Nudging children towards healthier bread choices: A field study on the influence of bread roll size

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Abstract

Background: The consumption of whole grain foods has various health benefits. Yet, many adults and children do not consume sufficient amount of whole grains. Whole grain bread is an important source of whole grain in the diet. Novel interventions are needed to encourage whole grain consumption in children. This study examines such an intervention, inspired on unit size effect of food. Previous research showed that although people tend to eat more when food is served in larger units (unit size effect), children often like to eat food served in smaller units as these foods look more attractive and are easier to eat.

Objective: To examine whether the unit size effect of bread can be used to persuade children to consume more whole grain bread during a school lunch.

Methods: The experiment was a within-subject cross over design whereby children lunched four times with the offered bread rolls, bread topping and drinks. Two factors were manipulated: the offered unit size of the whole grain bread rolls (small versus large) and the unit size of the white bread rolls (small versus large). 82 children in the age 11-12 participated in the study. After lunch, the children filled out a questionnaire about attractiveness of the bread rolls, tendency to count the bread rolls and satiety. At the end of the study, children filled out a final questionnaire about their habits and attitude towards consuming whole grain bread.

Results: No effect of unit size was observed on the consumption of whole grain bread rolls. Total bread consumption in grams and consumption of white bread, however, was affected by unit size in that children ate more bread in grams when the bread rolls were larger-sized. On average, children consumed 660 calories during the lunch and this energy intake was not affected by our manipulations. However, the relative contribution of toppings in the total number of calories consumed was lower when the bread rolls had a large size. The unit size manipulations did not impact taste evaluations.

Conclusions: Changing the unit size of whole grain bread rolls did not impact the bread choices that children made. But one must be aware that more calories from bread topping will be consumed. Making whole grain bread slices thicker without giving children the choice between whole grain bread and white bread is a suitable intervention that may result in an increase of intake of whole grains.

Keywords: bread, children, choice architecture, nudging, obesity, unit size, whole grain

Preface

This master thesis is a product of my master education at the department Marketing and Consumer Behaviour at Wageningen University. A large number of people have supported me during the 6-months period of writing this thesis. First, I would like to thank my supervisor Ellen Van Kleef who helped me stay motivated and challenged during the whole process. Her extensive knowledge about the subject gave me inspiration and creativity to get the most out of this master thesis.

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1. Introduction

Obesity has become a major concern worldwide among adults and children. In 2012, 13.2 per cent of the Dutch population between 4-20 years old was overweight. Besides this, one in seven children is overweight or obese (Ocké et al., 2008). In the age group from 20 years and older, 47.9 per cent was overweight ((CBS), 2012). This trend can lead to several diseases and disorders such as diabetes type two, heart- and vascular diseases, cancer, depressions and disorders of the respiratory system (Anderson, Hanna, Peng, & Kryscio, 2000; Steffen et al., 2003). A balanced diet is therefore recommended to decrease overweight and limit the risk of diseases and disorders. A balanced diet includes the right amount of proteins, carbohydrates, essential fatty acids, water and fibres. Specially, the intake of fibres reduces the risk of diseases and disorders that are associated with obesity. Whole grain bread contains fibres, vitamins and minerals and it stimulates the digestive system. Next to this, consuming whole grain bread is associated with consuming less refined sugar or sucrose. Consuming high amounts of whole grain is also related with non-smokers, doing more physical activity and with a lower Body Mass Index (BMI) (Jacobs, Meyer, Kushi, & Folsom, 1998).

According to The National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu), children and adults in the Netherlands do not reach their daily-recommended intake of fibres when looking at the contribution of bread on fibre intake. Children from 7-9 years old should eat four slices of bread per day but they only consume on average three slices per day. Children in the age 9-13 years old should eat four-five slices of bread per day but they only consume three-four slices per day (Rossum et al., 2011). The reason behind the insufficient amount of bread intake can be due to the children preferences for refined and sweetened products. The most common reason why children choose certain food products is because they like it, not because it is healthy (Ishak, Shohaimi, & Kandiah, 2013). Next to this, sensory properties and the familiarity of the product play an important role when consuming products. This is a barrier when it comes to consuming whole grain bread by children. Children also prefer white bread as it contains refined, sweetened grain and is without nuts and heavy crusts. Next to this, many parents assume that children dislike whole grain bread and prefer to consume refined bread. This may result that children eat more refined bread (Burgess-Champoux, Marquart, Vickers, & Reicks, 2006; Delk & Vickers, 2007).

Consumers develop their healthy eating habits as a child, this translates into a healthier lifestyle in their adult-life (Burgess-Champoux et al., 2006; Delk & Vickers, 2007). Therefor it is important to address the eating behaviour of consumers in an early stage of life. Campaigns have been designed to increase the fibre intake among children and adults. The Dutch Bakery Centre (Nederlands Bakkerij Centrum) designed nutritional education campaigns including slogans as ‘Whatever you do, whole grain is always good for you’. Still, children eat insufficient amounts of minerals, vitamins and fibres. Policy measures have focused on providing information about the benefits of fibres, but this only tends to result in short-term improvements. People have difficulties to control themselves when tempted by foods they like. Therefore, it is increasingly stressed by researchers and policy makers that environment inspired interventions need to take place to change the eating behaviour of children and adults on the long-term (Brian Wansink, 2013).

Nowadays, increasing attention is being paid to a new intervention approach called 'nudging' (Downs, Loewenstein, & Wisdom, 2009). Nudging interventions aim to facilitate healthy choices of consumers by changing the environment in which these choices are made. As such, nudging refers to "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (Marteau, Ogilvie, Roland, Suhrcke, & Kelly, 2011). Nudging is built on the principle that in today's society, consumers have the option to choose. They can choose what they eat, which education to follow and how much they want to save for their retirement. This can be very attractive but can also result in negative consequences (such as obesity or smoking addiction). Changing the choice architecture, that is changing the environment with unnoticed features, can nudge people to make healthier decisions without restricting them in their options. For example, a study by Hanks and colleagues (2012) showed that sales of healthier foods increased with 18% by making the healthy option more convenient instead of the less healthy option. By presenting healthy foods in an attractive and more prominently way, the likelihood of children choosing that option will increase.

One of the key factors in the food environment that influences how much people eat is the portion size of food (Zlatevska, Dubelaar, & Holden, 2014). Changing the environment can include changing portion size. The unit size refers to the number of units in which a given amount of food is divided We are inclined to finish the portion served to us; the so-called completion compulsion. One of the explanations of the portion size effect is that people consider the unit size of food and take that as a norm of what is acceptable to eat (Kleef, Kavvouris, & Trijp, 2014). As a result, we consume more foods when the food is served in larger units (Geier, Wansink, & Rozin, 2012). Moreover, as unit size increases, consumers find it more difficult to accurately monitor their consumption. This can lead to a higher energy intake (Raynor & Wing, 2007). The aim of this study is to understand whether the unit size of bread rolls can stimulate consumption of whole grain when children have the choice between whole grain bread rolls and white bread rolls. The experiment will be conducted among elementary school children who are 11-12 years old.

As larger units tend to increase consumption, this may lead to higher intake of whole grain bread when whole grain bread rolls are larger-sized. We expect, however, that the opposite is true. Small unit bread rolls could be more attractive to children to consume, as smaller shapes are unusual and hence may provide more pleasure and fun in the choice process. Fun elements in food are very appealing to children (Elliott, 2008). In addition, children may like the feeling that they ate a lot of bread rolls ('the more the better') in case of small bread rolls, which may stimulate the choice for smaller-sized bread rolls.

The key dependent variable in the experiment will be the individual amount of bread consumed. In this experiment two independent variables will be manipulated; the unit size of white bread rolls and the unit size of whole grain bread rolls. The different bread options are presented during the usual lunch break at a primary school. Trained observers collected data of the bread choices of every participating child. Next to this, the consumed amount of bread roll toppings will be recorded as the caloric content of the bread toppings may also change due to our manipulations.

If we better understand how we best present whole grain bread to children, an increase in the consumption of whole grain bread among children and adults can occur. In the long-term, these environmental interventions may hopefully contribute to a decrease of the Body Mass Index among children and a decrease of diseases and disorders that may result from obesity.

2. Theoretical framework

This chapter will focus on the theoretical framework behind nudging and the unit size effect. Chapter 2.1 describes the health benefits of whole grains and the contribution of calories from bread toppings. In chapter 2.2 attentions is given to the development of eating behaviour and cognitive functioning of children. Chapter 2.3 explains the decision making process of individuals and why consumers often do not make choices for their long-term best interest. The general idea behind nudging as behavioural intervention is discussed in chapter 2.4. This includes the concept of choice architecture, which refers to indirect altering the environment to influence decisions that consumers make. The arising tools that can be used to redesign the environment will be further explained. This study will focus on unit size and its implications and will therefor focus on the tool changing unit size. A portion size is the amount of food that is chosen in one occasion. Hereby is one unit for example, one slice of bread. The effects of portion and unit size of food on consumption are further explained in chapter 2.5.

2.1 Health benefits of whole grains

In the Netherlands, the consumption of fruits, vegetables and fibres is below the recommended amount in all age groups (7-69 years). An overview of the recommended and the actual whole-grain bread consumption of children is presented in Table 1 (Rossum et al., 2011). The reason why the intake of whole grain bread is insufficient among children can be due to the sensory properties of the product. Whole grain bread may taste bitter (Bakke & Vickers, 2007). The rejection of bitter is a genetic proposition of every new-born. The acceptability of whole grain products depends on the familiarity, appearance and taste of this product (Rosen, Sadeghi, Schroeder, Reicks, & Marquart, 2008).

Table 1: Recommended and actual bread consumption of Dutch children 7-13 years 1 (Rossum et al., 2011)

	7-8 years total male/ female	**9-13 years male**	**female**
Recommended bread consumption	140 gram (4 slides)	140-175 gram (4-5 slides)	140-175 gram (4-5 slides)
Actual bread consumption	109 gram (3 slides)	133 gram (3-4 slides)	114 gram (3-4 slides)

Grains, next to fruits and vegetables are important products that are included in a healthy diet. Grains are an essential source of food energy as it contains complex carbohydrates, fibre, vitamins and minerals. Whole grains are different from refined grains, as the latter contains less vitamins, minerals and fibres. The American Association of Cereal Chemists International and the Food and Drug Administration defined whole grains as “intact, ground, cracked or flaked fruit of the grain whose principal components, the starchy endosperm, germ and bran, are present in the same relative proportions as they exist in the intact grain”. That means that whole grain foods that undergo processing should include the same propositions as the intact grain. This makes the whole grain hence healthy, little dietary fibres gets removed, and there is little loss of essential minerals

and vitamins (Rawlings, 2006). Products high in fibre are whole-grain breads, cereals, enriched grains, fruits, vegetables, dry beans and peas. Consuming these products will benefit the bowel function and decreased the symptoms of chronic constipation (Kantor, Variyam, Allshouse, Putnam, & Lin, 2001). Next to this, numerous studies showed that higher intake of whole grains is related to a decrease in Body Mass Index (kg/m^2) (Liu et al., 2003; Rose, Hosig, Davy, Serrano, & Davis, 2007; Steffen et al., 2003; Ye, Chacko, Chou, Kugizaki, & Liu, 2012). Moreover, it is observed that consuming whole grains will result in a smaller waist circumference. To sum up, there is existing support that indicates that consuming whole grains is associated with a reducing risk of several deceases, weight loss, and the digestive system. Therefor it is highly recommended to include whole grains into a diet and for a healthy lifestyle (Jonnalagadda et al., 2011).

Calorie intake associated with bread toppings

Consuming bread is associated with the intake of bread toppings. In the Netherlands, people use savoury (cheese, peanut butter, chicken breast) and sweet products (chocolate flakes, jam, apple spread) as bread toppings which are high in fat and sugar. The Dutch Food and Nutrition Centre argues for bread topping with less calories, added sugars, salt and saturated fat. People tend to underestimate the total calories of bread toppings, more health improvements can be achieved by eating healthier bread toppings.

2.2 Eating behaviour and preferences of children

Adults develop their eating habits during their transition from being a baby to the diet they consume in their adult life. This learning process gets influenced by the genetics of that individual and the general predispositions (preference for sweet and rejection towards bitter and sour) (Birch & Fisher, 1998). Food can trigger children's appetite, this is mainly derived from the sensory properties. The five senses are haptic, olfaction, audition, taste and vision. These five senses have been used in marketing to produce subconscious triggers that a consumer perceives of the product (Krishna, 2012). If the sensory attributes of a product or the environment that the product is purchased or experienced in, matches the initial expectations, this positively influences the overall experience by the consumer (Spence, 2012).

Next to the predispositions, children are also inclined to reject new foods. They can have an adverse reaction towards an unfamiliar food, as the food is new for them, this refers to *neophobia*. This reaction can occur by children who have never or have little been exposed to that particular food, for example whole grain products. By learning to consume this product, the neophobia response reduces. So by increasing the number of exposures of new food products (mere exposure effect), the preferences for that product increases. Food is not always consumed because of its nutritional value. Individuals consume it as a source of pleasure, enjoyment or for comfort reasons. Pleasure and fun play an important role in consumer's food intake. Pleasure and fun can be divided into two categories: the product or the event. The product category refers to the thought, care and style of the product. For this research, the focus will lie at the product, whole grain bread rolls, as this will be altered during the intervention. Alba and Williams (2013) speculates that an attractive design increases the pleasure and attractiveness of that product. Next to this, the properties of a food product play an important role, such as taste, texture, quality, smell and appearance. This may determine whether an individual will choose to consume the food or not. The sensory properties are one of the most influential in food decision making. Parents also play a significant role when it comes to food habits of children. Early exposure of different foods is important for the acceptance and

familiarity of food, parents can play a role in this. The environment that parents create is there for important for food acceptance (Birch, 1999; Clark, 1998).

Throughout our lifetime we develop our cognitive functioning and social maturation. Our cognitive functioning is the mental process of storing knowledge, acquire information about our environment, and understanding different situations. Social maturation refers to the process of acquiring attitudes of personal, interpersonal, and social adequacies of other individuals (Lawrence & Jesudoss, 2011). Children undergo different stages to understand different viewpoints. Children in the age of 3-7 years old are egocentric and only have understanding about their own viewpoint, they do not have the full cognitive functioning to think from different perspectives. When children reach the age of seven, multiple viewpoints can be understood. Although combining their own standpoint with other standpoints is an ability they do not yet have. From the age of 11-16 years old, children are able to distinguish between different viewpoints and can adapt to each perspective. They are able to put it into a social context to reach a better understanding. This information about the cognitive functioning is important since children learn how to be a consumer from an early age (John, 1999). Because this study is focussed on children of 11-12 years old, these children are able to distinguish between different sorts of breads. They are able to understand functional and underlying features of white and whole grain bread. Next to this, they can make their own choices by analysing multiple attributes such as health, appearances and tastiness.

2.3 Consumer decision making; habits and the affective-cognitive system

Numerous choices that consumers make are based on direct gratification. They prefer to receive the positive outcome immediately (Ainslie, 2001). We therefor favour the short-time joys and forget the long-term effects of a decision. On the other hand, we will accept a period of non-pleasantness if the end is good (Kahneman, 2012). Many informative campaigns have been designed to change consumer's behaviour, unfortunately with little success. Consumer behaviour is linked to repeated performance situations; it cannot be easily changed with downstream, educational interventions. Downstream educational programmes are focussed on the negative outcomes. Upstream interventions are aimed at preventing these negative outcomes. Nudging is an upstream intervention that focuses on avoiding the negative consequences of an action (Verplanken & Wood, 2006).

Small actions and decisions such as what we have for breakfast or how we travel to work has significant impact on social and economic outcomes for not only the individual but also for society. Habits are decisions that are made subconscious and are a form of non-reflective repetitive behaviour (Verplanken & Wood, 2006). We learn habits by sequences of acts that have been repeated in the past by rewarding experiences and that is triggered by the environment to produce that behaviour (Wood & Neal, 2007). Habits are designed as a functional tool to obtain certain goals or end-states. We eat multiple times per day, most of the people eat at the same place and time. Habits are there for one of the most powerful predictors of eating behaviour, it does strengthens ever time when the behaviour is repeated (Aarts & Dijksterhuis, 2000). Changing a habit is easier if the context changes in which the habitual behaviour is performed. By changing the environment of the eating consumption, a disruption in habit can occur and acting on attentions can arise.

In consumer behaviour, two types of processes can be distinguished when making decisions and creating judgements (Kahneman, 2012). Process one, also referred as System 1, operates automatically, intuitive and triggers the low-order affective reactions and action propensities. It

reacts very quickly with little effort and is based on shortcuts, such as rules-of-thumb. Little thinking is necessary and we often trust the automatic system. System 1 is governed by habits. Driving a car, communicating in your mother language and knowing the answer of two times two are processes that occur in System 1 and are habits that humans acquire during their life. Process two, or System 2, operates deliberative, conscious and rational. This system triggers the high-order cognitive processes to construct decisions and judgements. System 2 is able to think rational and deliberately. Giving the answer of 53x12 or reading a scientific article are activities that are managed by the deliberative system. System 1 operates automatically and System 2 gets activated whenever a task needs to be fulfilled that needs our attention. Flying in an airplane and thinking of crashing is a thought that occurs in System 1. When thinking about statistics, we know that it is very rare to experience a plane crash. This knowledge derives from our System 2. Table 2 summarizes System 1 and System 2.

Table 2: System 1 and System 2, characteristics of the cognitive system (Kahneman, 2012)

System 1 – automatic	System 2 – deliberative
Uncontrolled	Controlled
Effortless	Laborious
Associative	Deductive
Slow	Fast
Experience	Follows rules
Subconscious	Conscious
Intuitive	Rational

We would like to think that we are living beings that think rational, conscious and wisely, that is the *homo economicus*. But in real life, we do not have comprehensive information; we do not think rational and are therefore able to make mistakes. We are the so-called *humans* (R. H. Thaler & Sunstein, 2008). Humans are susceptible for not making the optimum choice. What we choose is influenced by its context such as the default option or habits. Choices that humans make can be self-destructive without realizing it. We make between 200-300 food choices per day (B. Wansink & Sobal, 2007). With this amount, it is expected that we use heuristics when it comes to consumption decisions. Heuristics refers to rules of thumb or mental shortcuts based on readily accessible information. Giving a little push through the intervention nudging, we can make their choices better and healthier.

2.4 Nudging as an behavioural intervention

Nowadays, social scientists showed that individuals do not make rational decisions for their best interest because they lack clear, stable or well-organized preferences. Hereby individuals are seen as decision-makers that are inhibited by the problems of processing information, understanding certain situations, and see the consequences of some actions. If the choice becomes more numerous and varies on different dimensions, humans are more inclined to choose the simple option. These new insights about the human behaviour and this mechanisms and pathways, leads to a new intervention approach called *nudging*.

Nudging is a type of intervention to make small, noticeable or unnoticeable changes in the environment to make the healthy option more preferable. According to Thaler and Sunstein it is possible to nudge individuals into a specific behaviour by making use of the heuristics, emotions,

habits and biases we have. This behavioural intervention is based on the idea of bounded rationality, which indicates that humans are not successful in setting goals and understand their environment because of its limitations. Next to this, humans mostly face inertia, which means the resistance to change and we tend to hold on past lines or experiences (Thaler, Sunstein, & Balz, 2010; Thaler & Sunstein, 2008).

Nudging is an intervention whereby banning an option is not seen as a solution, but making the healthy option more convenient, attractive and normal (Brian Wansink, 2013). This intervention is not based on education or by law but on changing the behaviour directly when choosing the consumption. Researchers think it is possible to influence the behaviour of an individual towards making healthier choices by redesigning the environment where consumers make food choices. Hereby the focus lay within the environment, not with the individual (John, Smith, & Stoker, 2009; Kahneman, 2012; Quigley, 2013). Nudging is focussed on producing considerably positive effects and minimalizes the negative effects with low-level incentives and low costs. The actions followed are modest but require lots of thoughts before implementing.

This study will focus on one type of nudge namely changing the *unit size*. By changing the choice architecture an effect in consumption may follow. Altering the unit size of a healthy product (whole grain) and a less healthy product (white bread) is an intervention that can influence the choice that children make. It is an intervention that is subtle and gives the children a little push towards the right direction.

Choice architecture and basic principles

Traditional approaches to change the eating behaviour of individuals and decrease obesity have always been focused on the individual rather than on environmental factors. Individual factors include education strategies and dieting, environmental factors relate to mechanisms throughout the organization to encourage positive health actions (Peersman, Harden, & Oliver, 1998). Thaler and Sunstein created the term choice architecture. Choice architecture refers to redesigning the environment to influence the choice that decision-makers obtain. A choice architect refers to anyone who presents people with choices. There is not one unbiased way in which choices can be presented. Any way in which choices are presented influences the final decision. Every choice presentation contains a default option, every option that is assigned to be default is the most chosen option. Choice architects face the challenge to decide how many alternatives to present. Two fundamental issues are important: first, more options increase the chance of proposing a preference for each consumer and second, more alternatives gives more cognitive constraints to the consumer. A consumer prefers to have a few number of options that will encourage rational consideration that will not come across as overwhelming (Skov, Lourenco, Hansen, Mikkelsen, & Schofield, 2012).

Nudging can be seen as the movement ‘libertarian paternalism’, where libertarian refers to freedom of choice. Paternalism refers to a policy where it is legitimate to influence the environment to increase one particular choice (Bonell, McKee, Fletcher, Wilkinson, & Haines, 2011; Thaler & Sunstein, 2008). This new movement can bring ethical issues along. The law cannot interfere in the freedom and sovereignty of individuals. Individuals are according to the law, capable of making their own decisions regarding their lifestyle. The government should allow citizens to make their own choices as long as they do not harm other people. Consumers are aware of the choices they make and the consequences although the decisions may not be for their best interest (Thaler & Sunstein, 2008).

Key nudge examples in the food domain

A field study by van Kleef et al. (2012) showed that increasing the assortment of healthy snacks at the checkout counter (75% healthy snacks versus 25% less healthy snacks) resulted in an increase in sales of healthy snacks. This study shows that altering the position of an assortment increases the consumption of healthy snacks. A second study by Wansink & Hanks (2013) shows that the order in which a breakfast line is served can influence the overall decision-making. Participants were more inclined to choose products from the first breakfast line rather than the second breakfast line. This is due to the nudge 'choice over time', consumers are disposed to want direct gratification. A third study by Thorndik and colleagues (2012) shows that in a large hospital cafeteria healthy products that were labelled with a green sticker increased in sales during the intervention. Vice versa, unhealthy products that were labelled with a red sticker decreased in sales. This intervention showed that using colours for food products is a nudge that can be used to steer a consumer into a healthier. These studies display that by changing the choice architecture, consumers can be nudged into making healthier choices (Table 3).

Table 3: Examples of studies examining nudges in the food domain

Research	Intervention	Choice architecture tool	Result
(Kleef, Otten, & Trijp, 2012)	Shelf arrangement was altered by putting healthy snacks at higher shelves versus lower shelves (25% healthy and 75% less healthy, vice-versa).	Positioning of options: The way in which the set of options is presented has an impact on the choice behaviour.	Higher probability of choosing a healthy snack choice when 75% of the assortment consisted of healthy snacks compared to an assortment of 25% healthy snacks.
(B. Wansink & Hanks, 2013)	Two lines of breakfast were served. The order between the two lines was reversed (least healthy to most healthy, vice-versa).	Choice over time: Decision-makers want direct gratification. Which option is first presented, influences the overall decision-making.	With buffet foods, the first ones seen are the ones most selected. Over 75% of diners selected the first food they saw.
(Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012)	In a large hospital cafeteria food products and beverages received a colour-coded label (red=unhealthy, yellow=less healthy, green=healthy).	Sensory default option: Change the sensory perception of products.	A colour-coded labelling intervention improved sales of healthy items and was enhanced by a choice architecture intervention.

2.5 Unit size

This chapter focuses on unit size as this variable will be manipulated in the field experiment. The unit size of food refers to the number of units in which a given amount of food is divided. Two portions equal in quantity may be different in unit size (Kleef et al., 2014).

Distinctions between portion size and unit size

Portion size and unit size are not the same. Figure 1 shows that two portions of pizza that are equal in portion size contents (grams of pizza) can be different in terms of unit size (4 slices/units instead of 1). In unit size studies, the same amounts of food is typically offered in all conditions but the unit size of food differs. This is in contrast to the typical portion size study in which the total weight of food that is given to participants is manipulated (Kleef et al., 2014). When people consume more food when they are confronted with larger portions refers to the 'portion size effect'. Not only adults are affected by this effect but also children (Piernas & Popkin, 2011).

The portion size effect is in one line with the unit size effect, whereby consumers eat less of a unit if it is offered in a smaller size (Kleef et al., 2014). The unit size effect has primarily been studied among foods with high hedonic gratification, and less research is done on the effect of unit size for more utilitarian or healthy foods. Products for hedonic gratification are characterized by an affective multi-sensory experience that includes taste, sounds and visual images, such as pizza or chips (Hirschman & Holbrook, 1982). Utilitarian food products are cognitive based, goal oriented and achieves a functional task, for example fruit, vegetables or bread (Dhar & Wertenbroch, 2000).

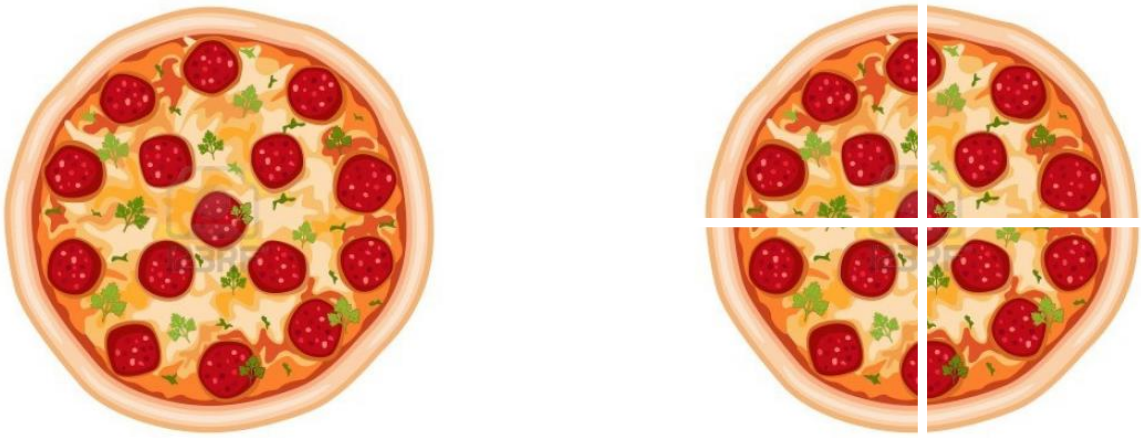


Figure 1: Illustration of the difference between portion versus unit size

Empirical evidence on the effect of unit size on food intake

Most of the studies treated unit size and portion size as one, little studies have only been focused on food-item size. Studies aiming on portion size manipulate the overall amount of food whereas studies on unit size alter the size of the food and keep the overall amount of food constant. Next to this, numerous studies focussing on portion size have been focussed on adults, little on children. (David Marchiori, Waroquier, & Klein, 2012).

The study by Geier et al. showed that in a work office more M&M's (small spoon or larger spoon), Tootsie Rolls (3 grams or 12 grams), and Pretzels (1,5 oz or 3 oz) were consumed if they were presented in larger units (Geier, Rozin, & Doros, 2006). Another study done by Raynor & Wing (2007) let participants receive a snackbox with four different food items. The package contained either small unit or larger unit snacks. An increase of 81% was found in the group who received the larger unit snack box. This study shows that the amount of food available to eat influences the overall intake. A study by Marchiori and colleagues (2011) evaluated the effect of changing the unit size of snack items. The study shows that by offering small unit snacks, fewer grams will be consumed. A summary of the studies can be found in Table 4.

Table 4: Summary of unit size studies

Research	Intervention	Result
(A. B. Geier et al., 2006)	In a work office, employees were offered small and large units of Tootsie Rolls, pretzels and M&M's.	The amount of food that the employees selected increases when it is offered in large units.
(Raynor & Wing, 2007)	Participants received a box with four different snacks, ranging from small to larger unit sizes and single or family serving packages.	A 100% increase in the amount of food provided showed an 81% increase in consumed energy. No effect of package unit size was found.
(D. Marchiori, Waroquier, & Klein, 2011)	The study evaluated the effect of altering the size of candies (small versus large) of equal-size food portions.	The study shows that using smaller candies, consumers ate half of the total grams offered with an decrease of 60 calories compared to the other group.
(Geier et al., 2012)	Two groups who ate chips from a cylinder (Pringles) without a segmentation and one group who ate chips from a cylinder with a red chip as interval.	Segmenting a package may reduce the consumption by three mechanisms: calling attention, suggest smaller portion norms and break automating eating habits.
(Wansink et al., 2011)	Can individuals accurately track their intake and reduce calorie intake by giving four 100-calorie packages instead of a 400-calorie package.	On average, 25.2 per cent is less consumed when given four 100-calorie packages.

Supposed underlying mechanism explaining unit size effect

What would explain the differences in food consumption given different unit sizes of food? Basically, there are four related explanations: (1) unit size represents a norm of what a suitable portion is, it serves as a benchmark is of what people find appropriate to consume. Consumers rely on perceptual indicators such as their plate; it gives an implicit norm of a certain quantity (B. Wansink & Ittersum, 2007). A larger unit can bias people to estimate the amount of food that has been served. Consumers set their consumption norm to a number of food items instead of the total amount of grams. Thus a consumption norm proposed what is acceptable to eat but also to finish the consumption (Wansink, 2004; Wansink & Sobal, 2007).

The second related explanation is numerosity. Consumers are overly sensitive to numbers as a cue for quantity. Numerosity refers to the number of units; children may confuse numerosity with quantity. Humans see the number of units as a cue of what is appropriate to consume, it is an approach to monitor consumption. Not only for children but also for adults it is very difficult to resist the numerosity cue as it happens effortless in System 1 (Pelham, Sumarta, & Myaskovsky, 1994). In general, more pieces of something are always more of something. For example, children may prefer two coins €0,50 instead of one coin of €1, -. Geier and colleagues (2012) conducted a study whereby a cylinder of chips (Pringles) included segmentations by inserting a different colour of chip (red), which indicated a cue to interrupt the consumption. This manipulation reduced the calorie intake with 250 calories. The authors argued that using segmentation cues with high-caloric foods could have positive effects on intake and eventually weight control. This research showed that by making a simple segmentation manipulation, the numerosity heuristic could be blocked (Kleef et al., 2014).

Third, smaller units may impact consumption monitoring. Keeping track of how much you eat is an essential component of self-control and it may decline when larger portions are eaten (Baumeister, 2002). As the unit size of food increases, it will be more difficult to determine the total number of servings for consumption. Because of this reduced accuracy of consumption monitoring, more may be consumed. This could be due because people find it more difficult to regulate the amount of servings they have consumed. Next to this, larger units can mislead people as it may provide false information about the actual servings they consume because the amount of food provides a guidance for consumers (Raynor & Wing, 2007). Self-control refers to ‘ the self’s capacity to alter its own states and responses.’ Smaller units may be harder to keep track of because people can lose track of their behaviour. Hereby, there self-control is put on a hold (Bell & Pliner, 2003). Research shows that the environmental context of the food choices and eating behaviours of others influences young children’s food preferences. For children, competitive goals in how much they eat may also play a role. They are inclined to think ‘the more, the better’.

Fourth, smaller units may be more attractive to children. Attractiveness plays an important role in the food consumption of children. Because utilitarian consumption is less pleasurable than hedonic consumption it is important to make the sensory properties of utilitarian products more attractive (Alba & Williams, 2013). Smaller units may indicate more fun for children than normal or larger unit sizes of food. Hereby the vision of the sensory properties gets triggered. A smaller-sized food item may also attract more attention as it new and unusual. Wansink and colleagues (2013) showed that pre-slicing fruit in smaller pieces in school cafeterias increased consumption substantially. By making whole grain bread more fun and attractive, an increase in consumption may follow.

We propose that children will be influenced by the unit size of bread rolls. Making the bread rolls more attractive may lead to an increase in the amount of bread rolls consumed and increases the child's expectation of the food (Brian Wansink, 2013). Next to this, the numerosity effect may lead to an increase of consumption as children are inclined to count the number of units as people prefer more of something as it usually gives more of something (Pelham et al., 1994).

2.6 Conceptual model and hypotheses

The unit size of bread refers to a small unit size and a large unit size of the different bread rolls. The model will focus on two mechanisms explaining the unit size effect. These mediators are attractiveness and tendency to count the bread rolls. The attractiveness is applicable to the design of the bread, namely a small unit or a large unit. The tendency to count the bread rolls relates to numerosity as children count the number of bread rolls consumed. The model will be tested during a field experiment. Next to this, attention will be given to the other mechanisms explaining unit size effect, consumption norms and consumption monitoring. These aspects will be analysed by questionnaires. The conceptual model is presented in Figure 2.

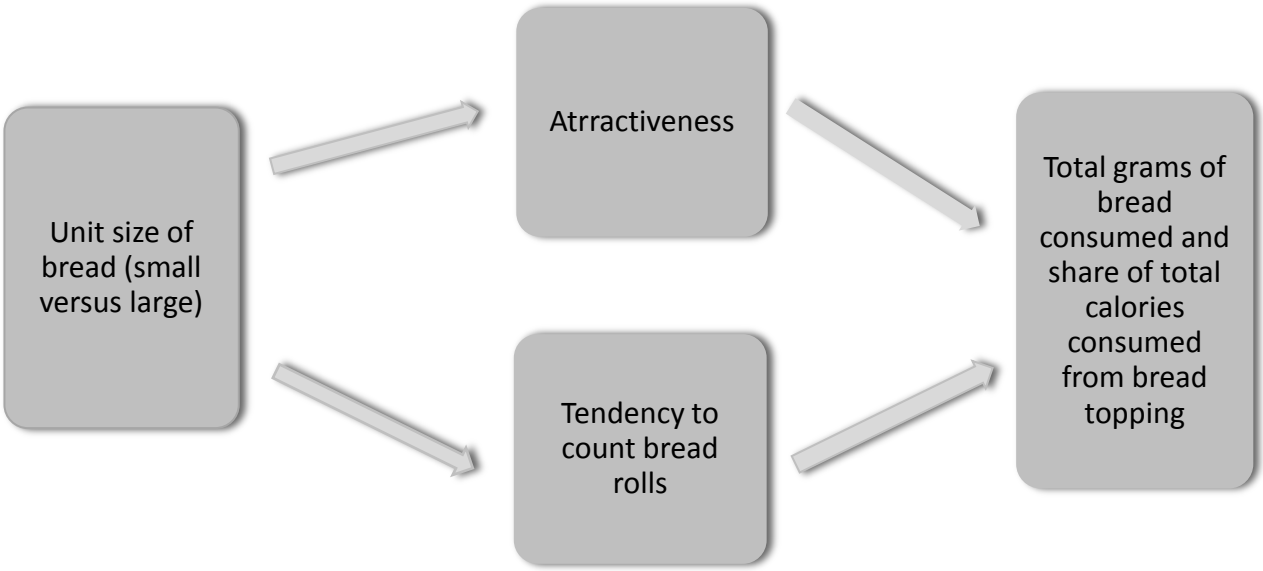


Figure 2: Conceptual model

The following hypotheses will be tested the field experiment. The first hypothesis builds on the premise that smaller-sized bread rolls are attractive to children and this may lead to higher intake. Children may find the smaller bread rolls more attractive as they are different than conventional bread roll available in the supermarket or bakery.

H1: *Children will consume more grams of bread when all the offered bread rolls are small sized compared to large sized.*

Because of the fun and competition effect, we also expect an interaction between the unit size of white bread rolls and the unit size of whole grain bread rolls. That is, we hypothesize that the largest increase in whole grain bread consumption would occur in the condition where the whole grain breads are small sized and the white bread rolls are larger sized.

H2: *Children will consume more grams of whole grain bread when the offered whole grain bread rolls are small sized and the offered white bread rolls are larger sized.*

Bread toppings are often served in units ready to be put on a bread slice or roll. For example, cheese is typically sliced in portions of 25 grams. In our study, the bread toppings were provided in one single portion packages. Hence, the unit size effect may also apply for bread roll toppings in that children may use the same amount of bread topping on small sized and large sized bread rolls. Understanding the effect of unit size of bread rolls on consumption of bread toppings is relevant as bread toppings are not only a source of valuable nutrients, they are often also calorie dense due to high amount of sugar (e.g. jams) or fat (e.g. cheese and meat) (Voedingscentrum, 2013). As it is likely that children will eat a higher number of bread rolls when these rolls are smaller-sized, we expect that this lead to more consumption of bread toppings. In other words, the total calories from bread toppings during lunch will be higher when bread rolls are smaller sized compared to larger sized.

H3. *Children will consume more calories from bread toppings when the offered bread roll units are small compared to large sized.*

3. Methodology

To understand the influence of the unit size of bread rolls (small unit size versus large unit size) on consumption of both whole grain and white bread rolls, a field experiment was conducted and surveys were filled out among 11-12 year-old children on primary school. Next to this, a final questionnaire about the habits and attitudes towards bread consumption was completed.

3.1 Field experiment

The study was conducted on a primary school in Gendt in the Netherlands. It was conducted in a total of four days allocated over three weeks, three Tuesdays and one Thursday. The field experiment was conducted in week 21 until 23 (May 20th, May 22nd, May 27th, and June 3rd 2014). The Dutch Bakery Centre, the knowledge and advisory centre for the bakery industry in the Netherlands, supported the study by delivering the bread rolls for the study. Nine students from WURkforce and two employees from Research Institute Food and Biobased Research gave assistance during the three weeks of data collection and facilitated with each lunch.

Participants

The participants were Dutch children on the primary school De Vonkenmorgen in Gendt. The participated children are 11-12 years old. Three classes of group 8 participated in the research. The three groups A, B, and C contained respectively 28, 25 and 28 children.

Design

A within-subject crossover design was used to examine the effect of unit size on bread and bread toppings intake. Three classes, in total 82 children were served a series of four lunches, which varied only in the unit size of whole grain bread rolls and the unit size of white bread rolls. The smaller unit bread roll weighted 30 grams and the larger unit bread roll weighted 60 grams. The classes were assigned to the experimental conditions. All the children in each class were assigned to the similar condition to prevent awareness of the experimental manipulations. The four conditions are presented in Table 5.

Table 5: Four different conditions, white versus whole grain and small versus large

	Small whole grain bread rolls	**Large whole grain bread rolls**
Small white bread rolls	Small white bread rolls versus small whole grain bread rolls	Small white bread rolls versus large whole grain bread rolls
Large white bread rolls	Large white bread rolls versus small whole grain bread rolls	Large white bread rolls versus large whole grain bread rolls

Figure 3 represents the four different conditions in a different layout. It is a visual representation of the different bread rolls that were used for the experiment.

		Unit size white bread rolls	
		Small	*Large*
Unit size whole grain bread rolls	*Small*		
	Large		

Figure 3: Visual representation of the study design

Three classes in total of one primary school participated in the experiment. Each class was assigned to one condition per day according to the randomisation scheme (see Appendix III). At the end of the four days of data collection, each class received all four conditions. The bread rolls were provided by the Dutch Bakery Centre, they provided sufficient amount of white and whole grain bread rolls during the experiment. Each class received 120 large bread rolls or 240 small bread rolls.

Procedure

Four weeks preceding the study, the primary school and all the parents of the children of group 8 received information about the study, this included background information, goal and procedure of the study. All the children could participate in the experiment, if a parent was not in favour of their child participating the study, the child did not had to take part of the lunch. Before the lunch started, trained observers accurately counted the bread rolls according to the randomisation scheme. This to make sure that the correct number of bread rolls for each condition was placed in the right breadbasket. The two different bread rolls were placed in two different baskets (see Figure 4). Each class received two extra breadbaskets to refill if needed. The bread rolls, drinks and bread toppings were delivered the same day when the lunch took place.

Figure 4: Example of offered bread rolls: whole grain bread rolls and white bread rolls

The observers took care that the correct breadbaskets were in place in each class before lunch started. Each child received a sticker with his or her name, which they had to stick on their chest. They also received a plastic bag with their nametag that included a knife, cup and a plate that they could use for the bread lunch. After receiving their own plastic bag with content children could choose one bread roll at the time. The children could consume as little or as much bread rolls as they would like. If the children selected a bread roll, the observers noted which bread roll each child had chosen. Children could freely choose which bread toppings and which drink they would like to consume. After finishing their first bread roll, they could get a second bread role and a third bread roll until they were satisfied. When children finished their lunch, they were instructed to enclose the leftovers of their bread rolls, bread toppings, litter, plastic plate, knife and cup in a plastic bag with their own nametag on the plastic bag.

Food supply

Next to the bread rolls, the rest of the lunch products were supplied, such as drinks and bread toppings. The type and assortment of toppings was selected based on the recommendations of the Dutch Nutrition Centre (Voedingscentrum). The beverages that were used for the study are orange juice, water and semi-skimmed milk. For bread topping this comprises cheese (30+), ham, chicken breast, strawberry jam, peanut butter, apple spread and halvarine. Children could consume as much or little bread topping and drinks as they would.

For this study, it was important to note how much bread topping each individual has consumed to accurately monitor consumption on an individual basis. Therefore, the bread toppings were all provided in single packages. Each class received seven baskets with single portion bread toppings. Each group of children in a class received one basket with the different sort of bread toppings. If a bread topping item was no longer available, researchers could refill the basket. Prior to the lunch, observers noted how much bread topping each basket comprised.

Figure 5: Basked with bread toppings provided during lunch

Measures of bread consumption in quantities and grams

The key dependent variable is the individual amount of bread consumed. The total number of white and whole grain bread rolls per condition, per class, was counted prior to the lunch and after the lunch. This to make sure that the observers accurately noted the number of bread rolls consumed by the children. The data was collected on an individual base; this provided a precise insight into the amount of bread rolls consumed and information about the amount of bread topping consumed per

participant and further inferences. The observers collected all the plastic bags and unbeknownst to the children, the observers noted how much bread leftover a child had (noted by 0.5 bread roll or 1.0 bread roll).

Figure 6: Assistant who notes the bread topping consumed by a child participant

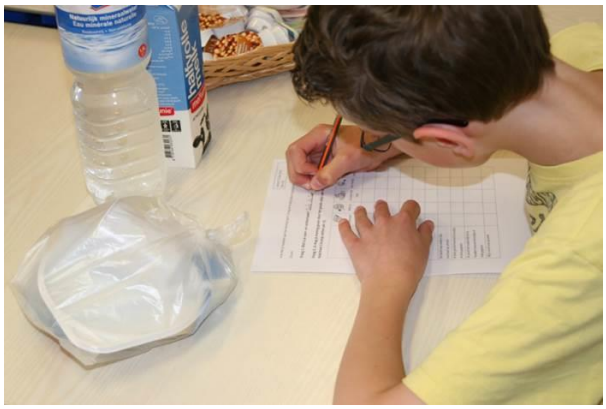


Figure 7: A child participant who is filling out a questionnaire

Measurement of bread topping

After lunch, the observers counted every bread-topping package per child. Any leftover bread toppings that were not used were counted and noted. It was checked if the missing bread toppings matched the bread toppings that were consumed. The observers collected the plastic bags of all the children and noted how much bread toppings each child had consumed. Here for, all the plastic bags needed to be reopened and scanned which bread toppings the children used and it was noted if a bread topping package was not fully used (noted by 0.25, 0.5 or 1.0 leftovers).

Data analysis

For each participant, data was collected about the sort of bread roll consumed, the quantity and which bread toppings were used during lunch. The total number of bread rolls consumed and bread topping per participant was used for statistical analysis. The data is analysed by using Linear Mixed Models by SPAW (SPSS), with p-value ≤ 0.05 for statistical significance. For this study, the subjects' variables are 'group' and 'participant number'. The repeated variable is the 'day of the experiment'. For this study the key dependent variable will be the individual amount of bread (whole grain, white and total) consumed. The independent variables are unit size of whole grain bread rolls and the unit size of white bread rolls.

Linear Mixed Models refers to the use of both fixed and random effects in the same analysis. In this study, fixed effect denotes the four treatments; unit size of whole grain bread rolls (small or large) and the unit size of white bread rolls (small or large). Random effects refer to the three different groups and individual participants. An advantage of the Linear Mixed Models is that it is able to deal with missing values; therefor participants that missed one treatment can still be included in the dataset.

3.2 Survey after lunch among participatory children

Immediately after lunch, each child that participated was asked to fill out a questionnaire about the attractiveness, tendency to count the bread rolls, consumption monitoring and satiety (see Appendix I for full questionnaire in Dutch). The questionnaire took about 10 minutes to fill out and observers made sure that every child received one questionnaire. When all the children were finished with the questionnaire, the observers collected all the surveys.

Measures

To test the model's two mediators, the questionnaire comprised two concepts, namely 'attractiveness' and 'tendency to count bread rolls'. The item that captured the concept attractiveness of the bread rolls is the question 'the bread rolls looked attractive'. Two items were included to measure children's tendency to count bread rolls during lunch: 'I have counted the number of bread rolls I have eaten' and 'I thought it was easy to keep track of how many bread rolls I have eaten.' Showed an Cronbach's α of 0.83.

The items 'It was immediately clear which bread roll I wanted' and 'my lunch was healthy' were included to give insights into the choice evaluation that children undergo when choosing a bread roll. Next to this, we measure the concept 'overall lunch was tasty' with the questions 'the lunch was tasty' and 'the bread rolls were tasty'. These items showed an Cronbach's α of 0.77. We also checked whether children noticed any differences in the offered lunch compared to the large lunch at school by including the item 'the lunch was different than normal at school'. All these items could be answered on a 5-point likert-scale with smileys. The scale is as followed: 'Not at all', 'Not really', 'I don't know', 'A little bit' and 'Very much'.

In the questionnaire the children could note how much white bread rolls and whole grain bread rolls they thought they had consumed. These questions are included to examine whether children keep track of how much they eat. This is in one line with consumption monitoring which is one out the four mechanism of the unit size effect. The questionnaire finished with questions if they consumed less, the same, or more bread and bread topping than usual during lunch at school. The last question is about their overall satiety. For this purpose, we used the specifically designed measurement instrument of Faith and colleagues (2002) who use an ordinal silhouette scale with increasing numbers of circles in the stomach region to indicate increasing levels of fullness (see Figure 8).

In addition, all children had to indicate whether they consumed more, less or the same amount of bread, bread topping and drinks than they would normally do during a lunch at school. Five point answer scaled were used 'much less than normal', 'less than normal', 'the same as normal, 'more than normal', and 'much more than normal'.

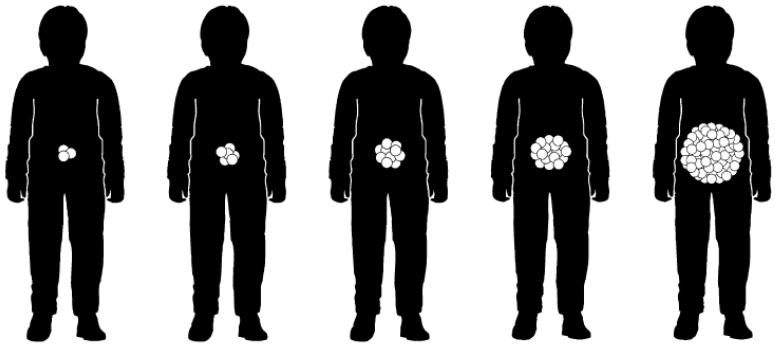


Figure 8: Satiety silhouettes

Data analysis

Data from the surveys were analysed by SPAW (SPSS) using Linear Mixed Models, with *P-value* ≤ 0.05 for statistical significance. Results of the questionnaires were used to indicate significance between the consumption of whole grain bread and other variables for example the attractiveness of the bread rolls or the satiety of the children after lunch.

3.3 Children survey about habits and attitudes towards bread consumption

This section provides an overview of the habits and attitudes towards bread consumption. It will also give attention to the fourth and last mechanism of unit size effect, namely the norm of what children find appropriate to consume during a typical lunch.

At the end of the four lunches, the children filled out a final questionnaire. This survey took about ten minutes to complete. The first item 'how many times do you eat whole grain bread during lunch' gives insight in how often children in a normal setting consume whole grain bread during lunch, what the norm is among the children. The following items 'when I eat bread, I always choose what I find the most tasteful', 'I think white bread is healthy', 'I think whole grain bread is healthy' and 'I think that whole grain bread is healthy' 'a tasty lunch is important for me' and 'a healthy lunch is important to me' measures the concept attitude and habits towards consuming bread rolls. The items 'consuming a lot of bread is not good for you', 'the more bread you eat, the better it is for you' gives insight into the general knowledge concerning whole grain bread among the participatory children.

The question about age and gender gives knowledge about the demographic background of the participatory children. Results of the final questionnaires were used to indicate the habits and attitudes of the children towards bread consumption. Demographic information about the subject is analysed by using Descriptive Statistics.

4. Results

4.1 Field experiment

This section will contain the results of the field experiment, the surveys after each lunch and the final surveys about the habits and attitudes of the children towards lunch and bread. General information about the participants will be analysed and the three hypotheses will be tested.

Descriptive information participants and bread roll consumption

The data that is used for analysis contains the actual consumption of the children. Any left-overs are deducted from the total bread rolls and bread toppings chosen. Overall, 82 children participated in the study. However, the results of 81 children were used for data analysis. One child was left out of the data because in general he does not consume bread and also during the study he did not consume any bread. No parent objected to let their child participate the study. The mean age of the children was 11.5(SD= 1.3). 39 boys participated in the study and 41 girls.

Overall, 88.6% of the children first chose a white bread roll to consume, and only 10.5% choose a whole grain bread roll as a first choice. The average number of consumed bread rolls was 4.2 (SD=1.9). White bread was more popular: the average number of white bread rolls was 3.3 (SD=1.9) and the average number of whole grain bread rolls was 0.8 (SD=1.4).

Linear Mixed Model analysed the total number of bread rolls consumed as a dependent variable and the unit size of white bread and the unit size of whole grain bread as independent variables. A main effect was seen regarding unit size of whole grain bread rolls F=(1.315)18.07, p=<0.001 and the unit size of white bread rolls F=(1.315)52.93, p=<0.001. This shows that children ate more bread rolls if the offered bread rolls were small sized compared to large sized. Next to this, a significant interaction effect was found in that children were likely to consume more white bread rolls when both the offered white and whole grain bread rolls are small sized (F=(1,312)33,1, p=0.03). In that condition, children ate on average 5.5 (SD=2.3) bread rolls in total, the average number of whole grain bread eaten in that condition was 1.2 (SD=1.9).

Total grams of bread consumed (both whole grain and white bread rolls)

The total grams of bread consumed (both white and whole grain bread) was affected by the unit size of white bread, the main effect unit size of white bread is F=(1,315)17.9, p=<0.001. So children ate in total the most bread rolls in grams when the offered white bread rolls were large in size (M=191.8, SD=75.6) compared to conditions in which the offered white bread was small in size (M=156.2, SD=62.5). No main effect of the unit size of whole grain bread F=(1,315)1.4, p=0.2 or an interaction effect on unit size of whole grain bread and unit size of white bread was observed F(1,315)0.69, p=0.4. The unit size of whole grain bread did not showed a significant effect on the consumption of whole grain bread. Figure 9 gives a visual image of the total bread rolls consumed in grams by the children.

The first hypothesis states ‘Children will consume more grams of bread when all the offered bread rolls are small sized compared to large sized’ cannot be accepted as the opposite has been proven. More grams of bread rolls is consumed if the offered bread rolls are large sized compared to small sized (see Table 6).

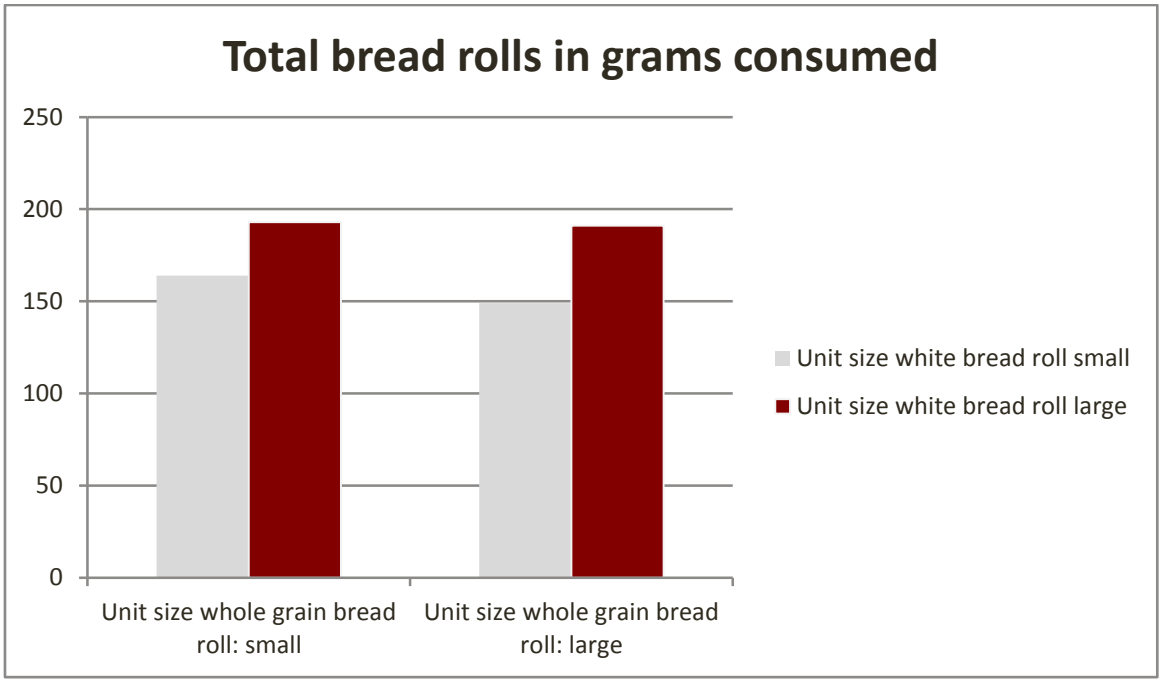


Figure 9: Total amount of bread rolls in grams consumed

Total grams of whole grain bread consumed

The Linear Mixed Model showed that there is no main effect of the unit size of whole grain bread on whole grain bread consumption F=(1.316)1.7, *p*=0.19. Children were not affected by the unit size of whole grain bread, they did not ate more whole grain bread if the unit size was small or large sized. Next to this, there is no main effect of the unit size of white bread on whole grain bread consumption F=(1.316)2.6, *p*=0.11. So children did not ate more or less whole grain bread if the offered white bread rolls differed in unit size (small or large).

Hypothesis 2 states: 'Children will consume more grams of whole grain bread when the offered whole grain bread rolls are small sized and the offered white bread rolls are larger size'.
This hypothesis cannot be confirmed, as results show that there is no interaction effect between the unit size of white bread and the unit size of whole grain bread on the total grams of whole grain bread consumed F=(1,316)0.012, *p*=0.91. In other words, children are not influenced by the unit size of bread in their consumption of whole grain bread (see Table 6).

Table 6: Bread rolls consumed per child in grams (mean, SD)

	Small unit size whole grain bread rolls		Large unit size whole grain bread rolls				
	Small unit size white bread	Large unit size white bread	Small unit size white bread	Large unit size white bread	P-value main effect unit size of whole grain bread	P-value main effect unit size of white bread	P-value interaction effect
Total grams of bread rolls consumed	163.8 (67.8)	192.6 (75.7)	148.9 (56.3)	191.2 (75.9)	0.23	P≤ 0.001	0.40
Total grams of whole grain bread rolls consumed	35.6 (56.1)	25.0 (40.7)	43.0 (58.6)	33.4 (62.4)	0.19	0.11	0.91
Total grams of white bread rolls consumed	128.2 (72.1)	167.5 (79.2)	105.9 (60.4)	157.8 (79.4)	0.06	P≤ 0.001	0.39

Total grams of white bread consumed

There is a main effect of the unit size of white bread rolls on white bread consumption F=(1.315)30.67, *p*=<0.001. This shows that there is an effect of our manipulation on the consumption of white bread rolls. Children eat more white bread when the size of the white bread is large (M=162.7, SD=79.3) than when the size of the white bread is small (M=117, SD=66.3). There is no interaction effect between the unit size of white bread and the unit size of whole grain bread on the total grams of white bread consumed F=(1.314)0.75, *p*=0.39. Changing the unit size of the white and whole grain bread rolls does not affect the total consumed white bread rolls in grams.

Calorie intake from bread toppings during lunch

The third and last hypothesis is 'Children will consume more calories from bread toppings when the offered bread roll units are small compared to large sized'. The total number of calories consumed per lunch per child was 660 (SD=257.74). This number can be divided into the total amount of calories from bread and bread topping, respectively 423 (SD=174) and 237 (SD=133) calories.

There is no main effect of the unit size of whole grain bread on the total calories from bread topping F=(1.311)2.5, *p*=0.12. The total calorie intake from bread toppings was not affected by the unit size of whole grain bread rolls. There is a main effect of the unit size of white bread on the total calories from bread toppings F=(1.311)9.07, *p*=0.003. This indicates that more calories from bread toppings were used on larger sized white bread rolls. There is no interaction effect between the unit size of whole grain bread and white bread on the total share of calories from bread topping F=(1.314), 0.04, *p*=0.85. The manipulation of unit size of white and whole grain bread did not have an effect on the total calorie intake from bread toppings (see Figure 10).

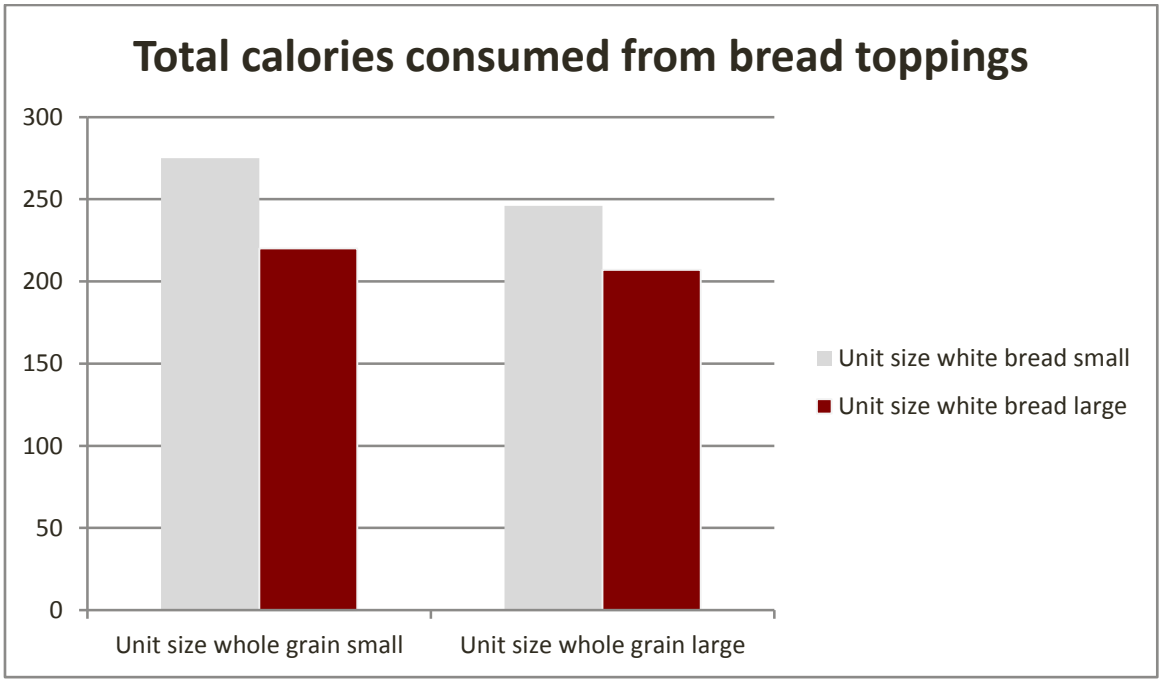


Figure 10: Total share of calories consumed from bread topping

4.2 Survey after each lunch

Participants

All the 82 children that participated in the study filled out a questionnaire after each lunch (see Appendix I). One child was not included in the analysis of the survey because he does not consume any bread in his diet, therefor the answers of 81 children were used for analyses. On the last day, the children filled out a second questionnaire (final questionnaire) about their habits and perceptions regarding bread and lunch consumption.

Attractiveness and tendency to count the bread rolls

The surveys were analysed by using Linear Mixed Models. The independent variables were the unit size of whole grain bread and the unit size of white bread. The dependent variable is the individual amount of bread consumed.

The concept 'attractiveness' of the bread rolls showed no main effect in the unit size of white bread rolls F=(1.307)0.55, p=0.46 and whole grain bread rolls F=(1.308)0.17, p=0.69. These results specify that children were not influenced by the unit size of the bread rolls in the attractiveness of the bread rolls. It also did not showed an interaction effect in the unit size of whole grain and white bread rolls on the concept attractiveness F=(1.308)0.53, p=0.47. The concept 'tendency to count bread rolls' all showed a p-value above 0.10. This means that the manipulations did not influenced the children to count the bread rolls. The children did not monitor their consumption different if the unit size of the bread rolls were large sized or small sized.

There is a significant interaction in the item 'it was fun to choose a bread roll' on unit size of whole grain bread and white bread rolls F=(1.314)6.05, p=0.01. Children had more fun when choosing the smaller unit size bread rolls.

Self-reported bread consumption

A main effect is found in the self-reported consumption of white bread rolls on the unit size of white bread rolls F=(1.283)37.1, *p*=<0.001. This shows that the children reported more number of white bread rolls consumed if the unit of white bread rolls were small sized. There is no interaction effect of the unit size of whole grain bread and white bread rolls on the self-reported white bread consumption F=(1.282)3.5, *p*=0.06. The children were not influenced to better monitor their consumption if the unit size of white bread rolls differs in small or large sized.

No effect is found in the self-reported consumption of whole grain bread rolls on the unit size of white bread rolls F=(1.282)1.88, *p*=0.17 or whole grain bread rolls F=(1.282)1.74, *p*=0.19. Next to this, no interaction effect is found in the unit size of whole grain bread and white bread rolls in the self-reported consumption of whole grain bread F=(1.281)0.27, *p*=0.60. Similar to the unit size of white bread rolls, children are not influenced by the unit size of whole grain bread rolls to better monitor their consumption.

Next to this, the children overestimated the amount of white bread rolls consumed. A main effect is found in the unit size of white bread on the number of white bread rolls consumed minus the self-monitoring consumption on F=(1.294)5.89, *p*=0.02. On average, the children overestimated the amount of white bread rolls consumed with 0.23 (SD=0.89) if the offered bread rolls were small sized compared to large sized (M=0.03, SD=0.99). No main effect or interaction effect is found in the unit size of whole grain bread on the number of whole grain bread rolls consumed minus the self-monitoring consumption (all *p*=>0.10). These results illustrate that the manipulation affected the children to overestimate the small sized white bread rolls that they have consumed, this was not the matter with the self-monitoring of whole grain bread rolls.

Satiety

There is a significant effect in the unit size of white bread rolls F=(1.302)14.7, p=<0.001 and whole grain bread rolls F=(1.302)14.6, p=<0.001 on the item 'did you consumed less, the same, or more bread than usual'. The children indicated to eat more bread than normal if the unit size of the offered bread rolls are small sized. The same item was tested with bread toppings. No main effect is found in unit size of white bread rolls on 'did you consumed less, the same, or more bread toppings than usual' F=(1.307)2.05, *p*=0.15. So the children indicated that the unit size of whole grain bread did not influenced them to eat more, the same or less bread toppings than normal.

There was no main effect of unit size of whole grain bread on experienced satiation after lunch F=(1.287)0.98, *p*=0.32. There is also no main effect of unit size of white bread on experienced satiation F=(1.287)0.85, *p*=0.36. Also, there is no effect found of the interaction in unit size of whole grain bread and the unit size of white bread on satiety F=(1.287)3.6, *p*=0.06. These results show that the children's satiety was not influenced by the unit size of the offered bread rolls (see Table 7).

Table 7: Ratings of questions from survey about the lunch experience (mean, SD)

	Small unit size whole grain bread rolls		**Large unit size whole grain bread rolls**				
Questions from survey*	**Small unit size white bread**	**Large unit size white bread**	**Small unit size white bread**	**Large unit size white bread**	**P-value main effect unit size whole grain bread**	**P-value main effect unit size white bread**	**P-value interaction effect**
My overall lunch was tasty	4.7 (0.5)	4.7 (0.4)	4.6 (0.6)	4.6 (0.5)	0.08	0.77	0.72
It was fun to choose a bread roll	3.8 (1.1)	3.4 (1.0)	3.4 (1.2)	3.6 (1.0)	0.52	0.30	0.01
It was immediately clear which bread roll I wanted	4.3 (0.7)	4.4 (0.8)	4.3 (0.8)	4.4 (0.7)	0.80	0.47	0.69
The bread rolls looked attractive	3.8 (1.0)	3.8 (0.8)	3.7 (1.1)	3.9 (0.9)	0.68	0.46	0.47
De bread rolls were funny	2.5 (1.4)	2.6 (1.3)	2.5 (1.3)	2.6 (1.4)	0.81	0.61	0.91
The lunch was different than normal at school	4.1 (1.0)	4.1 (1.0)	4.1 (0.9)	3.9 (1.0)	0.30	0.15	0.46
Counted bread rolls	4.1 (1.0)	4.1 (1.0)	4.0 (1.1)	4.2 (1.1)	0.75	0.34	0.78
My lunch was healthy	3.7 (1.0)	3.9 (0.9)	3.8 (0.9)	3.8 (0.9)	0.84	0.71	0.32
Indicate how full you are (satiety)	4.1 (0.7)	3.8 (0.7)	3.9 (0.7)	3.9 (0.8)	0.32	0.36	0.06
Self-reported consumption white bread rolls **	4.5 (2.7)	2.5 (1.5)	3.7 (2.2)	2.7 (1.4)	0.25	P≤0.001	0.06
Self-reported consumption of whole grain bread rolls **	1.2 (1.9)	1.0 (1.5)	0.9 (1.3)	0.7 (1.3)	0.19	0.17	0.60

*Note: Responses are measured on five-point scales, ranging from 1 (not at all) to 5 (very much)

** Note: Responses are measured in quantities

Survey about habits and attitude towards bread consumption

The results from the final questionnaire about the habits and attitudes towards bread consumption (see Appendix II) showed that 28,4% of all the participants eat 7 times per week whole grain bread during lunch, respectively 20,8% eat 6 times a week whole grain bread during lunch and 4,8% never eats whole grain bread during lunch (see Figure 8). Next to this, the results show that on average children consume 2.4 bread slices during lunch. During the experiment, the children consumed on average 4.2 (SD=1.9) bread rolls, which is almost the double amount. This shows that their consumption norm changed during the experiment, more bread rolls were consumed because of the manipulation.

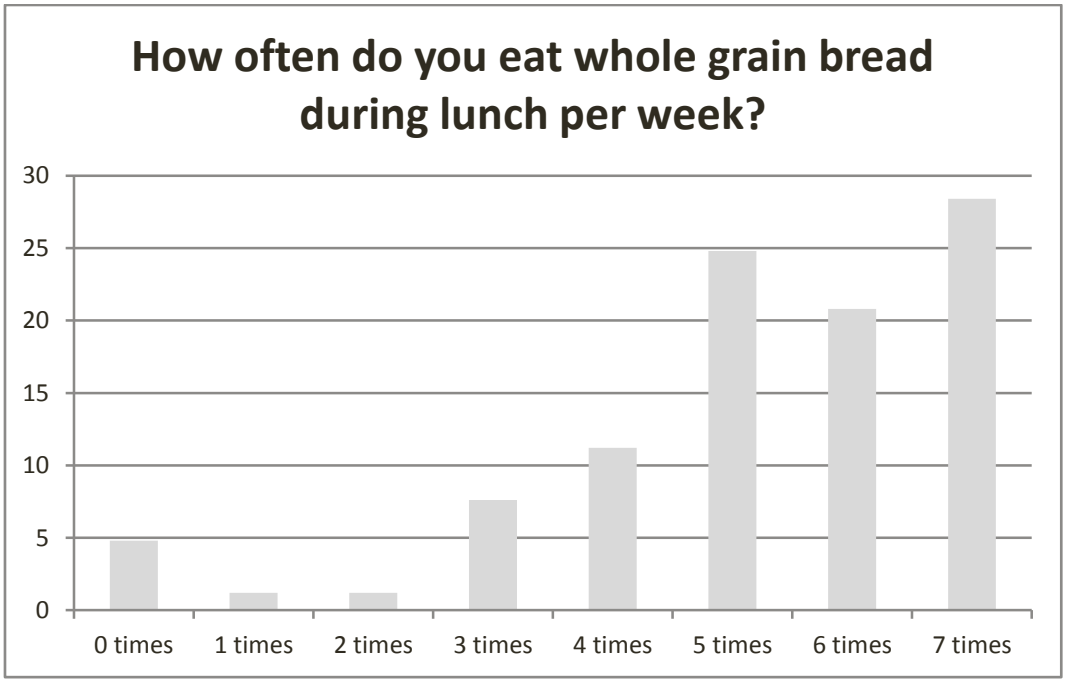


Figure 11: How often do you eat whole grain bread during lunch per week?

What stands out is that 34.4% does not know if white bread is healthy or not (indicated 3 on a scale from 1 to 5). The majority is aware of the fact that whole grain bread is healthy, 55.6% answered 'very much' on the question if whole grain bread is healthy. The items 'eating a lot of bread is good for you' and 'the more bread you eat, the better it is for you' answered the majority with 'I don't know, respectively 70.4% and 74%. This shows that children are now aware of the health benefits of whole grain bread.

5. Conclusions and discussion

This study was designed to better understand whether and how unit size could be used as a nudge to increase the consumption of whole grain bread rolls among children. *C*hildren were free to choose either the healthy option (whole grain bread) or the unhealthy option (white bread). We proposed that by changing the unit size of white and whole grain bread rolls the consumption of whole grain bread rolls would increase. A field study and two surveys were executed to test the hypotheses.

The results from the field study showed that unit size did not impact the amount of whole grain bread consumed. If you give children the choice between white bread and whole grain bread rolls, they largely choose for white bread rolls. Even though children had most fun in choosing which bread roll to choose when both types of bread rolls were smaller-sized, white bread rolls remained the most popular. The total consumption of bread in grams was impacted by the unit size manipulations. Bread consumption in total was higher when the white bread rolls were large sized. These results are similar to other studies that show that by providing a large unit, the total consumption of that product increases (Geier et al., 2006; Marchiori et al., 2011; Rose et al., 2007). Two factors may account for this. First, the unit bias heuristic proposes that people will eat a larger quantity when the presented food is a larger unit. Second, consumers interpret a unit as an appropriate portion to have. Consumers set those consumption norms by the number of food items, not the total amount of grams. So more grams can be consumed if the offered unit size is larger.

The unit size of the bread rolls also influenced the total calories consumed from bread toppings. On average, children consumed 660 calories during the lunch and this energy intake was not affected by our manipulations. However, the total calories from bread toppings were significantly higher when the offered white bread rolls are large sized. Overall, children consumed more calories from bread topping when both the offered bread rolls were large sized, this was on average 214 calories. The number of calories from bread topping is 260 when the offered bread rolls are small sized.

The results from this surveys showed children did not find the smaller bread rolls more attractive than the large bread rolls. The tendency to count the bread rolls was of influence during the experiment but was not affected by unit size. Even though caloric intake across conditions was equal, in the condition where both bread roll types were small in size, children felt more satiated than in other conditions. Next to this, the children indicated a higher consumption of small sized white bread rolls than they actually consumed. This shows that the self-monitoring of small sized white bread rolls is less accurate than keeping track with the whole grain bread roll consumption.

The results of this study is an extension of the current studies from Marchiori and colleagues (2012) and Van Kleef and colleagues (2014) as the subjects are children and the study was focused on an utilitarian food product rather than an hedonic food product. The results may indicate that the nudge that has been used is not strong enough to steer children into choosing the healthier option. The participatory children were 11-12 years old, this may be too young to let children choose the healthy option. A stronger nudge is needed to steer children into choosing the healthier option. Children are sensitive to the sensory perception of food products, not changing the unit size but the appearance of the bread may be a stronger nudge. This can be for example colouring the whole grain bread white, since white bread is not associated with nuts, heavy crusts and bitterness (Burgess-

Champoux et al., 2006; Delk & Vickers, 2007). As such, our manipulations cannot be considered to be an effective nudge to shift children's choice from white to whole grain bread.

Strength of this study is that data is collected on an individual basis. Moreover, we also collected data on the caloric intake of bread toppings, which provided precise insight into the total calories consumed during a lunch. Most studies focus on the food-decisions and not on the actual consumption. In this study, any left-over were deducted from the chosen bread rolls and bread toppings, this resulted in an accurate dataset with only the actual consumption of bread rolls and bread toppings. Next to this, extensive research is done to portion size but little on the influence of unit size to stimulate healthier food choices among children. This study provides more insight into the effects of unit size and how children change their food consumption during lunch.

Implications

The results of this study provide more insight into the approach of *nudging*. This study is useful for governmental institutes such as schools or hospitals. An implication for companies who offer bread in their assortment, such as bakery's, supermarkets or canteens can make the bread slices thicker to increase the total grams of whole grain consumed. Parents may buy breads that are not pre-sliced. Slicing bread by hand can results in thicker slices as it does not give the small slices that a bread slicer would give. Fibre is the compound that makes whole grain breads a healthy option. Other products that contain fibres such as cereals, enriched grains, fruits, vegetables and dry beans and peas can be offered in a large unit to increase the total grams of fibres consumed.

Limitations and further research

The study comprises some limitations that need to be acknowledged. The experiment took place in a classroom setting. Children ate in groups; group dynamics and social influence could play a role in the study. Next to this, the study was performed among young children aged 11-12 years old. As such, it cannot be fully generalized to children of other age groups. This study can be replicated among older children or adult participants. Nudging comprises different strategies, this paper is focused on one strategy namely changing unit size of bread rolls. Other strategies such as changing the default option, positioning of options, choice over time or change the sensory default option could be nudges to push a consumer into a healthier direction. By reducing the unit size indulgent food in an early stage of life, children will acquire different norms of unit size. This will diverge the view that children and adults have about the appropriateness of unit size (Fisher & Kral, 2008).

The results of this study can also be applied for fruit and vegetables but more research on these subjects is preferred. Also, this study can be replicated with another nudge. It can be that a different nudge gives significant results in increasing the consumption of whole grains. Last, this study was focussed on whole grain bread rolls. To increase the consumption of fibres, it is also possible to perform a study about another food product that comprises fibres.

References

(CBS), Centraal Bureau voor de Statistiek (2012). *Lengte en gewicht van personen, ondergewicht en overgewicht; vanaf 1981*. Retrieved from http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=81565NED

Aarts, H., & Dijksterhuis, A. (2000). Habits as knowledge structures: automaticity in goal-directed behavior. *Journal of personality and social psychology, 78*(1), 53.

Ainslie, G. (2001). *Breakdown of will*: Cambridge University Press.

Alba, J. W., & Williams, E. F. (2013). Pleasure principles: A review of research on hedonic consumption. *Journal of Consumer Psychology, 23*(1), 2-18.

Anderson, J. W., Hanna, T. J., Peng, X., & Kryscio, R. J. (2000). Whole grain foods and heart disease risk. *Journal of the American College of Nutrition, 19*(sup3), 291S-299S.

Bakke, A., & Vickers, Z. (2007). Consumer liking of refined and whole wheat breads. *Journal of food science, 72*(7), S473-S480.

Baumeister, R. F. (2002). Yielding to temptation: Self-control failure, impulsive purchasing, and consumer behavior. *Journal of Consumer Research, 28*(4), 670-676.

Bell, R., & Pliner, P. L. (2003). Time to eat: the relationship between the number of people eating and meal duration in three lunch settings. *Appetite, 41*(2), 215-218.

Birch, L. L. (1999). Development of food preferences. *Annual review of nutrition, 19*(1), 41-62.

Birch, L. L., & Fisher, J. O. (1998). Development of eating behaviors among children and adolescents. *Pediatrics, 101*(Supplement 2), 539-549.

Burgess-Champoux, Marquart, Vickers, & Reicks. (2006). Perceptions of children, parents, and teachers regarding whole-grain foods, and implications for a school-based intervention. *Journal of nutrition education and behavior, 38*(4), 230-237.

C.Bonell, McKee, M., Fletcher, A., Wilkinson, P., & Haines, A. (2011). One nudge forward, two steps back. *BMJ, 342*.

Clark, J. E. (1998). Taste and flavour: their importance in food choice and acceptance. . *Proceedings of the Nutrition Society, 57*(04), 639-643.

Delk, J., & Vickers, Z. (2007). Determining a series of whole wheat difference thresholds for use in a gradual adjustment intervention to improve children's liking of whole-wheat bread rolls. *Journal of Sensory Studies, 22*(6), 639-652.

Dhar, R., & Wertenbroch, K. (2000). Consumer choice between hedonic and utilitarian goods. *Journal of marketing research, 37*(1), 60-71.

Downs, J. S., Loewenstein, G., & Wisdom, J. (2009). Strategies for promoting healthier food choices. *The American Economic Review, 99*(2), 159-164.

Elliott, C. (2008). Assessing 'fun foods': nutritional content and analysis of supermarket foods targeted at children. *Obesity Reviews, 9*(4), 368-377.

Fisher, J. O., & Kral, T. V. E. (2008). Super-size me: portion size effects on young children's eating. *Physiology & behavior, 94*(1), 39-47.

Geier, Wansink, & Rozin. (2012). Red potato chips: segmentation cues can substantially decrease food intake. *Health Psychology, 31*(3), 398.

Geier, A. B., Rozin, P., & Doros, G. (2006). Unit bias a new heuristic that helps explain the effect of portion size on food intake. *Psychological Science, 17*(6), 521-525.

Hirschman, E. C., & Holbrook, M. B. (1982). Hedonic consumption: Emerging concepts, methods and propositions. *Journal of marketing, 46*(3).

Ishak, S., Shohaimi, S., & Kandiah, M. (2013). Assessing the children's views on foods and consumption of selected food groups: outcome from focus group approach. *Nutrition research and practice, 7*(2), 132-138.

Jacobs, D. R., Meyer, K. A., Kushi, L. H., & Folsom, A. R. (1998). Whole-grain intake may reduce the risk of ischemic heart disease death in postmenopausal women: the Iowa Women's Health Study. *The American journal of clinical nutrition, 68*(2), 248-257.

John, D. R. (1999). Consumer socialization of children: A retrospective look at twenty-five years of research. *Journal of Consumer Research, 26*(3), 183-213.
John, J., Smith, G., & Stoker, G. (2009). Nudge nudge, think think: two strategies for changing civic behaviour. *The Political Quarterly, 80*(3), 361-370.
Jonnalagadda, S. S., Harnack, L., Liu, R. H., McKeown, N., Seal, C., Liu, S., & Fahey, G. C. (2011). Putting the whole grain puzzle together: Health benefits associated with whole grains—summary of American Society for Nutrition 2010 Satellite Symposium. *The Journal of nutrition, 141*(5), 1011S-1022S.
Kahneman, D. (2012). *Thinking Fast and Slow*.
Kantor, L. S., Variyam, J. N., Allshouse, J. E., Putnam, J. J., & Lin, B. H. (2001). Choose a variety of grains daily, especially whole grains: a challenge for consumers. *The Journal of nutrition, 131*(2), 473S-486S.
Kleef, E. V., Kavvouris, C., & Trijp, H. C. M. V. (2014). The unit size effect of indulgent food: How eating smaller-sized items signals impulsivity and makes consumers eat less. *Psychology & Health*(just-accepted), 1-41.
Kleef, E. V., Otten, K., & Trijp, H. C. M. V. (2012). Healthy snacks at the checkout counter: A lab and field study on the impact of shelf arrangement and assortment structure on consumer choices. *BMC public health, 12*(1), 1072.
Krishna, A. (2012). An integrative review of sensory marketing: Engaging the senses to affect perception, judgment and behavior. *Journal of Consumer Psychology, 22*(3), 332-351.
Lawrence, A. S., & Jesudoss, I. (2011). Relationship between Social Maturity and Academic Achievement of Higher Secondary School Students. *International Journal of Educational Administration, 3*(3), 7.
Liu, S., Willett, W. C., Manson, J. A. E., Hu, F. B., Rosner, B., & G.Colditz. (2003). Relation between changes in intakes of dietary fiber and grain products and changes in weight and development of obesity among middle-aged women. *The American journal of clinical nutrition, 78*(5), 920-927.
Marchiori, D., Waroquier, L., & Klein, O. (2011). Smaller food item sizes of snack foods influence reduced portions and caloric intake in young adults. *Journal of the American Dietetic Association, 111*(5), 727-731.
Marchiori, D., Waroquier, L., & Klein, O. (2012). "Split them!" Smaller item sizes of cookies lead to a decrease in energy intake in children. *Journal of nutrition education and behavior, 44*(3), 251-255.
Marteau, T. M., Ogilvie, D., Roland, M., Suhrcke, M., & Kelly, M. P. (2011). Judging nudging: can nudging improve population health? *BMJ, 342*. doi: 10.1136/bmj.d228
Ocké, M. C., Rossum, C. T. M. v., Fransen, H. P., Buurma, E. M., Boer, E. J. d., Brants, H. A. M., . . . Ghameshlou, Z. (2008). Dutch National Food Consumption Survey - Young Children 2005-2006
Peersman, G., Harden, A., & Oliver, S. (1998). *Effectiveness of health promotion interventions in the workplace: a review*: Health Education Authority London.
Pelham, B. W., Sumarta, T. T., & Myaskovsky, L. (1994). The easy path from many to much: The numerosity heuristic. *Cognitive Psychology, 26*(2), 103-133.
Piernas, C., & Popkin, B. M. (2011). Increased portion sizes from energy-dense foods affect total energy intake at eating occasions in US children and adolescents: patterns and trends by age group and sociodemographic characteristics, 1977–2006. *The American journal of clinical nutrition, 94*(5), 1324-1332.
Quigley, M. (2013). Nudging for Health: On Public Policy and Designing Choice Architecture. *Medical law review, 21*(4), 588-621.
Rawlings, S. (2006). FDA Provides Guidance on 'Whole Grain'for Manufacturers [Press release]
Raynor, H. A., & Wing, R. R. (2007). Package unit size and amount of food: do both influence intake? *Obesity, 15*(9), 2311-2319.

Rose, N., Hosig, K., Davy, B., Serrano, E., & Davis, L. (2007). Whole-grain intake is associated with body mass index in college students. *Journal of nutrition education and behavior, 39*(2), 90-94.

Rosen, R., Sadeghi, L., Schroeder, N., Reicks, M. M., & Marquart, L. (2008). Gradual incorporation of whole wheat flour into bread products for elementary school children improves whole grain intake. *Journal of child nutrition & management: a publication of the American School Food Service Association, 2008*.

Rossum, C. T. M., Fransen, H. P., Verkaik-Kloosterman, J., Buurma-Rethans, E. J. M., & Ocké, M. C. (2011). Dutch National Food Consumption Survey 2007-2010: Diet of children and adults aged 7 to 69 years.

Skov, L. R., Lourenco, S., Hansen, G. L., Mikkelsen, B. E., & Schofield, C. (2012). Choice architecture as a means to change eating behaviour in self-service settings: a systematic review. *Obesity Reviews*.

Spence, C. (2012). Managing sensory expectations concerning products and brands: Capitalizing on the potential of sound and shape symbolism. *Journal of Consumer Psychology, 22*(1), 37-54.

Steffen, Jacobs, Murtaugh, Moran, Steinberger, Hong, & Sinaiko. (2003). Whole grain intake is associated with lower body mass and greater insulin sensitivity among adolescents. *American journal of epidemiology, 158*(3), 243-250.

Steffen, L. M., Jacobs, D. R., Murtaugh, M. A., Moran, A., Steinberger, J., Hong, C. P., & Sinaiko, A. R. (2003). Whole grain intake is associated with lower body mass and greater insulin sensitivity among adolescents. *American journal of epidemiology, 158*(3), 243-250.

Thaler, Sunstein, & Balz. (2010). Choice architecture. *Available at SSRN 1583509*.

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*: Yale University Press.

Thorndike, A. N., Sonnenberg, L., Riis, J., Barraclough, S., & Levy, D. E. (2012). A 2-phase labeling and choice architecture intervention to improve healthy food and beverage choices. *Journal Information, 102*(3).

Verplanken, B., & Wood, W. (2006). Interventions to break and create consumer habits. *Journal of Public Policy & Marketing*, 90-103.

Voedingscentrum. (2013). from http://www.voedingscentrum.nl/nl/nieuws/voedingscentrum-wil-gezonder-broodbeleg.aspx

Wansink, B. (2004). Envirommental Factors that Increase the Food Intake and Consumption Volume of Unknowing Consumers. *Annu. Rev. Nutr., 24*, 255-479.

Wansink, B. (2013). Convenient, Attractive, and Normative: The CAN Approach to Making Children Slim by Design. *Childhood Obesity, 9*(4), 277-278.

Wansink, B., & Hanks, A. S. (2013). Slim by Design: Serving Healthy Foods First in Buffet Lines Improves Overall Meal Selection. *PloS one, 8*(10), e77055.

Wansink, B., & Ittersum, K. V. (2007). Portion size me: downsizing our consumption norms. *Journal of the American Dietetic Association, 107*(7), 1103-1106.

Wansink, B., & Sobal, J. (2007). Mindless Eating The 200 Daily Food Decisions We Overlook. *Environment and Behavior, 39*(1), 106-123.

Wood, W., & Neal, D. T. (2007). A new look at habits and the habit-goal interface. *Psychological review, 114*(4), 843.

Ye, E. Q., Chacko, S. A., Chou, E. L., Kugizaki, M., & Liu, S. (2012). Greater whole-grain intake is associated with lower risk of type 2 diabetes, cardiovascular disease, and weight gain. *The Journal of nutrition, 142*(7), 1304-1313.

Zlatevska, N., Dubelaar, C., & Holden, S. S. (2014). Sizing Up the Effect of Portion Size on Consumption: A Meta-Analytic Review. *Journal of marketing, 78*(3), 140-154.

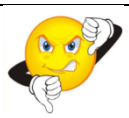
Appendix I: Questionnaire for participatory children

Leuk dat je meedoet aan het lunchproject. Ik hoop dat je hebt genoten van de lunch. Graag wil ik dat je een vragenlijst invult voor het project. Je mag er zo lang over doen als je wilt.

Succes!

Vraag 1: Wat is je voor- en achternaam? _____

Vraag 2. Je mag je mening geven door het goede vakje aan te kruizen. Je mag maximaal 1 kruisje zetten per rij.

	 Helemaal niet	 Niet zo	 Ik weet het niet	 Een beetje	 Heel erg
Mijn lunch was lekker					
Het was leuk om een broodje te kiezen					
Het was meteen duidelijk welk broodje ik wou					
De broodjes waren lekker					
De broodjes zagen er aantrekkelijk uit					
De broodjes waren grappig					
De lunch was anders dan normaal op school					
Ik heb geteld hoeveel broodjes ik heb gegeten					
Ik vond het makkelijk bij te houden hoeveel broodjes ik heb gegeten					
Mijn lunch was gezond					

Vraag 3: Hoeveel volkoren/bruine broodjes heb je gegeten?

_____ broodjes

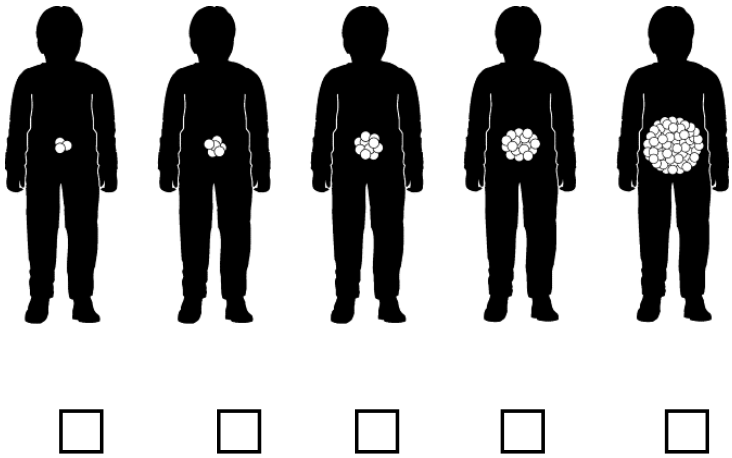
Vraag 4: Hoeveel witte broodjes heb je gegeten?

_____ broodjes

Vraag 5: Als je terugdenkt aan de lunch, heb je dan minder, ongeveer hetzelfde, of meer gegeten en gedronken dan normaal? Zet een kruisje onder het goede antwoord.

	Veel minder dan normaal	Minder dan normaal	Ongeveer hetzelfde	Meer dan normaal	Veel meer dan normaal
Brood					
Beleg (kaas, vlees en zoet)					
Drinken					

Vraag 6: Je mag het bij het juiste poppetje een kruisje zetten die aangeeft hoe vol je zit.



☐ ☐ ☐ ☐ ☐

Bedankt voor het invullen!

Appendix II: Final questionnaire

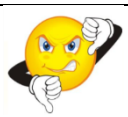
Ik hoop dat je hebt genoten van de laatste lunch. Omdat het de laatste dag is mag je voor ons nog een laatste vragenlijst invullen. Je mag er zo lang over doen als je wilt. Succes!

Vraag 1: Wat is je voor- en achternaam? _____

Vraag 2. Hoe vaak lunch je in één week met bruin of volkoren brood? Je mag het juiste antwoord aankruisen.

- ☐ 0 keer (nooit)
- ☐ 1 keer
- ☐ 2 keer
- ☐ 3 keer
- ☐ 4 keer
- ☐ 5 keer
- ☐ 6 keer
- ☐ 7 keer (altijd)

Vraag 3: In hoeverre ben je het eens met de volgende stellingen?

	 Helemaal niet	 Niet zo	 Ik weet het niet	 Een beetje	 Heel erg
Als ik brood eet, kies ik altijd wat het lekkerst is					
Ik vind wit brood gezond					
Ik vind wit brood lekker					
Ik vind bruin brood gezond					
Lekker lunchen vind ik heel belangrijk					
Gezond lunchen vind ik heel belangrijk					
Ik vind bruin brood lekker					
Veel brood eten is NIET goed voor je					

Hoe meer brood je eet, hoe beter					

Vraag 4: Hoeveel broodjes vind jij normaal om te eten tijdens een lunch op school?

_____ stuks

Vraag 5. Wat is je leeftijd?

Ik ben _____ jaar oud.

Vraag 6. Ik ben een:

- ☐ Jongen
- ☐ Meisje

Appendix III: Randomisation scheme

	Condition	Tuesday May 20 '14	Position and number in breadbasket	Condition	Thursday May 22 '14	Position and number in breadbasket	Condition	Tuesday May 27 '14	Position and number in breadbasket	Condition	Tuesday June 3 '14	Position and number in breadbasket
8A	1	Small white	240 right	4	Large white	120 right	2	Large white	120 left	3	Small white	240 right
		Small whole grain	240 left		Large whole grain	120 left		Small whole grain	240 right		Large whole grain	120 left
8B	2	Large white	120 right	1	Small white	240 right	3	Small white	240 left	4	Large white	120 right
		Small whole grain	240 left		Small whole grain	240 left		Large whole grain	120 right		Large whole grain	120 left
8C	3	Small white	240 right	2	Large white	120 left	4	Large white	120 right	1	Small white	240 right
		Large whole grain	120 left		Small whole grain	240 right		Large whole grain	120 left		Small whole grain	240 left