sprinkles, which is slightly more than is recommended. Furthermore, adults consumption did not increase with the influence of depicted portion sizes. Besides, adults with a large depicted portion size did not indicate a larger consumption norm compared to the other groups. However, the relationship between estimated appropriate consumption norm and the served portion implies that subjects perceived estimated portion size are in line with their serving behaviour. Moreover, participants with a depicted portion size did not indicate the temptation of chocolate sprinkles significantly different than participant without depicted portion size. The indicated temptation of chocolate sprinkles did not change the amount participants served themselves. Lastly, the amount people serve themselves is highly related to the amount consumed.

Conclusion: No significant results of depicted portion sizes on the serving and consumption of adults were found. Adults were highly familiar with the product causing already strongly developed fixed habits regarding consumption. Single exposure of a large depicted portion size did not modify these habits. However, a strong relationship between serving and consumption indicates that adults tend to consume what they served themselves.

Keywords: depicted portion size, external cue, food environment, food consumption, on-pack marketing, adults

INTRODUCTION

The epidemic problem of obesity in western societies show no sign of decline yet (Swinburn et al., 2011; Kessler, 2009). Estimated is that by 2030, 51% of the U.S. adults will be obese (Finkelstein et al., 2012). A strong external cue of the food environment contributing to obesity are growing food portion sizes (Steenhuis & Vermeer, 2009). Throughout the years, retailers and food manufacturers increased portion size to compete on quantity with competitors, to offer the highest value for money (Antonuk & Block, 2016; Steenhuis & Vermeer, 2009; Young & Nestle, 2007). This competition changed humans perception of “normal” and resulted in a new benchmark for portion sizes. Although food portions in the U.S. have grown larger than in Europe, food portions in Europe did increase as well (Rozin et al., 2003; Young & Nestle, 2002). Regularly portion sizes and food packaging are 25% larger in the U.S. than in France, where obesity rates are lower (Rozin et al., 2003). Increased portion sizes may lead to an increased level of food intake.

Multiple studies demonstrated a strong impact of environmental influences on eating (Bilman et al., 2017; Wansink, 2012; Zlatevska et al., 2014). The portion-size effect explains how external cues within the food environment can guide consumption (Zlatevska et al., 2014). It demonstrates that people who are exposed to larger package sizes or portion sizes tend to increase food intake. The impact of the portion size effect is partly dependent on external cues of the food environment. “External cues” and “Environmental cues”, are both used in literature, to refer to the same concept - cues within the food environment influencing food decisions of people unconsciously. In this research only, “External cues” are used to refer to such a situation. A few examples of external cues are size, visibility, and accessibility of food (Wansink, 2010). Size-related external cues, such as package size, portion size and serving size, can all independently and together manipulate portion size (Zlatevska et al., 2014).

In the literature, a distinction was made between servings size, portion size and package size (Zlatevska et al., 2014). To clarify and correctly apply the concepts in this research, each concept will be explained. Firstly, “serving size”, is referring to the recommended amount of food to consume, often available in the nutritional facts lists (e.g. Mohr, Lichtenstein & Janiszewski, 2012). Secondly, “portion size”, is a descriptive concept, referred to as: “a quantity of food contained in a portion, this can be indicated in weight or volume of the contents of the package (p.141).” The quantity of one portion size can be more (or less) than the recommended serving size. Thirdly, the size of a container in which food or drink is served is defined as the “package size”, this can be a plate, a package or a cup (e.g. Wansink, 1996). Package size can be manipulated independently of portion size.

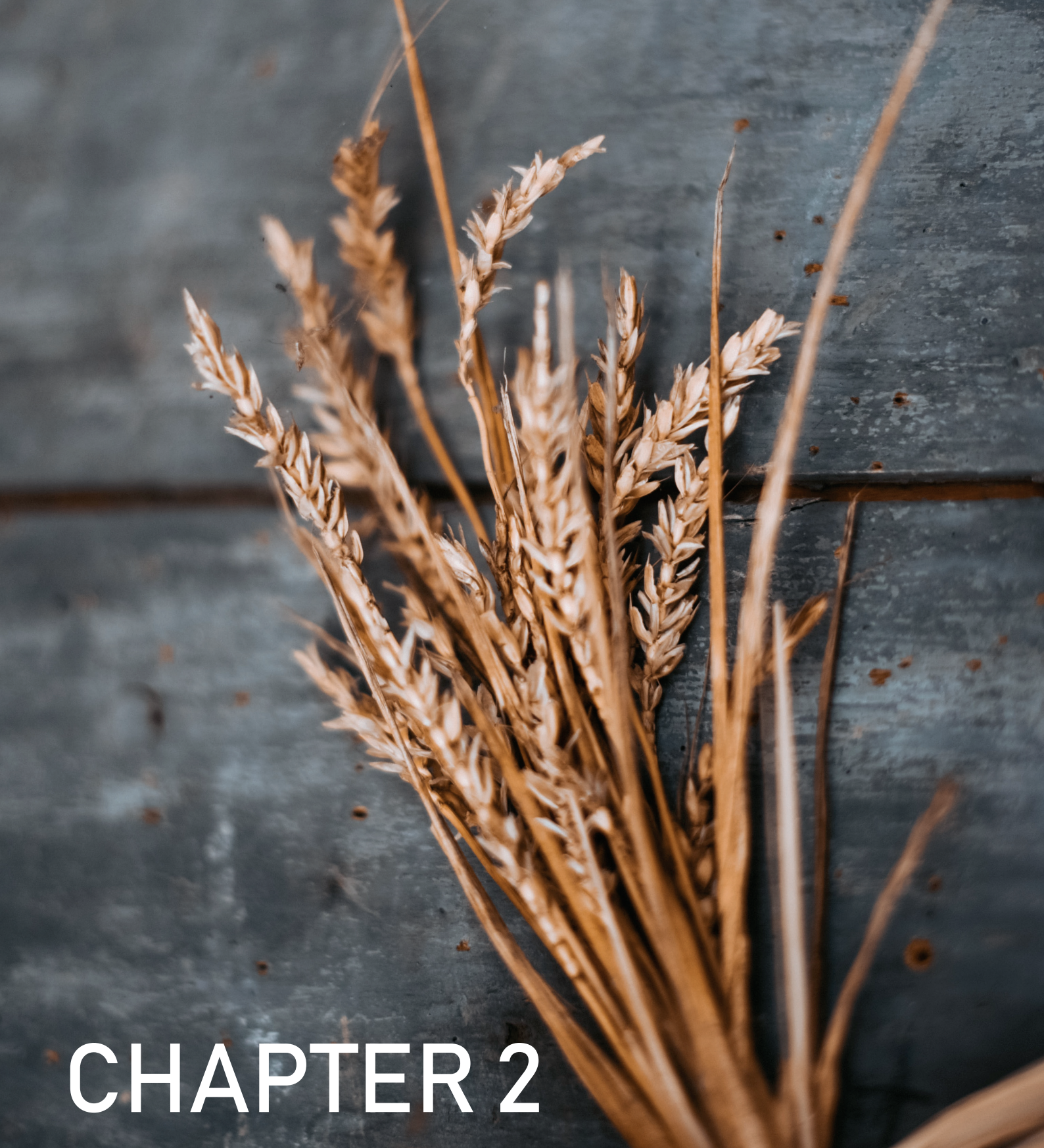
Depicted portion size on-pack is an example of a size-related external cue from the food environment, where portion size and serving size can be manipulated. Firstly, the serving size, recommended in the nutritional fact lists, can be manipulated by depicting a different portion size on-pack, this is often more than is recommended (Tal et al., 2017; Aerts & Smits, 2018). Secondly, the depicted portion size can be a more salient cue to determine portion size on than the recommended serving size, which is a manipulation of portion size (Wansink, 2010). Although people are often unaware of these influences and most of the time unable to explain which factors influenced their eating decisions, it has been demonstrated that depicted portion sizes could have a significant impact on consumption.

Aerts and Smits (2018) researched the impact of depicted portion size on consumption behaviour of children between four and seven years old. In two studies with experimental design, they manipulated on-pack depictions of portion size. Results of Aerts and Smits (2018) demonstrated that children ate significantly more when exposed to large serving suggestions on-pack than to a recommended depiction. However, it has not been studied yet if this effect also appears with adults. This research will build further on the work of Aerts and Smits (2018), it will cover the knowledge gap by investigating if depicted portion size on-pack influences serving and consumption behaviour of adults. Additionally, this study also considers the effect of no depicted portion influencing consumption. This control condition was not a part of the design of Aerts and Smits (2018) and is a unique contribution to this research field. In particular, this research focuses on bread spreads. Bread spreads are interesting because granularity is often manipulated. The containers of bread spread are often sold as multi-serving packaging which makes it more difficult to estimate an appropriate portion (Ledikwe et al., 2005). In other words, the number and size of the packaging that contains the portion size are manipulated (Zlatevska et al., 2014). Besides, another form of granularity manipulation is the size of food pieces in the portion (Zlatevska et al., 2014). For instance, chocolate sprinkles have a very fine granularity, which challenges the consumer to estimate an appropriate individual portion because it is not suggested by the size of the tiny parts.

The purpose of this paper is to contribute to the theoretical understanding of size-related external cues of the food environment, by examining the influence of depicted portion size on-pack of bread spreads on serving and consumption behaviour of adults. Similarly to the study of Aerts and Smits (2018), this research will use an experimental design, measuring the difference between three experimental groups, manipulated by depicted portion size. Expected is that a largely depicted portion size will lead to an increase in serving and consumption behaviour compared to a small and no depicted portion size. The underlying mechanism could be that perceiving a desirable food could create “visual hunger” and overrule the feeling of hunger and satiety (Bilman

et al., 2017; Spence et al., 2016). This could lead to less self-restraint and increased consumption. Another reasoning is, that the individual is unconsciously influenced by the depicted portion size (which is more than recommended) and use this without being aware of it, as a determinant to estimate appropriate portion size.

The outcome would be interesting for individuals to understand the influence of the food environment on consumption behaviour. Besides, it would be interesting for Wageningen University & Research to broaden the understanding of the impact of size-related external cues on serving and consumption.



CHAPTER 2

THEORETICAL BACKGROUND

THEORETICAL BACKGROUND

This chapter consists of information to broaden the understanding of the research topic. It starts with an explanation of the food environment and continues with an understanding of automatic decisions. Furthermore, the portion-size effect is explained. After that, depicted portion sizes as an external cue from food environment is explained. Then, two potential mechanisms are shown to demonstrate why food intake can be influenced by depicted portion size on-pack. Lastly, the conceptual framework is discussed, including the hypotheses.

2.1 Influences from the food environment

2.1.1. THE FOOD ENVIRONMENT

Multiple studies demonstrate that there is a strong impact of environmental influences on eating (e.g. Bilman et al., 2017; Wansink, 2010; Zlatevska et al., 2014). The food environment is complex and operates within different layers. Booth et al. (2001) discussed eight different layers, varying from internal factors such as cultural and social factors, to external factors, for instance, a supermarket, a restaurant or at home. Although they demonstrated the importance of all layers influencing food and physical activity choices, only the external influences are in the scope of this research. These external factors consist of all places where food can be bought or eaten including the people who are present in those environments (Booth et al., 2001). They shape unconsciously what and how much individuals eat- e.g. setting rules to clean your plate. Furthermore, governments have a more distal influence on what and how much is eaten, but are part of external influences. Through law and policy, they try to control and influence what is present in supermarkets and restaurants. These external influences by governments, family and restaurants modify food decisions and consumption behaviour of individuals, without being aware of it.

2.1.2. EATING AS AUTOMATIC BEHAVIOUR

Automatic decisions, often the case with food decisions, can be explained by dual-process theories. Key is that the mental processes underlying behaviour and judgements are divided into two general categories depending on whether they operate automatically or in a controlled fashion (Gawronski & Creighton, 2013). Kahneman (2011) distinguished System 1 and System 2, generically described as intuition versus reasoning. Both systems process information from our outside world, but both in a completely different way. System 1 is considered as fast, parallel, automatic, effortless, associative, slow learning and emotional. In contrast, System 2 is defined as, slow, serial, controlled, effortful, rule-governed, fast learning and emotionally neutral. Both systems can be activated by verbal information or based on past, present or future occasions. When there is no immediate intuitive response of System 1, judgments and behaviour are made by System 2. However, if an intuitive reaction arises by System 1, System 2 can either confirm this reaction, change response regarding relevance, correct for occurring bias or block the response

(Gawronksi & Creighton, 2013).

Regarding food and consumption, eating can be regarded as an automatic behaviour which can be categorized by System 1 processing (Cohen & Farley, 2008). They assume that eating is an act over which the environment has more control than the individual. Moreover, people have limited access to their higher cognitive processes (Nisbett and Wilson, 1977). This means that, with automatic behaviour, people are often unaware which stimuli causes which response and therefore unable to report their cognitive process accurately. An external influence from the food environment, such as depicted portion size, can be a stimulus for eating (too much). However, because eating is considered automatic behaviour people are not aware of the stimulus causing the eating response. Even when individuals are aware of the external cue (stimulus) and the response, they are probably unaware of the fact that the stimulus caused the response (Nisbett & Wilson, 1977). Instead, individuals tend to come up with reasons to explain their behaviour and, often choose the most obvious one. People's refusal to accept and understand the influence of the food environment starts with our inability to recognize eating as an automatic behaviour.

2.1.3. THE BOUNDARY MODEL

The human body consists of a physiological system that signals feelings of hunger and satiety which should support adequate food intake. However, in places where food is overly present, external influences of the food environment tend to override and/or undermine these signals (Bilman et al., 2017). Already in 1984, Herman and Polivy developed the boundary model for regulation of eating. They argue that people have two end states: hunger and satiety. When extreme hunger is experienced, people feel an urge to consume food to gain new energy. While on the other hand, when they experience the unpleasant feeling of satiety, an urge to stop eating occurs. Between these end states, external influences from the food environment exert their strongest influence on the internal signal to start or stop eating and people can be more sensitive for external cues of the food environment (Bilman et al., 2017). However, people are still unaware of which cue causes which response (Nisbett & Wilson, 1977).

2.2 Portion sizes as a driver of consumption

2.2.1. THE PORTION-SIZE EFFECT

The portion-size effect explains how external cues within the food environment can guide consumption. It suggests that the larger the packaging, dinnerware or portion size, the more people tend to eat (Zlatevska et al., 2014). Furthermore, anchoring and the adjustment process naturally describes the portion-size effect (Marchiori et al., 2014). With anchoring, the size of a served portion is taken as a reference amount which serves as an indicator of what might be an appropriate consumption amount. For example, the portion size is taken as a reference amount and based on the portion size a certain amount is determined to be appropriate to eat. People tend

to over-serve when confronted with larger packaging, dishware etcetera, and underserve when confronted with smaller indicators (Bilman et al., 2017). In general, people tend to eat more when food is presented in larger compared to smaller units (Geier et al., 2006). The unit bias is a heuristic which can help understand the portion-size effect. According to Geier et al. (2006), the unit bias entails that a unit of a food product can be perceived as one even when it is above minimal size. It is perceived as the appropriate and optimal amount to consume. Therefore, individuals can have a natural urge to finish one unit, perhaps established by parental instructions received in childhood (e.g. Birch et al., 1987; Fay et al., 2011; Geier et al., 2006). Hence, if the size of the one-unit decreases, people will consume less (Geier et al., 2006). The portion-size effect is applicable in multiple fields and can be explained with different theories. But fundamentally is, that when people are confronted with larger serving sizes, package sizes or portion sizes, consumption increases.

2.2.2. THE IMPACT OF PORTION-SIZE EFFECT ON FOOD CONSUMPTION

A large body of studies has been carried out regarding portion sizes. Zlatevska et al. (2014) wrote a meta-analytic review of 104 portion size studies. The portion size effect was measured with comparing studies who reported three or more levels of portion size and consumption. Comparing these levels of portion sizes (i.e. small, medium, large, extra-large and extra-extra-large) increased consumption, however, decreasing effect size for successively larger portion size comparisons. Another attempt to measure the effect size is done by comparing reported serving and consumption measures by growing portion sizes. The outcome was similar to the latter, whereas the effect size became smaller when the portion sizes became too big. In other words, greater serving leads to greater consumption, although, there is a maximum point where this linear growth declines. Furthermore, Zlatevska et al. (2014) defined a limited set of individual factors (age, gender, and BMI) and environmental factors (snack food and food focus) that might alter the effect size as well. Findings suggest that the portion size effect does change among characteristics. For instance, adults' consumption increased (39%) when doubling portion size, whereas, children's consumption only increased by 20%. Moreover, a surprising difference between gender was found. Men consumed 52% more when the portion was doubled, while women consumed only 27% more. Another unexpected result was that people with a higher BMI than 25 responded less on the increased portion sizes than people with a BMI of 25 or less. Concerning, environmental factors, individuals consumption increased when consuming snack foods (37%) compared to non-snack foods (27%). Lastly, when people knew the research was about food, they responded less on the increased portion (26%) than when there was no food integrated (45%). Hence, the portion size effect does lead to greater consumption, to a certain extent, but the effect size differs across characteristics.

2.3 External cues of the food environment

2.3.1. PACKAGING

The importance of product design has increased throughout the years. This is partly because retailers discovered that packaging is a useful tool to communicate and generate consumer attention (Underwood et al., 2001). Moreover, package design is commonly used to affect attitude and preferences of individuals with the help of cues on-pack. In general, people notice visual information often before verbal content, which indicates a potential advantage because of greater accessibility. Package related cues from the food environment can be distinguished between structural-, graphical and informational cues (Magnier & Cri  , 2015). Firstly, Structural cues are related to the structure of the packaging, including shape, size, material and re-usability. Retailers can influence the consumer by manipulating single-serving portions. Single-serving products are defined as units that can be reasonably consumed at once (Ledikwe et al., 2005). Nevertheless, consumers experience difficulties to determine a single-serving if the packaging allows multiple servings. Namely, the estimated portion size can be more than is recommended (Antonuk & Block, 2016; Tal et al., 2017). Secondly, graphical cues on-pack represent cues that relate to the graphics or icons displayed on the packaging, including colours, photographs, images and logos. Lastly, informational cues are related to information displayed on the packaging including labelling, licensing agreements and general (environmental) claims (Magnier & Cri  , 2015). Therefore, it could be useful to label a product big or small to propose a certain consumption amount (Underwood et al., 2001). Hence, packaging can influence consumption in many (unconscious) ways.

2.3.2. DEPICTED PORTION SIZE ON-PACK

Nowadays graphical cues, such as depicted portion sizes on-pack, are often used to gain consumers attention. A quick look around the supermarket and it becomes clear that food pictures often dominate front packaging. However, it is astonishing that depicted portion sizes on-pack are often not in line with the recommended portion size stated in the nutritional facts list (Tal et al., 2017; Aerts & Smits, 2018). In an observational study comparing cereal packages, it became clear that depicted portion size on-pack is on average 64.7% larger than suggested by nutritional information (Tal et al., 2017). Furthermore, the study of Aerts and Smits (2018) demonstrated that based on estimates, a brand often visualizes a portion size on-pack five times bigger than is recommended by the nutrition label. They estimated that the depicted portion size of their experimental products (i.e. chocolate- and cheese spread) contains 73 grams of spread, while a regular recommended portion contains 15 grams of spread (Aerts & Smits, 2018). These external cues (product imagery) can be a more powerful guide as appropriate consumption norm than nutrition labels and can have a great impact on food intake (Tal et al., 2017).

2.3.3. EFFECTS OF DEPICTED PORTION SIZE

Only two studies demonstrated a significant effect of depicted portion size on serving and consumption behaviour (Table 1). However, to the best of our knowledge, depicted portion sizes have not been studied from an adults perspective. The study of Tal et al. (2017) focussed only on pouring of the cereal and not on consumption, while Aerts and Smits (2018) focussed on children and their serving and consumption behaviour. Findings show that product imagery (external cue of the food environment) can increase consumers attention towards low familiarity brands (Underwood et al., 2001). Although food intake was not investigated, it does suggest that product imagery can be an important stimulus for consumers attention (Underwood et al., 2001). Continuing with depicted portion sizes, which are also considered as product imagery, there are two main findings demonstrated by Tal et al. (2017) and Aerts and Smits (2018). Firstly, product imagery on the front of the packaging suggests significant larger portion sizes than was recommended by the nutritional facts lists. Secondly, when exposed to larger servings through a picture, adults and/or children tend to serve and consume more.

With two studies Tal and colleagues (Tal et al., 2017) examined the impact of large serving size depictions on product packaging and its influence on the served portion of cereals. With an observational field survey, they compared 158 U.S. cereal packaging with depicted serving size on-pack and suggested serving amount stated in nutritional facts panel. Results show that the depicted serving size on-pack was 64.7% larger than the recommended serving size. The second study measured the actual amount of cereals poured in a bowl. Cereals who depicted greater portions of cereals led to an increase in the served portion of 17.8%. This was 42% more than the recommended number of grams from the nutritional information.

Furthermore, Aerts and Smits (2018) performed two studies concentrated on serving and consumption behaviour of children with an age between four to seven years. Both studies focussed on multi-serving packaging with a suggested portion size displayed on-pack (Aerts & Smits, 2018). A distinction was made between a healthy versus less healthy food and depicted portion sizes were manipulated between regular versus large. Consumption was measured subtracting pre-weight from post-weight of the used jars. The results from study 1 suggest that children ate more when exposed to larger portions (Aerts & Smits, 2018). However, contradicting their expectations, large depicted portion size did not have a significant influence on the consumption of the less healthy snack. Children did consume more of a healthy snack compared to a less healthy snack. An explanation could be due to the ceiling effect in the chocolate nut consumption because both conditions reached a certain satiety level. In the second study, findings demonstrate that children ate more when exposed to a large serving on their first slice compared to the second slice. A possible reason could be that tasting is partly done with our eyes. Moreover, children ate more of the less healthy chocolate spread compared to the healthy spread, due to

likeability. In summary, this suggests that subtle cues such as depicted portion size on-pack can be an unconscious stimulus to determine food intake.

Authors	Research group	Setting	Manipulation	Results
Aerts & Smits (2018) Study 1	Total: 47 children. Ranging from 4 - 7 years old.	Controlled school environment	Regular vs. large depicted portion size, grapes vs. chocolate nuts.	Children consumed more when exposed to large portion and ate more of the healthy snack but depicted portion did not affect the consumption of unhealthy snack.
Aerts & Smits (2018) Study 2	Total: 24 children. Ranging from 5 - 7 years old.	Controlled school environment	Regular vs. large depicted portion size, cheese vs. the chocolate spread.	Children ate more of the less healthy spread, and more on their first slice when exposed to large servings.
Tal et al. (2017) Study 1	Total: 158 coded U.S. cereal packaging	Observational field survey	The compared serving size on the front with serving size from nutritional list	Portion size depictions on the front were 64.7% larger (221 vs 132 calories) than recommended by nutritional facts.
Tal et al. (2017) Study 2	Total: 51 students from U.S. University	Mixed cross-sectional design	Exaggerated vs. accurate depicted portion size	Participants poured 17.8% more cereal when exposed to larger serving in a multi-serving packaging.

Table 1. Summary of research done at depicted portion sizes

2.4 Potential mechanisms of why depicted portion size impact consumption

Previous chapters explained the food environment, the portion-size effect and the influence of subtle cues such as product imagery, on food intake. However, it remains unclear how depicted portion size influences consumption. In this chapter two potential mechanism are explained to account for this phenomenon.

2.4.1. CONSUMPTION NORMS: RULES TO DETERMINE FOOD INTAKE

The first potential mechanism, which could explain how depicted portion sizes can influence serving and consumption is consumption norms. To the best of our knowledge, no clear definition of “consumption norms” is given in the literature. Therefore, in this research consumption norms are defined as a unit of some entity that is perceived by humans as appropriate to consume. People tend to make use of eating habits to save cognitive resources for other tasks and decisions during the day (Marteau et al., 2012). This kind of automatic behaviour can be based on past behaviours, such as what one normally buys or consumes and can help determine how much people should consume (Chandon & Wansink, 2006; Wansink & van Ittersum, 2007). Besides, food-related

estimation and consumption behaviour can also be influenced by norms and external cues from the food environment. However, people are often unaware of external cues changing over time and simultaneously change their consumption norms. There are many examples of external cues from the food environment which might shape an individual's consumption norms. For instance, "clean your plate" type of rules during childhood (Wansink & van Ittersum, 2007), the size of a bowl, plate, spoon etcetera (Wansink, 2010), the presence of others (dinner as a social activity) (Belk, 2009), consumption rules in line with current diet (Zlatevska et al., 2014), but also packaging size and depicted portion sizes (Aerts & Smits, 2018). A larger depicted portion size than is recommended can be a salient external cue modifying people consumption norms and thus modifying consumption estimation. The same already occurred with bigger bowls and plates, it changes people's consumption norms unconsciously. Hence, bigger depicted portion sizes can change consumption norms without being aware of it.

2.4.2. VISUAL HUNGER: SEEING FOOD MAKES US WANT FOOD

Some particular foods, such as hedonic foods, are considered appealing, they can stimulate a desire or urge towards consumption. Already in the first century, Apicius phrased: "we eat first with our eyes". Nowadays research reveals the accurateness of this aphorism (Spence et al., 2016). When the eyes perceive stimuli from food, an instinct of survival arises because food (i.e. energy) can increase the chance of survival (Spence et al., 2016). Although this is not applicable in the present time anymore- in most countries there is enough food to survive, it does declare why humans, in the presence of food, have a natural urge to consume. Moreover, the search for nutritious foods is one of the brain's most important functions (Spence et al., 2016). Several studies demonstrated that vision plays an important role by attentional, pleasure and reward systems of our brain (e.g. Berthoud & Morrison, 2008; Kringelbach, Stein & van Harteveldt, 2012; LaBar et al., 2001). Moreover, finding nutritional foods, which is essential for human well-being is an activity where vision plays a central role. Hence, the overall perceived pleasure of food arises from exerted visual appeal (Spence et al., 2016).

Visual appeal can create visual hunger – a concept that Spence et al. (2016) define as: "a natural desire, or urge, to look at food (p. 54)." Nowadays, the human brain knows that it is enjoyable to perceive food since this will regularly lead to consumption. Exposure to food has increased dramatically in the past few years. Upcoming cooking shows, food advertisements and social media feed containing images or videos preparing food results in a multitude of food choices every day. It requires a lot of effort to neglect hunger and satiety feelings when food advertisements constantly remind people of the pleasurable foods available (Spence et al., 2016). These food advertisements can exert an increase in consumers' desire for food. Thus, it can increase a feeling of pleasure, while at the same time indirectly promotes overconsumption and gratification (Spence et al., 2016). For instance, an individual is doing groceries, food images

displayed on-pack are present and the visual system is stimulated. If bread spreads are considered as an appealing food, the visual system will emit a signal of pleasure. The brain assumes consumption will take place and signals a desire to consume or overconsume to satisfy the food craving.

2.5 Conceptual framework and hypotheses

The conceptual framework, demonstrated in Figure 1, aims to provide a better understanding of the influence of depicted portion size on serving and consumption behaviour of adults. The relationships between the different variables will be explained based on the formulated hypotheses.

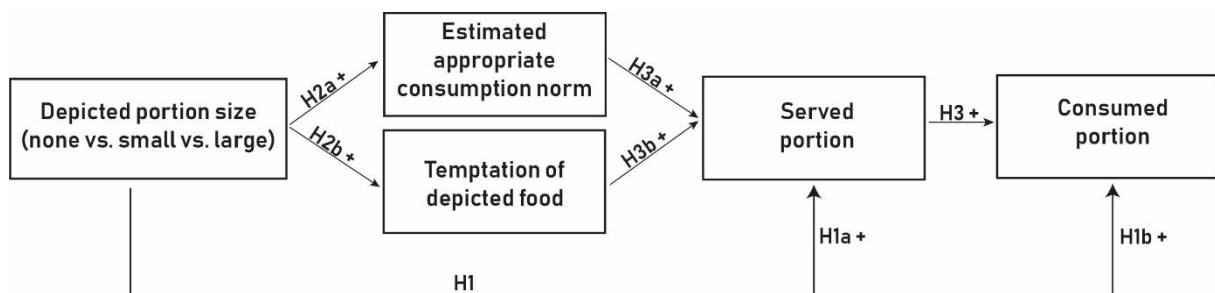


Figure 1. Conceptual Framework

This study will examine different outcomes of serving and consumption between the three experimental conditions. Demonstrated in the study of Aerts and Smits (2018) is that children are (unconsciously) influenced by depicted portion sizes. When the children are exposed to a large depicted portion size, they serve themselves more than is recommended as appropriate (Aerts & Smits, 2018). Besides, not only serving increased, but also consumption increased. The calorie intake of children expanded while servings became bigger. Similarly, subjects served on average 17.8% (162 vs. 137 calories) more cereals when depicting a large portion than was recommended in the nutritional label (Tal et al., 2017). With the help of the previous literature, the following hypotheses are formulated:

H1a: Largely depicted portion size on-pack will increase the served portion compared to small depicted portion size and no depicted portion size.

H1b: Largely depicted portion size on-pack will increase consumption compared to small depicted portion size and no depicted portion size.

Research established that pictorial information is often more salient, strong and seductive than verbal information (Underwood et al., 2001). Between the two end states hunger and satiety, external cues can exert their strongest influence on food decisions (Bilman et al., 2017). Hence, depicted portion size can result in two reactions. Firstly, it can change people's estimation of what is appropriate to eat (Chandon & Wansink, 2006). For example, a larger depicted portion size can

be a salient external cue modifying people consumption norms (Wansink, 2010). Hence, it can cause an increase in food intake without people being aware of it. Secondly, perceiving the depicted food can cause visual hunger towards and overrule the feeling of hunger or satiety (Spence et al., 2006; Bilman et al., 2017). The following hypotheses are formulated based on previous literature:

H2a: Largely depicted portion size on-pack will increase the estimated appropriate consumption norm compared to small depicted portion size and no depicted portion size

H2b: A depicted portion size will positively increase the temptation of the depicted food compared to no depicted portion size.

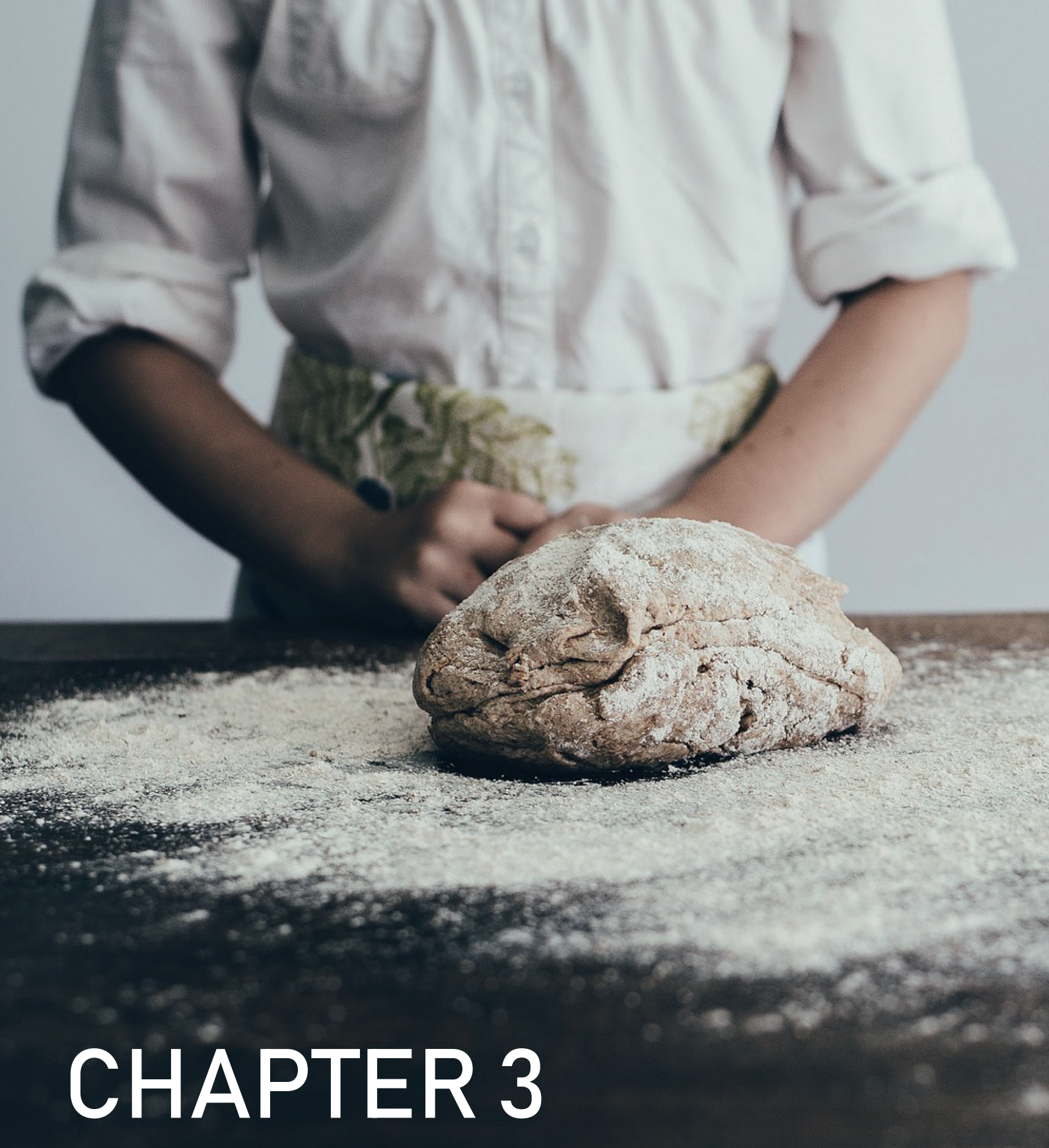
When the estimation of an appropriate portion was modified by depicted portion sizes it is more likely that the portion size will be based on the newly developed consumption norm. The portion size effect explains this phenomenon by demonstrating that people tend to serve and consume more when they are exposed to larger packaging sizes, serving sizes and portion sizes (Zlatevska et al., 2014). In this case, when the estimated appropriate consumption amount is influenced by depicted portion size, expected is that portion size will increase evenly. Furthermore, when the depicted food stimulates positive temptation towards food, it can lead to an urge to look or consume without the presence of hunger or saturation (Spence et al., 2016; Bilman et al., 2017). With a lesser extent of self-regulation, serving size can be positively influenced because of the temptation of the depicted food (Bilman et al., 2017). Moreover, expected is that this phenomenon only occurs when there is a depicted food presented on-pack. Assumed is that without a depicted food on-pack temptation towards that food will be less significant. Therefore, the following hypotheses are formulated:

H3a: An increase in estimated appropriate consumption norm will lead to an increase in the portion served.

H3b: A positive temptation for the depicted food will lead to an increase in the portion served.

Finally, Geier et al. (2006) stated that individuals are being influenced because of unit bias. This means that people feel the urge to finish one unit of some entity. Hence, it is expected that when a greater amount is served people will consume the amount they served themselves. Another potential influence of this relationship is because of product familiarity and habits (Wansink, 2010). People know how to serve and consume the product, whereas it is “normal” and socially accepted to consume one slice of bread. Therefore, a correlation between portion served and consumption is hypothesized.

H4: An increase in the portion served will lead to an increase in consumption



CHAPTER 3

METHODS

METHODS

3.1 Research design

3.1.1. EXPERIMENTAL DESIGN

To measure the influence of different depicted portion sizes on-pack, a between-subject design was used. Every subject accomplished the experiment individually, with one of the three conditions. The manipulation (chocolate sprinkles packaging) was placed on the table together with other necessary equipment. The chocolate sprinkles, both dark- and milk chocolate were presented in cardboard packaging of 380 grams. The packaging was refilled when the content became less than 285 grams, to prevent that a subject could be influenced because the container was almost empty. The chocolate sprinkle packaging was covered with white paper except for the front side, these were stickered with the manipulation (see Figure 2). However, to make the manipulation not too obvious compared to the other products available, all products were stickered. Subjects are led to believe this was done due to advertisements restrictions. The margarine is from the brand Blueband and is a regularly used product in the Netherlands. The bread is called in Dutch: “Zaans Bruin”. It is a brown bread made from wholegrain. It has the typical shape and colour for an average Dutch bread. The chocolate sprinkles are from the brand “De Ruijter”, leading in producing chocolate sprinkles since 1860 (De Ruijter, 2019).



Figure 2. Presentation of chocolate sprinkles packaging

In each experimental condition, the participants were presented with 1 of 3 conditions: no depicted portion size, small depicted portion size or large depicted portion size. The small depicted portion size is the recommended quantity (15 grams) by “Voedingscentrum” (Voedingscentrum, 2019). Large depicted portion size corresponds with the estimated amount presented on-pack. A pilot study was done to reproduce the estimated amount depicted on

chocolate sprinkle packaging. Therefore, a large depicted portion sizes consist of an estimated amount of 35 grams of chocolate sprinkles.

3.1.2. MANIPULATION PACKAGING PRESENTATION

This study consists of three conditions: a control group, a small depicted portion size and large depicted portion size. The first condition is demonstrated in Figure 5, a cardboard packaging of chocolate sprinkles (380 grams) with no depicted portion size. The second condition is demonstrated in Figure 3 and represents a cardboard packaging of chocolate sprinkles (380 grams) with small depicted portion size (15 grams). The third condition is demonstrated in Figure 4, a cardboard packaging of chocolate sprinkles (380 grams) with the large depicted portion size (35 grams).



Figure 5. No depicted portion size



Figure 3. Small depicted portion size



Figure 4. Large depicted portion size

The obligated nutritional information is still available on the side of every package with every condition. In every condition, the packaging is covered in white to reduce the possibility of influencing consumption rather than the manipulation. In all three conditions subjects are presented with milk and dark chocolate sprinkles. They are allowed to choose, but not to use both tastings. The stickers used per manipulation are the same for dark and milk chocolate sprinkles. Solely the chocolate sprinkles changed and the colour of the rectangle.

To enhance the randomization of the manipulation within groups and cities, the manipulation changed after every subject. Starting with no depicted portion size, continued with small depicted portion size and finish with large depicted portion size. This was repeated until the preferred sample size was achieved.

3.1.3. SETTING

The experiment is executed from 25 April until 8 May 2019. The experiment was completed in different cities across the Netherlands to ensure diversity in the sample. The different locations used are, among others, a tennis club, a university building and a clothing store. On every location, all three conditions were measured. In every city, a building was selected beforehand and checked whether there was a separate room available. The similarity between the different locations was ensured as much as possible. This means that every location was separated from public areas and was not used while the experiment was done. Before the experiment started, a window was opened to create a natural odour. All rooms were provided with a table (large enough for four

persons), a few chairs and a laptop. Additionally, before the subjects arrived in the room, the facilitator prepared the setting as shown in Figure 6. The subjects were provided with a plate, cutlery, glass of water, margarine, bread, chocolate sprinkles (dark- and milk chocolate taste) and a laptop to fill in the questionnaire. Background music was played softly, to create a more comfortable and relaxed setting. The same playlist was repeated with every location. The subjects were told that the purpose of this study is to investigate the appreciation of typical Dutch breakfast and lunch products including taste. Furthermore, other types of bread spreads (e.g. peanut butter, chocolate paste) were also present in the room although not available for the subject. This was done to enhance the cover-up story.

The experiment was carried out as natural as possible. This means that the subjects could use margarine or drink a glass of water if preferred. While doing the experiment it was not allowed to disturb or come into the room. Multiple subjects (max. 3) could experiment at the same time, but they were allocated to different rooms. This was done to ensure the test was completed individually, without the influence of others. If multiple subjects (max. 3) experimented at the same time, different rooms were used to ensure the experiment was completed individually, without the influence of others. Moreover, they were not able to see each other nor what type of bread spread they applied and how much.



Figure 6. The setting of the experiment

3.2 Participants

We recruited potential subjects through social networking and advertising at universities. They were asked if they met the inclusion criteria: older than 16 years and have no food allergies related to the products consumed. Individuals were excluded from the study when they disliked the food served or guessed the actual purpose of the study right. They would not receive a reward for participating although, consuming a slice of bread with chocolate sprinkles could be a reward in the sense of saturation.

3.3 Measurements

3.3.1. DEPENDENT VARIABLE

In this study, two dependent variables are used. The first dependent variable is the amount of bread spread served on one slice of bread, and the second is the amount consumed.

Served portion

To measure how much bread spread is served on one slice of bread per participant, the packaging of both dark- and milk chocolate is weighed on a scale, before and after consumption. After that, subtracting pre- from post spread serving in grams results in the total grams served per participant.

Estimated consumption

The estimated consumption is an estimation of the total consumed chocolate sprinkles. The consumption of bread and margarine was not included in this variable. If a participant ate the entire slice of bread, 100% of the served portion was consumed. If participants had leftovers, the facilitator made an indication of the estimated quantity consumed (e.g. 50% of the slice of bread was finished). To have an indication of the number of “plate cleaners” and the number of people with leftovers a binary variable was created: finished versus not finished. Eventually, the estimated quantity of consumed chocolate sprinkles was calculated with the formula: grams served multiplied by the estimated amount consumed (e.g. 1 if 100% or 0.5 if 50% etcetera).

3.3.2. MEDIATORS

Two mediators were considered in this study, the first is the estimated appropriate consumption norm and the second is the temptation of depicted food.

Estimated appropriate consumption norm

Estimated appropriate consumption norm was measured with a newly created item in the questionnaire which was based on several studies (Marchiori et al., 2014; Wansink & Ittersum, 2007; Tal et al., 2017). After consumption, the participants are asked to estimate appropriate portion size. Seven different quantities of chocolate sprinkles are displayed in pictures (see Figure 7). The smallest amount equals 5 grams of chocolate sprinkles and the largest equals 35 grams of chocolate sprinkles. The other amounts are 10, 15, 20, 25 and 30 grams of chocolate sprinkles. The subjects were asked to choose, which is according to them, an appropriate portion to consume. The pictures demonstrated in Figure 7 are presented in the same order as in the questionnaire, only the description of amount grams is not visible. The “highlighted” portions are the portions used in the manipulation.

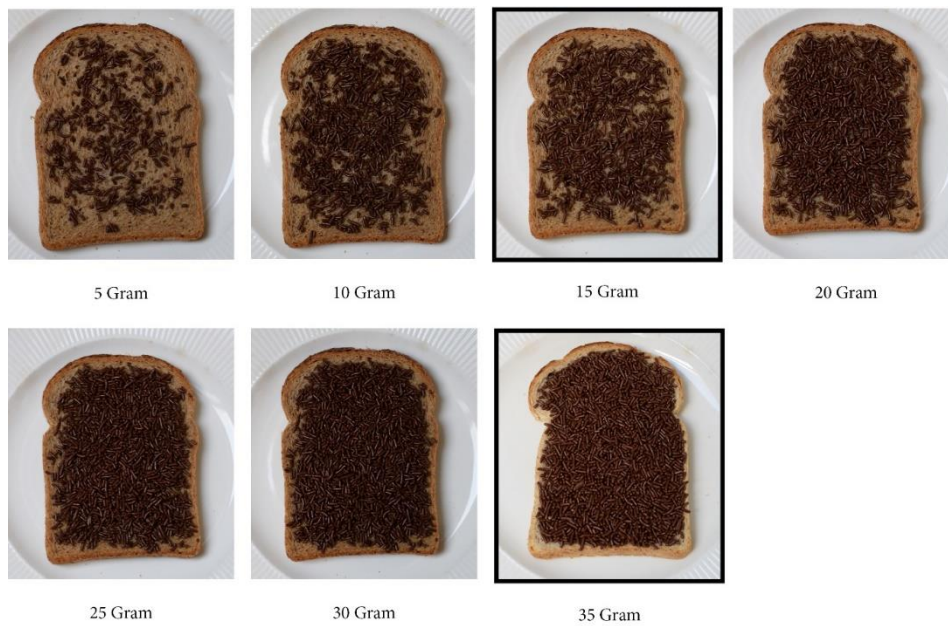


Figure 7. Measurement consumption norms

The temptation of depicted food

Before consuming and tasting, subjects are asked to indicate the temptation of chocolate sprinkles based on three propositions (see Table 2). The first row represents the items in the questionnaire in Dutch. The second row demonstrates the translation of the items. The subjects answered every proposition one by one on a 7-point Likert scale. The left end state was: “strongly disagree” and the right end state was: “strongly agree”. These items were newly created and based on several studies (Spence et al., 2016; Weingarten & Elston., 1991; Bilman et al., 2017). The Cronbach’s Alpha revealed a reliable scale for temptation (Three items, $\alpha=0.721$). To analyse the temptation of depicted food, the average of the three items was calculated. The findings per respondent per item were added up and divided by three.

Constructs	The wording in the questionnaire
The temptation of depicted food	Ik heb zin om deze hagelslag te eten
	Het is verleidelijk om deze hagelslag te eten
	Ik denk dat deze hagelslag lekker is
English translation	I am excited to eat these chocolate sprinkles
	It is tempting to eat these chocolate sprinkles
	I think these chocolate sprinkles are delicious

Table 2. Construct and items in the questionnaire

3.3.3. CONTROL VARIABLES

To measure whether characteristics within the groups were equally distributed across conditions, control variables were created. Randomisation check was carried out with appetite scale, likeability, BMI, age and frequency of consumption as control variables. Appetite scale was measured before the experiment on a 7-point Likert scale ranging from “not very hungry” (1) to “very hungry” (7). Similar to appetite scale, the likeability of the food was idem measured with 7-point Likert scale ranging from “very dissatisfied” (1) to “very satisfied” (7). BMI of the

respondents was calculated with the length in meters and weight in kilograms (Formula: $\text{height}^2 / \text{weight in kg}$). A rating between 18,5 and 25 is considered a healthy BMI (Voedingscentrum, 2019). Lastly, the frequency of consumption was measured with a 5-point Likert scale ranging from “consumed every day” (1) to “never” (5).

3.4 Procedure

Before the subjects could start, informed consent was answered. After approval, the subjects were given a personal number which they needed to fill in in the questionnaire. The experiment started with a short introduction from the facilitator:

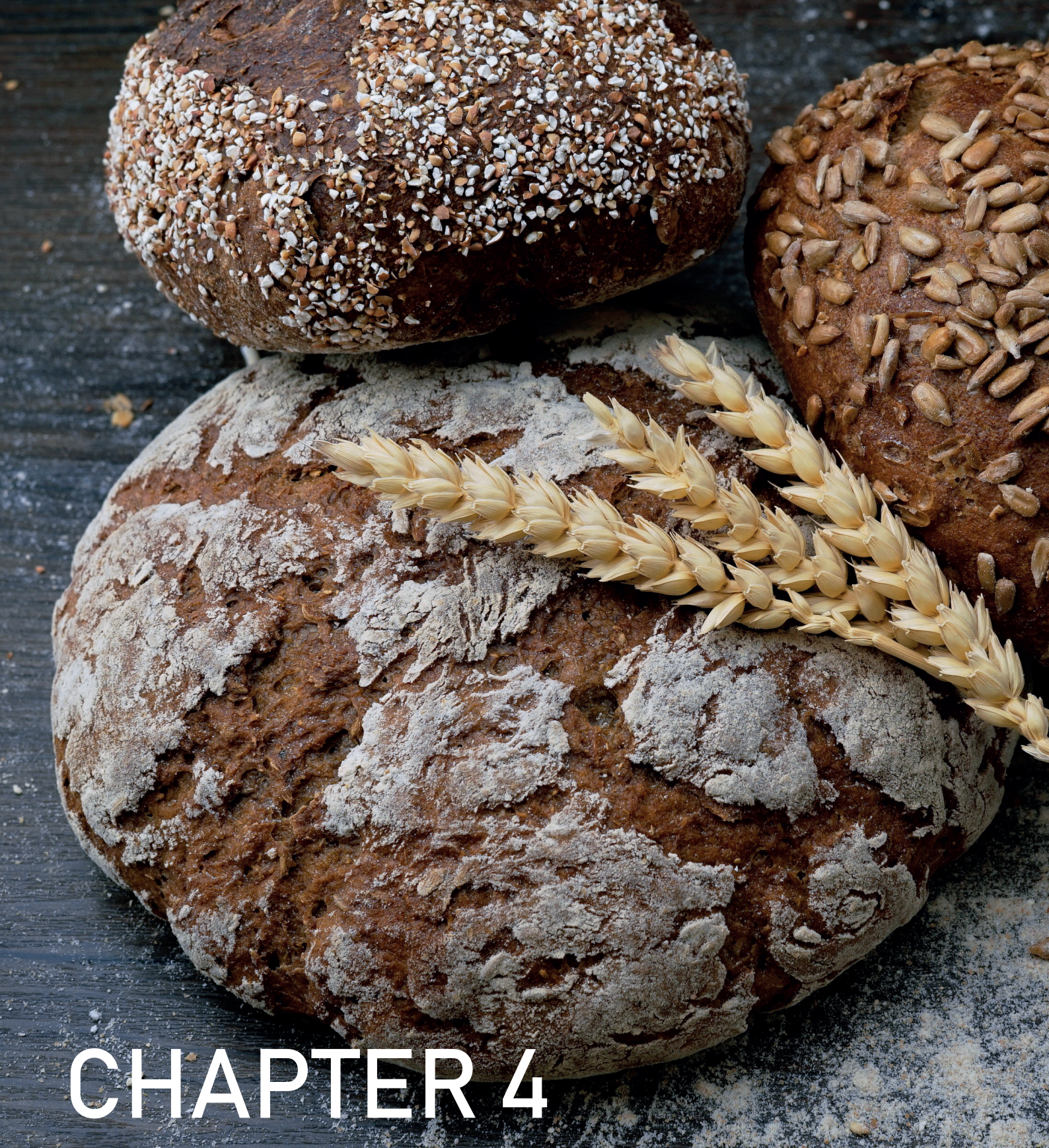
“Hello, thank you for participating in this research. My name is (name of the facilitator), and we are here today to research the appreciation of typical Dutch breakfasts and lunch products including taste. The laptop provides a Qualtrics questionnaire which will guide you through the research and explains what to do. The first question after the informed consent is to fill in your number, this is done to ensure anonymity. From the products I am testing, you are designated to “team chocolate sprinkles”. You can choose between dark- or milk chocolate tasting. First, you will be answering some questions about breakfast products in general and after that, the questionnaire will give you a sign to start eating. Please signal the facilitator when you are finished with the research. Again, thank you for participating and you can start now.”

The questionnaire exists of two types of information: basic information and classification information (Grover & Vriens, 2006). The questionnaire starts with general questions about breakfast products e.g. frequency of consumption, what type of products are frequently consumed, what type of bread you prefer etcetera. These questions are followed up with the propositions of the temptation of depicted food. After completion of these questions, the subjects are asked to consume and taste a slice of bread with the allocated bread spread - always chocolate sprinkles. Afterwards, some questions regarding the research topic are verified (basic information). First, some questions about the taste of the chocolate sprinkles and the assumptions people have. Second, the estimated appropriate consumption norm was measured by indicating a normal portion size. The questionnaire ends with a few questions regarding the control variables such as length, weight, age, etcetera (classification information). Finally, a control question about the actual purpose of the study was formulated. After finishing the questionnaire, the subject was thanked and left the room. The entire questionnaire is available in Attachment I.

3.5 Data analyses

The data were checked for differences across conditions regarding the control variables mentioned in paragraph 3.3.3. The randomisation checks for all control variables were successful (indicated in Table 3, p. 20) and therefore all conditions could be implemented for the analysis of

the results. Furthermore, a Cronbach's Alpha was carried out to check the reliability scale to measure the temptation. A factorial analysis of variance was used to analyse the main effect of depicted portion size on the served portion and consumed portion (H1a and H1b). This also applies to the main effect of depicted portion size on estimated appropriate consumption norm and the temptation of the depicted food (H2a and H2b). Moreover, both Pearson (r) and Spearman (r_s) correlations were applied to analyse the results. Pearson correlation was used to indicate the relationship between variables measured on the ratio or interval level. Spearman correlation was used when one or both variables were measured at an ordinal or nominal level. If a correlation appeared, an unstandardized linear regression was used to discover the explained variances of the dependent variable. These analyses were done using the statistical software package IBM statistics 24. Across all analyses, a significance level of $p < 0.05$ was used.



CHAPTER 4

RESULTS

RESULTS

4.1 Descriptive information and randomisation check

A total of 120 respondents completed the experiment. None of the respondents guessed the purpose of the study right nor disliked one of the product. Hence, no respondent was excluded from the research. Distribution of the (control) variables per condition was successfully achieved with the randomisation check (see Table 3). The average age of the respondents was 28.2 ($SD=12.5$) years (range 18-69 years). The sample groups were equally distributed with 40 respondents per group. The average age per group was: 29.7 years ($SD=13.5$) with no depicted portion size, 26.8 years ($SD=10.7$) with small depicted portion and 29.0 years ($SD=13.4$) with large depicted portion size, no significant difference was found ($F(2,117)=0.52$; $p=0.60$). From the 120 subjects, 42,1% ($n=51$) were male and 57% ($n=69$) were female. A Chi-square test revealed that gender was independent when condition changed ($X^2(2) = 0.82$; $p=0.66$). Additionally, no significant difference was found between the groups in BMI ($F(2,117)=0.10$; $p=0.90$). On average participants, BMI was 23.3 ($SD=3.2$). The average value for appetite across all conditions was 3.2 ($SD=1.8$) which implies that the adults were not that hungry ($F(2,117)=0.12$; $p=0.88$). In terms of likeability, no significant difference appeared between the groups. On average the groups indicated that they liked the chocolate sprinkles ($M=6.1$; $SD=1.1$; $F(2,117)=0.39$; $p=0.68$). Lastly, consumption frequency was verified, no significant difference across conditions was found ($F(2,117)=0.46$; $p=0.63$). Adults indicated to consume chocolate sprinkles on average 1 or 2 days per week ($M=3.9$; $SD=1.1$). Thus, no significant differences appeared between groups.

	No picture (n 40)		Small portion (n 40)		Large portion (n 40)				
Randomisation checks	Mean	SD	Mean	SD	Mean	SD	Df	F	P-value
Appetite-scale*	3.3	1.9	3.1	1.9	3.3	1.7	2,117	0.12	0.88
Likeability*	6.0	0.9	6.2	1.1	6.0	1.0	2,117	0.39	0.68
BMI	23.4	3.4	23.2	2.8	23.4	3.4	2,117	0.10	0.90
Age in years	29.7	13.6	26.8	10.7	28.0	13.4	2,117	0.52	0.60
Frequency consumption**	4.0	1.0	3.8	1.0	3.9	1.0	2,117	0.46	0.63

* 7-point Likert scale

** 5-point Likert scale

Table 3. Randomisation check with control variables

4.2 Chocolate sprinkles served and consumed

The hypothesized main effect of depicted portion size on the served portion and estimated consumption was analysed with a factorial ANOVA. An overview of the descriptive statistics and corresponding test outcome are demonstrated in Table 4.

	No picture (n 40)		Small portion (n 40)		Large portion (n 40)				
	Mean	SD	Mean	SD	Mean	SD	Df	F	P- value
Served and est. Consumption									
Served Chocolate sprinkles (g)	16.5	6.1	20.2	9.5	17.4	7.5	2,117	2.68	0.07
Consumed total (g)	14.5	6.7	17.6	10.1	16.1	6.6	2,117	1.53	0.22

Table 4. Overview of descriptive statistics and test outcome of dependent variables

4.2.1. SERVED PORTION

On average adults served 18.0 (SD=7.5) grams of chocolate sprinkles. A Levene's test revealed a significant ($p<0,05$) p-value when testing homogeneity of variances within the served portion. A Welch correction was carried out, to correct for the unequal variances ($p=0,134$). No significant main effect of depicted portion size appeared on the amount served ($F(2,117)=1.53$; $p=0.07$), rejecting hypothesis 1a (see Figure 8). Adults did not serve significantly more when the on-pack sticker suggested a large portion ($M=17.3$; $SD=5.8$) compared to small ($M=20.1$; $SD=9.5$) and no depicted portion size ($M=16.5$; $SD=6.1$).

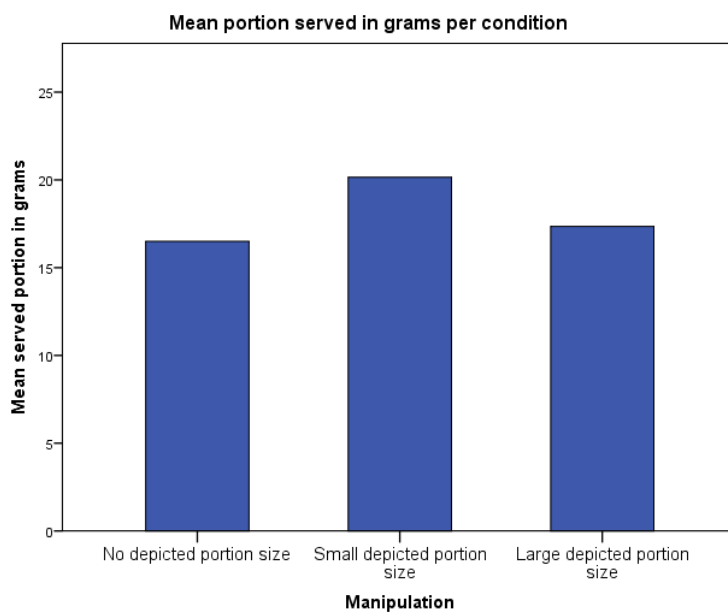


Figure 8. The mean portion served per condition

4.2.2. ESTIMATED CONSUMPTION

To test the effect of depicted portion size manipulation on estimated consumption, again a factorial ANOVA analysis was performed (see Figure 9). On average, estimated is that adults consumed 16.1 (SD=8.0) grams of chocolate sprinkles. Twenty-four adults in total did not finish their served portion. Chi-square test indicated that manipulation was independent of adults finishing their served portion or not ($X^2= 0.94$; $p=0.63$). Thus, the non-finishers were equally

distributed across conditions. No significant main effect of depicted portion size appeared on the amount consumed ($F(2,117)=1.53$; $p=0.22$), rejecting hypothesis 1b. Adults did not consume more when the on-pack sticker suggested a large portion ($M=16.1$, $SD=6.6$) compared to small ($M=17.6$; $SD=10.1$) and no depicted portion size ($M=14.5$; $SD=6.7$).

The correlation matrix considering all variables revealed another relationship regarding estimated consumption (see attachment II, Table 7). Findings suggest that there is positive a significant relationship between appetite and estimated consumed portion ($r_s(118)=0.25$; $p=0.01$). This implies that an increase in appetite influences consumption positively. An unstandardized linear regression with the appetite as the independent variable and estimated consumed portion as dependent variable reached significance $F(1,118)=7.687$, $p=0.01$. Only 6.1% of the variances in the estimated consumed portion can be explained by appetite ($R^2=0.061$), still, a considerable amount is unexplained. However, the regression coefficient reached significance ($t(118)=2.77$; $p=0.01$) and was 1.092. Appetite is for 6.1% of the estimated consumed portion a significant predictor.

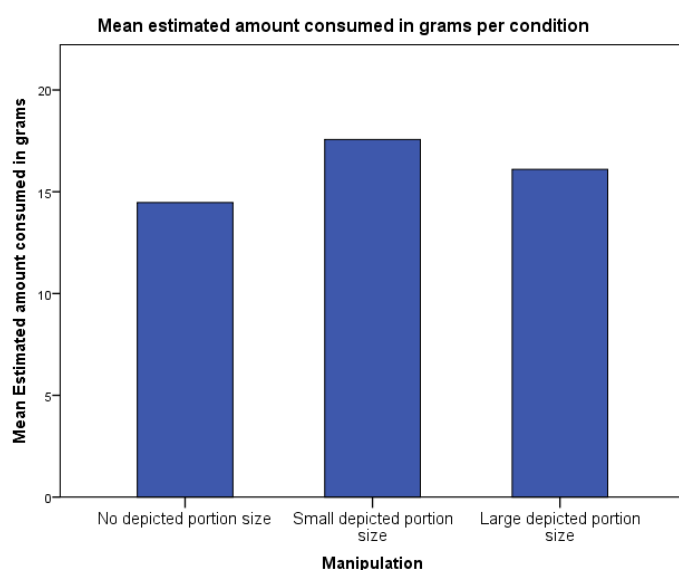


Figure 9. The mean portion served per condition

4.3 Mediators

The hypothesized main effect of depicted portion size on both mediators, estimated appropriate consumption norm and the temptation of depicted food, are analysed with a factorial ANOVA. Table 5 represents the corresponding descriptive statistics and the test outcome. The relationship between both mediators (independent variables) and portion served (dependent variable) was analysed with a Pearson or Spearman correlation.

Mediators	No picture (n 40)		Small portion (n 40)		Large portion (n 40)		Df	F	P-value
	Mean	SD	Mean	SD	Mean	SD			
Consumption norm*	3.4	1.1	3.8	1.2	3.6	1.1	2,117	0.82	0.43
The temptation of depicted food*	4.7	1.1	4.9	1.2	4.9	1.5	2,117	0.21	0.81

*7-point Likert scale

Table 5. Descriptive statistics and test outcome of mediators

4.3.1. ESTIMATED APPROPRIATE CONSUMPTION NORM

To analyse the main effect of depicted portion size manipulation on consumption norms, we performed a factorial ANOVA with the condition as the independent variable and estimated appropriate consumption norm as the dependent variable. However, the main effect did not reach significance ($F(2,117)=0.82$; $p=0.43$), rejecting hypothesis 2a. Depicted portion size did not serve a cue to determine appropriate consumption. Adults with a large depicted portion size did not indicate a larger consumption norm ($M=3.6$; $SD=1.1$.) than adults with a small ($M=3.8$; $SD=1.2$) or no depicted portion size ($M=3.4$; $SD=1.1$). Across all conditions on average an amount between 15 and 20 grams was considered as an appropriate norm to consume.

However, a Spearman correlation (r_s) demonstrate a significant positive relationship between estimated appropriate consumption norm and amount served ($r_s(118)=0.31$; $p<0.00$), confirming hypothesis 3a. This implies that an increase in estimated appropriate consumption norm increases the amount served. An unstandardized linear regression with the amount served as the dependent variable and estimated appropriate consumption norm as independent variable reached significance ($F(1,118)=13.83$, $p<0.00$). Only 10.5% of the variances of the served portion can be explained with the variable estimated appropriate consumption norm ($R^2=0.105$). The regression coefficient of appropriate consumption norm was 2.135 and significant ($t(118) = 3.67$; $p<0.001$). This means that estimated appropriate consumption is significant, but not an enormous, predictor of the served portion.

4.3.2. TEMPTATION OF DEPICTED FOOD

A factorial ANOVA analysis with depicted portion size as the independent variable and the temptation of depicted as dependent variable revealed no main effect ($F(2,117)=0.21$; $p=0.81$). Participants with a small ($M=4.9$; $SD=1.2$) or large ($M=4.9$; $SD= 1.5$) depicted portion size did not indicate the temptation of chocolate sprinkles significantly different than participant without ($M=4.7$; $SD=1.1$) a depicted portion size. Hence, no confirmation was found for hypothesis 2b.

Furthermore, a Spearman correlation was done to analyse the relationship between the temptation of depicted food and portion served. No significant result appeared ($r_s(119)=-0.004$; $p=0.97$), rejecting hypothesis 3b. The indicated temptation of chocolate sprinkles did not change

the amount participants served themselves. However, a correlation matrix considering all variables revealed some more relationships (demonstrated in attachment II, Table 6 and Table 7).

It appears that the temptation of depicted food is positively related to the appetite of the participants ($r_s=0.43$; $p<0.001$). Participants with greater appetite indicated the temptation of chocolate sprinkles higher. Moreover, another positive correlation was found between likeability and temptation of depicted food ($r_s=0.43$, $p<0.001$). Participants who liked the depicted food indicated a higher temptation. An unstandardized linear regression with both variables revealed a significant result ($F(2,117)=23.02$; $p=0.00$). 27% of the variance in temptation can be explained by appetite and likeability (Adjusted $R^2=0.27$). The regression coefficient of likeability was 0.425 and of appetite was 0.231, both coefficients reached significance ($t(117)=4.42$; $p<0.00$, $t(117)=4.12$; $p<0.00$). Hence, both appetite and likeability are a significant predictor of the temptation of depicted food.

4.3.3. BOTH MEDIATORS AS PREDICTOR OF SERVED PORTION

An unstandardized linear regression with both mediators as the independent variable and served portion as dependent variable reached significance ($F(1,117)=6.86$; $p=0.002$). However, the regression coefficient of the temptation of depicted food did not reach significance ($t(117)=-0.03$; $p=0.97$). This implies that the temptation of depicted food is not a significant predictor explaining served portion. The R squared remained the same ($R^2=0.105$), in meanwhile, adjusted R^2 showed some sign of decline (from Adjusted $R^2 = 0.097$ to Adjusted $R^2= 0.090$). This can be explained because only the independent variable estimated appropriate consumption norm affects the dependent variable and explains part of the variance of the served portion.

4.4 Relationship between served and consumed

A Pearson correlation (r) was carried out to analyse the relationship between the served portion and the consumed portion. A strong positive relationship appeared ($r(118)=0.84$; $p<0.00$), confirming hypothesis 4. This implies that an increase in portion served will lead to an increase in consumption. An unstandardized linear regression was accomplished with the served portion as the independent variable and consumption as the dependent variable ($F(1,118)=290.20$, $p<0.00$). A great part of the variance in consumption ($R^2=0.71$) can be explained by the quantity served. The regression coefficient of portion served was 0.89 and significant ($t(118)=17.04$; $p<0.00$). The predicted increase of consumed portion was 0.90 grams per gram of served portion ($B=0.899$; $t(118)=17.04$; $p<0.00$). The served portion is a significant predictor of the estimated consumed portion.



CHAPTER 5

CONCLUSION / DISCUSSION

CONCLUSION AND DISCUSSION

A driver for obesity is growing portion sizes across many western countries. Aerts & Smits (2018) researched the influence of depicted portion sizes on children's consumption behaviour. Their study demonstrated that large depicted portion sizes increased consumption behaviour of children. To contribute to a greater understanding of depicted portion sizes, this study focussed on the serving and consumption behaviour of adults while being exposed to different portion sizes on-pack (none vs. small vs. large), the control group had no portion size depicted on the packaging. This enabled comparison between serving and consumption behaviour when there is no external cue indicating an appropriate portion size. In contrast to the findings of Aerts and Smits (2018), this study demonstrated that a large depicted portion size has no significant effect on serving and consumption behaviour of adults, compared to small- or no- depicted portion size on-pack.

Both Aerts and Smits (2018) and Tal et al. (2017) demonstrated that serving amount increases when exposed to larger depicted portions. Thus, contrary to the expectations, this study demonstrated that adults did not serve more when exposed to a large depicted portion. Subjects served on average 18.0 grams of chocolate sprinkles on one slice of bread. This is slightly more than is recommended by Voedingscentrum - i.e. 15 grams (Voedingscentrum, 2019). The difference in outcome could be due to adults fixed habits regarding consumption and their familiarity with the product. Findings suggest pre-school children are already able to recognize and understand advertisements which can influence children's preferences and attitudes towards food (Preston, 2016). Therefore, children can be more sensitive to influences from the food environment compared to adults, because their food habits are not fully shaped yet. Estimated is that behavioural modification takes around 28 days – one month- to break an old habit and to replace it with another one (Wansink, 2010). Hence, a reason it failed to replicate the study of Aerts & Smits (2018) could be because it is hard to modify adults behaviour related to consumption of high familiar products by exposure of external cues compared to children. When consuming high familiar products, consumption norms are known, this makes adults less reliant on their environment than people who are less familiar with the product. For instance, when a foreigner, who is not familiar with the product, does not know what is acceptable to consume, it will search (unconsciously) for other norms (e.g. external cues) to determine an appropriate servings amount on.

Furthermore, again contrary to the expectations, adults did not consume more when the packaging suggested a large portion. On average, estimated is that adults consumed 16.1 grams of chocolate sprinkles. Similar to the reasoning by serving, adults probably did not consume more because of fixed habits and high familiarity with the product. However, a relationship between appetite and estimated consumption is in line with the literature. The feeling of hunger challenges

the appetite control system and people are more likely to overeat (Bilman et al., 2017). Hence, appetite is a greater predictor for consumption than the influence of depicted portion size.

Moreover, subjects did not indicate a higher estimated appropriate portion size when exposed to a largely depicted portion on-pack. An explanation could be that past behaviour is a more salient determinant to estimate an appropriate portion size compared to the depicted portion size. This is in line with literature explaining that past behaviour and/or consumption norms are a guide to help estimate an appropriate portion size (Wanksink & van Ittersum, 2007). In this case, it can be assumed that the subjects made use of their past behaviour or a different external cue to indicate an appropriate portion.

In line with the expectations, a positive relationship between estimated appropriate consumption norm and the served portion appeared. However, this relationship only indicates that the amount of subjects perceived and indicated as “normal” is in line with the amount they served themselves. How this “normal” portion is determined, depends on influences from past behaviour and/or consumption norms. It remains difficult to make proper statements about which of the two influences has more impact on the decision because humans experience difficulties to retrieve which stimuli caused which response (Nisbett & Wilson, 1977). However, from all the cues available, it is most likely that depicted portion sizes do not influence the served portion.

Furthermore, a depicted portion size was not more tempting than no depicted portion size. In contrast with the expected results, people indicated that they were “neutral” tempted to consume the chocolate sprinkles. As explained by Spence et al. (2016) visual appealing of food can cause visual hunger. Which implies that subjects did not consider the chocolate sprinkles as visually appealing. An explanation for this could be because of prior expectations (Deliza & MacFie, 1996). Most of the people were, despite the container was covered in white, able to identify the brand because of perceptual constancy; recognizing the same pattern/object regardless of the sensory input (Kenyon & Sen, 2016). Familiarity with the brand and sensory properties on-pack can influence consumers expectations (Deliza & Macfie, 1995). Since the appearance of the packaging is not in line with their expectations, visual appeal but also quality perception can decrease. Hence, it could be that the product imagery on-pack was tempting, however since the overall packaging was not in line with their prior expectations, depicted portion size did not have a positive influence on temptation compared to no depicted portion size.

Findings show that the degree of the temptation did not have an influence on the amount served. This could be due to preferences. For instance, when subjects did not like the spread or because it conflicts with prior expectations. The indicated temptation was independent of the portion served.

In line with the literature, a strong relationship between the served portion and the consumed portion appeared. As Geier et al. (2006) explained, a unit of food can be perceived as one, whereas humans have the natural urge to finish a unit. Perhaps because of parental instructions in childhood (Birch et al., 1987) or because of rules/shortcuts to make eating a more efficient activity (Madzharov & Block, 2010). Besides, Dutch adults have strong and fixed habits regarding the consumption of a slice of bread. Hence, because of the familiarity with the product, it is expected that the amount served, is almost the same as, the amount consumed. As expected, people often finish the amount they served themselves.

5.1 Strengths

This research consists of some strong characteristics experimenting in a relatively new field of research. Firstly, random allocation is used in both control- and experimental groups which allowed us to compare all the groups concerning the independent variable (Vaus, 2001). Moreover, with an approved randomization check and an experiment conducted from multiple studies across the Netherlands, more confident can be said that the sample size is representative (Vaus, 2001). Secondly, another strength of the experimental design is the ability to indicate how much direct causal impact depicted portion sizes have on a variable (Vaus, 2001). It enables to make comparisons between post differences between groups. Despite it does not explain why or why not those differences exist, it does demonstrate how big the influence on a variable is. Since this design does not contain a pre-test and the groups were randomly allocated, testing effects were omitted (Shadish, Cook & Campbell, 2002). It is beneficial when the pre-test could not cause more difference in the outcome than the manipulation. Lastly, instead of indicating a simulated natural behaviour, subjects were required to perform the investigated behaviour with a cover-up story.

5.2 Limitations and suggestions for future research

The findings of the experiment in this paper are limited in some respect. A first limitation is concerning experimental designs in general. Experimental studies are not regularly used in social sciences because an experimental design identifies often only one or two variables affecting behaviour (Vaus, 2001). However, in real life, there are often many other factors which may contribute to the actual difference appeared. Since human behaviour is often not that black and white, it is a challenge to build a complex set of factors that produce a given outcome with an experimental design. Thus, experimental designs do allow to conclude something about the size of the impact, however many factors are also eliminated and can not be identified anymore. Hence, future research could investigate which other factors contribute to the increasing portion sizes, and try to answer the “why” question instead of the effect size. Furthermore, it would be interesting to see how the fixed habits of adults could be stimulated to break an old habit and

replace it for a new one. In addition to real-life situations, when executing a field experiment there is less control over what happens to people (Vaus, 2001). This can be partly solved by adding a control group, however, it cannot be entirely sure that both the experimental- and control group are equally exposed to certain unknown and uncontrolled influences (Vaus, 2001). Since the experiment was carried out in different locations, uncontrolled influences from the environment can fluctuate per location. Another research could repeat the same experiment but then in a controlled lab to reduce the unknown and uncontrolled influences.

Secondly, when measuring behaviour, it is more reliable to have a considerable sample size, because the results can be more widely applied. Unfortunately, random allocation and a diverse sample are not enough to generalize the results. To be more confident, replication could be applied. Hence, a suggestion for future research is to repeat the experiment many times with different samples and in different contexts to increase external validity. When the same results are repeated over time, there will be more confident to generalize. If, however, replicating this study fails again with particular types of people under certain conditions, it enables specific boundaries to the generalization. Knowledge is gained about the types of people to whom the results do and do not apply (Vaus, 2001).

Thirdly, a possible explanation for the few articles found regarding depicted portion sizes could be due to the publication bias. According to Franco, Malhotra and Simonovits (2014), significant differences are 40% more likely to be published compared to null results. Perhaps, more studies exist without finding confirmation for this phenomenon, however, these are not published. This makes it seem if this research is an exception to this rule.

Lastly, another limitation is also known as the Hawthorne effect. Although little can be securely said about the conditions and the effect of the Hawthorne effect, McCambridge, Witton & Elbourne (2014) demonstrate that there are influences on behaviour when participants know their behaviour is investigated. For instance, participants could experience cognitive dissonance (Solomon, Russell-Bennet & Previte, 2012). Participants are aware that their behaviour is being investigated and a conflict can arise between their regular behaviour and socially accepted behaviour. To reduce the feeling of dissonance, the participant could change, eliminate or add one of the elements in conflict. For example, the participant could change their normal behaviour to the one what is socially accepted. This could influence the outcome of the results regarding the experimental variable.

Despite that depicted portion sizes did not have a significant effect on serving and consumption the behaviour of adults, we were able to investigate and broaden the understanding of some specific external cues of the food environment. It is interesting to know that the influence of

depicted portion size is product and people dependent, to some extent. It enables a specific boundary to the generalization, knowing that adults are excluded concerning the influence of depicted portion sizes with this kind of bread spread. However, when children's perception should positively be shaped regarding portion sizes, it is recommended to start early in their childhood (Wardle et al., 2003), because modifying behaviour of adults takes more time and it is harder to change habits. If, however, the focus relies on changing habits of adults, this should be done with repeated exposure- i.e. longer than one month. This can even be combined with changing habits towards a more healthy diet, whereas consumption of, for example, vegetables can be promoted. Lastly, the increasing portion size and therefore increasing food intake can partly be reduced by smaller serving sizes. Since serving and consumption are strongly related, it is recommended to serve smaller portion sizes when food intake should cut down.

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I. APPENDIX I: QUESTIONNAIRE



Nederlands

Beste deelnemer,

Deze studie is georganiseerd door de leerstoelgroep van Marketing en Consumentengedrag van Wageningen Universiteit en is onderdeel van een afstudeeronderzoek. In dit onderzoek gebruiken we verschillende methodes om de waardering van Nederlandse ontbijt en lunch producten te meten.

De hele studie duurt naar verwachting ongeveer 10 minuten. Tijdens het onderzoek word je gevraagd een boterham te proeven en te consumeren en daar een aantal vragen over te beantwoorden door middel van deze enquête.

Als je na voltooiing van deze studie nog vragen of opmerkingen hebt, kun je contact opnemen met Susan van Dijk door een email te sturen naar: susan1.vandijk@wur.nl.

Door goedkeuring te geven op deze vraag, geef je toestemming om deel te nemen en erken je het volgende:

- Ik heb de bovenstaande informatie gelezen en begrepen en ik heb een volledige uitleg gekregen van mijn taken als deelnemer en de waarschijnlijke duur van deze studie.
- Ik begrijp dat alle persoonlijke gegevens met betrekking tot mijn deelname aan dit onderzoek strikt vertrouwelijk worden bewaard en verwerkt.
- Ik begrijp dat ik me op elk moment kan terugtrekken uit deze studie de noodzaak om mijn beslissing te rechtvaardigen en zonder vooroordelen. Ik kan kan dit doen door de instructeur te informeren over het terug trekken van mijn deelname.
- Dit onderzoek is uitsluitend voor academische doeleinde en omvat geen commerciële bedrijven.

Ik bevestig dat ik bovenstaande informatie heb gelezen en begrepen en dat ik vrijwillig deelneem aan deze studie.

- ☐ Ja ik geef goedkeuring, start de studie
- ☐ Nee ik geef geen goedkeuring, ik wens niet deel te nemen



Nederlands

Deze enquête is als volgt opgebouwd:

- Sectie 1 - Vragen over ontbijt en lunch producten
- Sectie 2 - Proeven
- Sectie 3 - Smaak en consumptie
- Sectie 4 - Algemene vragen

Wat is het nummer op je ontvangen kaartje?

>>

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Sectie 1 - Vragen over ontbijt en lunch producten

Hoe hongerig ben je op dit moment?

Helemaal niet hongerig

☐ ☐ ☐ ☐ ☐ ☐ ☐

Heel erg hongerig

☒ ☐ ☐ ☐ ☐ ☐ ☐

>>

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Welk van de volgende typische Nederlands ontbijt en lunch product heb je standaard in huis? (Meerdere antwoorden zijn mogelijk)

☐ Pindakaas

☐ Vleeswaren

☐ Hagelslag

☐ Jam

☐ Kaas

☐ Geen van allen

☒ ☐ ☐ ☐ ☐ ☐ ☐

>>

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Nederlands ▾

Hoe vaak eet je hagelslag als broodbeleg?

- ☐ Elke dag (7 dagen per week)
- ☐ Bijna elke dag (5 of 6 dagen per week)
- ☐ Niet elke dag (3 of 4 dagen per week)
- ☐ Soms (1 tot 2 dagen per week)
- ☐ Nooit



>>

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Nederlands ▾

Rank de verschillende soorten brood naar eigen voorkeur.
1 = meest lekkere brood, 5 = minst lekkere brood

- Volkoren brood
- Wit brood
- Bruin brood
- Meergranen brood
- Mais brood



>>

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Nederlands ▼

Geef aan in hoeverre je het eens bent met de volgende stellingen:

Ik heb zin om deze hagelslag te eten

Helemaal niet mee eens

☐ ☐ ☐ ☐ ☐ ☐ ☐

Helemaal mee eens

>>

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Nederlands ▼

Het is verleidelijk om deze hagelslag te eten

Helemaal niet mee eens

☐ ☐ ☐ ☐ ☐ ☐ ☐

Helemaal mee eens

>>

Survey Powered By [Qualtrics](#)

Nederlands ▼

Ik denk dat deze hagelslag lekker is

Helemaal niet mee eens

☐ ☐ ☐ ☐ ☐ ☐ ☐

Helemaal mee eens

>>

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Sectie 2 - Proeven

Naast de vragen over ontbijt en lunch producten ga je nu ook daadwerkelijk een boterham met broodbeleg proeven en consumeren.

Deze studie is zo natuurlijk mogelijk opgezet. Dat betekent dat je gebruik mag maken van margarine en een glas water kan drinken wanneer dit gewenst is.

Je mag nu 1 boterham pakken en deze beleggen met het broodbeleg wat bij jouw op tafel staat. Je bent vrij om zoveel of zo weinig van deze boterham te eten.

Als je klaar bent met eten, klik dan op het pijltje rechts om door te gaan.



Sectie 3 - Smaak en consumptie

In hoeverre ben je tevreden met de smaak van de **hagelslag**?

zeer ontevreden | ○ ○ ○ ○ ○ ○ ○ | Zeer tevreden



In hoeverre ben je tevreden met de smaak van de **boterham**?

Zeer ontevreden
 ☐
☐
☐
☐
☐
☐
☐
 Zeer tevreden



>>

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Geef aan in hoeverre je het eens bent met de volgende beweringen.
Voor elke bewering is één optie mogelijk.

Mijn boterham met hagelslag:

	Helemaal mee oneens	Mee oneens	Een beetje mee oneens	Neutraal	Een beetje mee eens	Mee eens	Helemaal mee eens
is dikmakend	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
te zoet van smaak	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
is zeer calorierijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
is van hoge kwaliteit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



>>

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Bekijk onderstaande foto's.

Welke foto geeft, volgens jou, een normale portie hagelslag weer? (Je kan er één aanklikken).



Nederlands ▾

Sectie 4 - Algemene vragen

Wat is je geboortjaar? (Bv. 1995)

>>

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Nederlands ▾

Wat is je geslacht?

- ☐ Man
☐ Vrouw
☐ Anders

>>

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Nederlands ▾

Wat is je lengte in cm?

>>

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Wat is je gewicht in kg?



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Wat denk je dat het daadwerkelijke doel van deze studie is?

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 (niet nodig als je al op deze lijst staat):

Bedankt voor je bijdrage aan het onderzoek!

Klik op het pijltje naar rechts om de vragenlijst in te sturen.



Bedankt voor uw tijd om aan deze enquête deel te nemen.
Uw antwoord is geregistreerd.



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II. APPENDIX II: CORRELATION OVERVIEW

Correlation overview (Pearson correlations)												
Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1. Served	18.0	7.5										
2. Estimation of consumption	16.1	8	0.84**									
3. Appetite scale	3.2	1.8	0.12	0.25**								
4. Frequency of consumption	3.9	1.1	-0.08	0.03	0.01							
5. Temptation	4.8	1.3	0.04	0.14	0.40**	-0.04						
6. Likeability	6.1	1.1	-0.03	0.00	0.21*	-0.07	0.42**					
7. Consumption norm	3.6	1.1	0.32**	0.17	0.00	-0.08	0.14	0.20*				
8. Manipulation	-		0.05	0.08	0.00	-0.03	0.05	0.02	0.05			
9. Age	28.2	12.5	-0.16	-0.11	-0.01	-0.08	-0.14	-0.1	-0.02	-0.05		
10. Gender	-		0.00	-0.9	0.031	0.05	0.03	0.00	-0.05	0.41	-0.16	
11. BMI	23.3	3.2	-0.03	0.00	0.04	0.04	0.05	0.07	0.12	0.00	0.28**	-0.12

** correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Correlation overview (Spearman correlations)												
Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1. Served	18.0	7.5										
2. Estimated consumption	16.1	8	0.78**									
3. Appetite scale	3.2	1.8	0.05	0.25**								
4. frequency of consumption	3.9	1.1	-0.07	0.06	0.02							
5. Temptation	4.8	1.3	0	0.14	0.43**	-0.1						
6. Likeability	6.1	1.1	-0.07	0.00	0.17	-0.11	0.42**					
7. Consumption norm	3.6	1.1	0.31**	0.15	0.00	-0.09	0.12	0.17				
8. Manipulation	-		0.09	0.11	0.01	0	0.06	0.05	0.05			
9. Age	28.2	12.5	-0.07	0.17	-0.02	-0.08	-0.04	0.01	0	-0.04		
10. Gender	-		-0.02	-0.11	0.03	0.03	0	-0.04	-0.04	0.04	-0.2*	
11. BMI	23.3	3.2	0.03	0.05	0.06	0.07	0.04	0.04	0.13	0.00	0.36**	-0.18*

** correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

