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Consumer health on(the)line: Improving food choices in digital supermarket environments using behavioral nudges

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Abstract

As the popularity of online grocery shopping is increasing rapidly, poor nutrition is still a large global problem. Using the power of existing behavioral nudges, the current study aims to increase healthy food choices in online supermarket environments. In an online survey, an online supermarket was recreated and the effects of a salience nudge and a social proof nudge were tested. Participants (n = 117) were tasked to choose one product from each of five different product categories. In the salience nudge condition, the healthiest option was made more salient and in the social proof nudge condition participants were shown a social norm about healthy eating. Although no significant effect of either nudge was found, the current study does confirm that taste is viewed as the most important factor in food decisions, whereas product packaging is the least important. Furthermore, the study encourages and visualizes the implementation of behavioral nudges in online supermarkets.

1. Introduction

Poor and unhealthy nutrition is still a large problem in the Western world, even though healthy food options are widely available. Eurostat estimates that almost 53 percent of adults in Europe were overweight in 2019 (Eurostat, 2021). At the same time, a large number of negative health effects of overweight are known (i.e. increased risk of cardiovascular diseases, diabetes and hypertension) (Eurostat, 2021). Furthermore, nutrition decisions play a large role of peoples' everyday life, as Wansink & Sobal (2007) find that people on average make more than two hundred food choices every day. In The Netherlands, the majority of these food choices are made in supermarkets, as it is estimated that about 66 percent of the average Dutch household food-budget is spent in supermarkets (Geurts, Van Bakel, Van Rossum, De Boer & Ocke, 2017). Therefore, supermarkets can play an important role in preventing health issues as a result from unhealthy nutrition. However, it can be argued that supermarkets do not prioritize healthy eating despite the negative consequences for their customers. For example, it was found that 66.7 percent of all food products promoted in Dutch supermarket flyers could be categorized as unhealthy (Ravensbergen, Waterlander, Kroeze & Steenhuis, 2015). Furthermore, larger quantities of the unhealthy products need to bought to make use of the promotion compared to the promotional offers for healthy products.

At the same time, there is a large and growing body of scientific literature on potential solutions to unhealthy eating behavior. In most of these studies, researchers test the effect of so-called *nudges* on the food choices consumers make in an everyday supermarket situation. A nudge can be defined as "*any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives*" (Thaler & Sunstein, 2008). However, Dutch supermarkets do not seem to be implementing these nudges that are proven to be effective to improve the healthiness of the food choices. Instead, they use various tricks, such as advertising and product salience and product placement to lure consumers to more profitable, but less healthy, choices (Chandon & Wansink, 2012; Roberto et al., 2015).

The current thesis will test the effect of two existing behavioral nudges on the food choices in online supermarkets. The first nudge can be categorized as a salience nudge. This type of nudge is made to draw the consumer's attention to a specific

element of the food choice, increasing the importance of that element (Thunström, Gilbert & Ritten, 2018). The second type of nudge is shown known as a social proof nudge and uses a social norm about peers of the consumer regarding food choices to influence their food choice. Finally, using these two types of nudges, the current thesis aims to answer the following research question:

What is the effect of salience nudges and social proof nudges on the healthiness of consumers' food choices in online supermarkets?

The current report will continue to discuss the scientific and societal relevance of the study. Next, a brief summary of existing literature on the topic of healthy food choice and nudges will be presented. Here, the hypotheses of this study will also be mentioned. Following this, the report will discuss the methodology and data collection process, after which the results of the experiment will be presented. Finally, the last sections of this thesis will be dedicated to the conclusions of the results and a general discussion of the current research.

1.1. Scientific relevance

Behavioral nudges have been found to be effective in many different fields of life. The often simple and low-cost interventions can be used to alter behavior without limiting the options for individuals (Thaler & Sunstein, 2008). Since the term nudge was coined in 2008, many researches have aimed to study the effects of different types of nudges in various environments. In the field of food choice, nudges have been shown to increase awareness of healthy food and improve the healthiness of food choices in physical and virtual reality shops. However, the current scientific literature lacks information and findings on the effect of nudges on healthy food choices in online supermarkets. The current research therefore aims to provide insights into the effect of nudges in an environment that is relatively new to the scientific literature; online supermarkets.

1.2. Societal relevance

It is well known that unhealthy eating increases the risk of many diseases and health issues. Improvement of healthy food choices can therefore lead to an increase in overall health and will thus serve as main reason why this gap in the literature is relevant to study. Furthermore, three reasons, which all lead up to the most important reason of health issues, can be distinguished. First, the current research can offer a cheap solution to an expensive problem. Nudges are generally viewed as low-cost and high-reward interventions. This also holds for the problem of unhealthy nutrition, as poor health due to unhealthy eating leads to large healthcare costs. For example, for the United States, it was estimated in 2019 that unhealthy eating costs the country around 50 billion U.S. dollars in healthcare costs every year (Jardim et al., 2019).

Secondly, in the recent years the popularity of online grocery stores has increased rapidly. Originally, existing physical supermarkets would offer a grocery home-delivery service. However, the number of new companies aimed solely at home-delivery of groceries in Europe is increasing: in 2021, flash-delivery companies such as *Gorillas* and *Getir* took the European market by storm (Butler, 2021). As a result, a larger part of unhealthy food choices will most likely be made in online supermarkets and therefore it is important to support people in this new environment. Furthermore, the Covid-19 pandemic has increased the number of people who use online grocery services. For people with large health risks, ordering groceries without running the risk of getting infected with the Covid-19 virus is a safe way to get their essential food. Especially for those with lower health, eating more healthy is very important in reducing the risk of health issues.

Thirdly, physical supermarkets may not allow for nudges to be tested or implemented. Using an online supermarket environment allows for the usage of third party software, browser extensions or mobile phone applications to implement nudges without the permission of supermarkets being necessary. For example, a browser extension could make the healthiest products more salient by scanning the nutrition information available on a supermarket site. This information is currently freely accessible and thus no permission of the supermarket is needed. Therefore, nudging in an online environment gets rid of a large barrier for making healthier food choices in practice, as nudges can be implemented easier.

2. Literature review

2.1. Consumers understanding of healthy nutrition

To get a better idea of how to solve the problem of unhealthy food choices, first a step back needs to be taken. For someone to be able to consistently and consciously make healthy choices, they need to be aware of what is considered healthy and what is considered unhealthy. This section will therefore go into what is currently known about how much consumers know about healthy eating.

2.1.1. Consumers caloric estimation of healthy and unhealthy food

There are many aspects of nutrition information on which food products can be judged as healthy or unhealthy. For example, food products containing a lot of saturated fats, salt or sugar can be seen as unhealthy, whereas foods with a lot of protein and fiber can be judged as healthy. Another way of determining healthiness of a food product is by looking at its calorific content. In general, calories are seen as an important measure used to judge whether something is healthy or not. Therefore, if an individual is able to give a close estimate of the calorific content of food products, it can be argued that they know what healthy eating is. However, Chernev & Gal (2010) found that, in practice, people tend to underestimate the calorific content of food choices when multiple products are combined. In over four different experiments they show how people, primed to think in a healthy way, estimate that the combination of a vice and a virtue food product contains less calories than a sole vice product. In other words, people tend to think that the combination of a healthy food and an unhealthy food, adds up to less calories than the unhealthy food on its own. Of course, this can never be the case, as the combination should always have at least as much calories as the single unhealthy food. This study serves as evidence that people might not be able to judge what food is healthy and what food is unhealthy.

2.1.2. Annual food and health survey in United States

The Annual Food and Health Survey is a yearly questionnaire ran by the International Food Information Council (IFIC), which aims to get an understanding of the behavior, insights and beliefs of Americans around food and food purchases. In its most recent version in 2020, it is mentioned that the familiarity with the national dietary guidelines of United States citizens has increased tremendously since 2010 (International Food Information Council, 2021). Although an 18 percentage points increase in familiarity with healthy eating sounds promising, the portion of Americans who are familiar with the guidelines is still surprisingly low. IFIC estimates that in 2020, a mere 41 percent

of Americans where familiar with the guidelines. Furthermore, note that this number does not say anything about whether people actually adhere to these guidelines. Therefore, although the knowledge is increasing, the majority of Americans are still unaware of what healthy eating is.

2.1.3. Consumers' conceptualization of healthy food

Next, existing literature shows that people do not only look at nutritional facts when judging the healthiness of food products. Therefore, it is relevant to understand what other factors can influence people's perception of a healthy product. Liñán, Arroyo & Carrete (2019) aimed to find out more about how people pick healthy food. They argue that in the head of consumers there is more to healthy food than just nutrition scores. Liñán et al. (2019) call the food choice process "*elusive, imprecise and intuitive*" and try to give a more clear definition of healthy food by interviewing consumers. In their study, most participants said that they had looked at nutrition facts when making food choices before, but that this is not the main driver for their food choices in general. Furthermore, people in their research considered less processed food as more healthy food, which is in line with other existing research (Roman, Sánchez-Siles & Siegrist, 2017). Finally, the findings of Liñán et al. (2019) suggest that heuristics play a big role in judging healthy food. Here, they mention the example of how people perceive certain product categories as more healthy than others, despite the nutritional values being the same. For example, participants in the experiment would judge snacks as unhealthy products, whereas dairy products were seen as healthy. Because of this expectation about the product category, people sometimes refrain from comparing the nutritional values of products. Then, because of this, they can make an unhealthy decision while believing they are actually making a healthy choice. These findings are again in line with other existing studies (Orquin & Scholderer, 2011; Scheibehenne, Miesler & Todd, 2007). Therefore, even when a product may be healthy nutritional-wise, consumers might still perceive it as unhealthy and vice versa.

2.1.4. Effectiveness of nutrition information on food packaging

Finally, there are multiple researches that study the effect of nutritional information on food packaging. Understanding healthy eating has been made a lot easier in recent years, as producers started providing the consumer with accurate information on the nutritional content of food products. Orquin & Scholderer (2011) studied what part of the packaging people pay attention to during the food choice process. When people

where tasked to look for health cues, they mainly looked at the nutrition label and the product category. Furthermore, unexpectedly, people did not pay attention to the fat percentage and organic label on packaging. This study therefore shows that people only pay attention to a small number of elements on the packaging when judging the healthiness. In addition to this, a literature study by Grunert & Wills (2007) aimed to summarize the findings on the perception, understanding and opinion of European citizens on the nutritional information on food labels. They conclude that most consumers understand nutritional information in the sense that they believe that they themselves understand them. Note that this does not say anything about whether people actually understand the meaning of nutrition labelling. Furthermore, later on Grunert & Wills (2007) mention findings that pointed to the complexity of standard nutrition labelling and that said people had problems with technical terms, calculations and for some people also percentages. In conclusion, there is no hard evidence for the idea that people know how to understand and apply information on nutrition labels when presented with them.

2.2. Why consumers do or do not eat healthy

After looking into whether consumers understand what healthy eating is, it is important to look at why people do or do not eat healthy. Even if someone fully understands what healthy eating is, they could still fail to put this to practice. This section will give a brief summary of existing literature on the reasons of eating healthy. It must be noted, however, that this section is unable to provide information on all factors that influence healthy food choice. Therefore, some concepts that might influence food choice are left undiscussed.

2.2.1. Reasons given by adolescents

As many studies believe that teaching people to make healthy nutrition at a younger age, makes them more likely to live a healthier life at a later age (Story & Neumark-Sztainer 1996; Story & Alton, 1996; as cited in Neumark-Sztainer, Story, Perry & Casey, 1999), part of literature focuses on the beliefs of teenagers and adolescents on healthy eating. More specifically, Neumark-Sztainer et al. (1999) looked at reasons why adolescents made certain food choices using focus group interviews. In addition to a large list of factors given by the adolescents that influence food choices, the focus groups came with some barriers to eating more healthy and some suggestions on how adolescents can be influenced to eat a more healthful diet. Important suggestions

made are limiting the availability of unhealthful options and changing social norms to normalize eating healthy. Furthermore, Contento, Williams, Michela & Franklin (2006) did a detailed study on how adolescents made their food choices. They found that the primary reason why adolescents picked a certain food product was the taste of this food. The second and third most given reasons were health and habit. This implies that even if someone knows how and is motivated to eat healthy, they might fail to do so because they prefer the taste of unhealthy options. In addition to personal preference, Contento et al. (2006) find that the environment and peers of adolescents have an influence on food choice. For example, adolescents in the study reported that they would want to eat healthy, but would choose an unhealthy food if the others in the room all chose the unhealthy option. Therefore, there is a form of peer pressure or social norms present in food choices.

2.2.2. Behavioural elements influencing food choice

Dimitri & Rogus (2014) mention that, besides access to food and economic status, behavioral elements play a major role in food choices of people. In their study, they mention that social norms play a role in determining the portion or package size of the food an individual will consume. The quantity of food that people in the environment consume influences what an individual perceives as a normal portion size. Furthermore, they mention that people will eat more if the ease is increased or effort involved to obtaining food is decreased. In addition to this, a greater variety of a certain product will increase the likelihood that an individual buys this product.

Furthermore, current supermarket campaigns that aim to increase healthy eating work under the assumption that consumers have enough self-control to follow through with their healthy intentions. For example, Dutch supermarket Jumbo has launched a FoodCoach application, which helps customers swap unhealthy products for more healthy products in their favorite recipes (Jumbo, 2022). The application seems simple and effective, as people only have to download the application, scan their favorite products and are then shown a more healthy alternative of that product. However, the campaign is based on the idea that people are unaware of healthy alternatives and still requires individuals to voluntarily choose the healthier option the next time they go shopping. As in most decision making processes, self-regulatory skills play a large role in food choice. Therefore, even if consumers would have the right intention and information to choose more healthy, they might fail to do so in real life because of the

low level of self-control at the moment of shopping. Instead of designing solutions that can improve healthy food choices by relying on high self-control, nudges have been proven to work even under low self-control. Salmon, Fennis, De Ridder, Adriaanse & De Vet (2014) provide evidence that people under low self-control make fewer healthy choices. However, they also show how using a social proof heuristics increases healthy food choices when people are in a state of low self-control in the lab. Furthermore, Salmon et al. (2015) replicated these findings outside of the lab, once again finding that a social proof nudge increases the likelihood to buy a healthier alternative when in a state of low self-control. Furthermore, the nudges were shown to be harmless to consumers with higher levels of self-control.

2.2.3. LEX framework for food prediction

There are more studies in existing scientific literature that support the idea of heuristics influencing food choice as mentioned in the previous section. For example, Scheibehenne et al. (2007) believed that the food choice process is more so driven by simple heuristics than by a complex analysis consisting of comparing a large number of product characteristics. More precisely, they make two assumptions regarding food choices. First, people are frugal in terms of information they assess for their choices, meaning that people have limited time and suffer bounded rationality. Bounded rationality refers to the idea that humans are limited in their thinking capacity and therefore are unable to always think rationally. Secondly, instead of aggregating a lot of information pieces by weighing and adding, people base their choices on a much simpler decision rule. Scheibehenne et al. (2007) succeed in designing a prediction model based on a lexicographic decision rule (LEX) that is equally successful as complex existing models that need a lot of information to make predictions. According to LEX, people do not consider a large number of characteristics when making a choice, but instead search for information on the one characteristic they value the most. Consumers will compare options on the most important characteristic and end their search if they find a dominating option. However, if multiple options rank equal on this prioritized characteristic, people will compare their second highest valued characteristic between the options. This continues until a dominating option is found on one of the products aspects. Therefore, the study by Scheibehenne et al. (2007) proposes that food choice mainly relies on what single factor a participant finds most important. If an individual finds health very important, then most food choices will be based on a comparison in perceived health of products, regardless of other attributes

of both products. Finally, Scheibehenne et al. (2007) mention other studies that show how people try to avoid difficult trade-offs in decision making for food.

Knowing this, a characteristic should be presented in a simple and effortless way, to increase the likelihood that an individual considers this characteristic in their food choice. Schulte-Mecklenbeck, Sohn, de Bellis, Martin & Hertwig (2013) build on the research by Scheibehenne et al. (2007) by diving deeper into the process of food choice using LEX. First, they distinguish between a compensatory model and the non-compensatory LEX model. The latter is used for when people stop searching for information about the food product as soon as they found the relevant information about their most-valued attribute. For example, a healthy person would stop looking for information about the product as soon as they find the calorific content. On the other hand, compensatory strategies predict that people compare values for all product characteristics, weigh these and add these up and then make a decision on the overall best score. The results of Schulte-Mecklenbeck et al. (2013) show that, when choosing food, people were more likely to rely on strategies that limit search and computations than on compensatory strategies. Furthermore, they found that people rely on visual information more than on any other type of information when choosing between dishes.

2.2.4. Promotion of unhealthy vs. healthy food in supermarkets

The previous three paragraphs all examined the case of eating healthy or not eating healthy from the idea that the consumer is to blame for their behavior. However, it should not be disregarded how the consumer's subconscious is influenced into making unhealthy food choices, though the consumer wants to eat healthy. More specifically, consumers that know how to eat healthy and that want to eat healthy can be prevented from choosing healthy options because of external factors. One example of an external factor is the promotion of unhealthy products by producers and supermarkets. This paragraph discusses two papers that provide evidence of the unbalanced promotion of healthy versus unhealthy foods products. First, Ravensbergen et al. (2015) studied the prevalence of advertisements of healthy and unhealthy food in Dutch supermarket flyers. They found that 66.7 percent of all food products promoted could be categorized as unhealthy. Furthermore, they found that in order to make use of the promotion, a larger quantity of the product needed to be bought for unhealthy products than for healthy products. This means that an individual buys a larger quantity of unhealthy

products when using the promotion than they would for healthy food promotions. In line with these results, Charlton, Kähkönen, Sacks & Cameron (2015) also found a higher ratio of unhealthy food being promoted in supermarket flyers in over 12 different countries. These studies show that eating healthy is not explicitly made financially appealing by supermarkets.

2.3. Nudging in food choice

The final section of the literature review will give a brief overview of studies that test the effect of nudges on food choices. This literature will be used to design the nudges of the current research. In addition to this, this section will also present the hypotheses that will be tested.

2.3.1. Food positioning nudges

There are several papers written about the effectiveness of a food positioning nudge on food choice. In general, a food positioning regards changing the proximity to or order in which food products are presented to the customer. Using this nudge, people can be influenced into making certain food choices without restricting their choices or making it extremely hard to choose certain options. For example, Keller, Market & Bucher (2015) found that changing the order in which cereal bars with different healthiness were presented on a vendor's tray influenced the number of each cereal bar sold. This is a good example of how food positioning is a very cheap, but highly effective nudge and can influence the food people chose. Furthermore, Bucher et al. (2016) studied literature on food positioning nudges and summarized the main findings. Out of the eighteen studies on food positioning nudges they included in their research, sixteen studies showed a positive influence of food positioning on food choice. This serves as evidence that rearranging food products can increase healthy eating.

2.3.2. Social norms nudges in food choice

As mentioned in section 2.2.2 on general nudges, social norms and peer pressure are effective tools for influencing an individual's behavior. Social norms have also been found to be effective in influencing people's food choice. Demarque, Charalambides, Hilton & Waroquier (2016) showed that social norm nudges in supermarkets can influence people into buying more sustainable groceries. Furthermore, Huitink, Poelman, van den Eynde, Seidell & Dijkstra (2020) studied the effect of a social norms nudge on vegetable purchase in Dutch supermarkets. In the experiment, Huitink et al.

(2020) added a green inlay with a message about other people's vegetable purchasing behavior to supermarket trolleys of the largest Dutch supermarket. Furthermore, this inlay served as a special place where consumers could put their vegetable products. The results of Huitink et al. (2020) show that this intervention increased the quantity of vegetables (in grams) that consumers bought. A similar research in a Portuguese supermarket, ran by Gonçalves, Coelho, Martinez & Monteiro (2021) showed similar results. In this experiment, social norms messages were added to handlebars of shopping carts, fruit and vegetable weighing scales and near basket pick-up location in the store. Although not all consumers were influenced in the same way, in general these nudges increased the sale of healthy products and consumption of healthy products for the majority of the supermarket's customers. In conclusion, these papers provide evidence that social norm nudges seem to have a positive effect on healthy and sustainable food choice in a physical supermarket environment. Based on these studies and the paper by Dimitri & Rogus (2014), the current research presents Hypothesis 1: *a social proof nudge in online supermarkets positively influences healthy food choices.*

2.3.3. Salience nudge in virtual reality supermarket

This final paragraph of the literature review section will discuss an experiment testing the effect of nudges on healthy food choice in a virtual reality supermarket. A virtual reality supermarket can be seen as a combination of a physical supermarket and an online supermarket, as consumers do not need to leave their home but can get the real supermarket experience. In the research by Blom, Gillebaart, De Boer, van der Laan & De Ridder (2021), the effect of a salience nudge on the food choice of consumers in a virtual reality supermarket was tested. Participants were given a grocery list with six products from different product categories and were asked to buy these products in a virtual reality supermarket. Each of these product categories had several products ranging from very unhealthy to very healthy. Furthermore, participants were randomly assigned treatment. For the treatment, two out of the six categories on the grocery list had an orange border around the healthy option in the product category. Blom et al. (2021) argued that this salience nudge would make the healthy product stand out and would influence the consumer in picking the healthy option in that product category. The results confirmed this expectation and showed that people in the treatment group were more likely to buy the nudged healthy product than those in the control group. Even more striking was that not only the nudged healthy product was bought more by

the treatment group, but the treatment group was also more likely to buy more healthy products in non-nudged categories. Therefore, the salience nudge even had an effect on food choice in product categories where the nudge was not visible. This study provides relevant evidence for the positive effect of salience nudges on healthy food choice in non-physical supermarkets. Based on the literature about the influence of nutrition information on healthy eating awareness (Orquin & Scholderer, 2011; Grunert & Wills, 2007) and the study by Blom et al. (2021), Hypothesis 2 is as follows: *a salience nudge in online supermarkets positively influences healthy food choice.*

3. Methodology

3.1. Study design

The current research aims to learn more about healthy food choices in online supermarkets. Data was collected using an online survey made in Qualtrics, which aimed to simulate a real life online supermarket. Similar to real life online grocery shopping, participants filled in the survey on their own laptop or computer at home. Participants were allocated to either the control group, a salience nudge group or a social proof nudge group. The dependent variable was the healthiness of participants' food choices measured in a grocery shopping task. This was measured using the Nutri-Score system, which will be explained in Section 3.4. In addition to this, the study gathered information on participants' knowledge on healthy food.

3.2. Procedure

Upon visiting the survey page, participants were briefly explained the topic of the current research and asked for their consent. Next, participants were instructed to pick exactly one product from each of the product categories that were going to be presented to them in the grocery shopping task as follows: "*On the next page, you will find an online shelf of the hypothetical supermarket Ultra with 8 products from the same category. Please choose exactly 1 product that you would prefer to buy, by clicking on the orange plus sign underneath the product".* Note that these instructions did not differ across treatment groups. Each participant was shown five product categories, randomly selected from a total of ten product categories. A complete list of product categories and their products, ordered on Nutri-Score, can be found in Table A1 in Appendix A. Furthermore, after making the five choices, participants were asked to report how much certain factors (taste, price, healthiness and packaging) influenced

their choices and whether there were any other factors that influenced their choices. Specifically, they were asked how much they agreed with the statement *"When choosing a product, taste/price/healthiness/packaging of the product is important to me"* on a scale of 1 (*totally disagree*) to 5 (*totally agree*).

3.3. Online supermarket

The survey was designed to look similar to the websites of existing large Dutch supermarkets, as the study was targeted at Dutch inhabitants. The ten product categories were chosen based on *(i)* whether they were a category that Dutch consumers commonly purchase products from and *(ii)* whether there was a fair distribution of healthy and unhealthy products within each category. Furthermore, each product category page consisted of a basic supermarket lay-out, product titles (including product volume), product images and product prices. The product images were gathered from the websites of Dutch supermarkets Albert Heijn and Jumbo. Furthermore, any home brand logos were replaced by a custom logo for the hypothetical supermarket. This was done to prevent confusion and to increase credibility of the hypothetical supermarket. In addition to this, there was a clickable plus-sign underneath each product image so participants could add their preferred product to their digital shopping cart. Figure 1 shows an example of the product page for sodas without any nudges. For each product category, participants could choose between a total of eight products, with varying healthiness based on the Nutri-Score system. Furthermore, within each category the order in which the products were presented was randomized using an online webtool and all participants saw the same order. This was done to prevent any bias in the product positioning induced by the researcher.

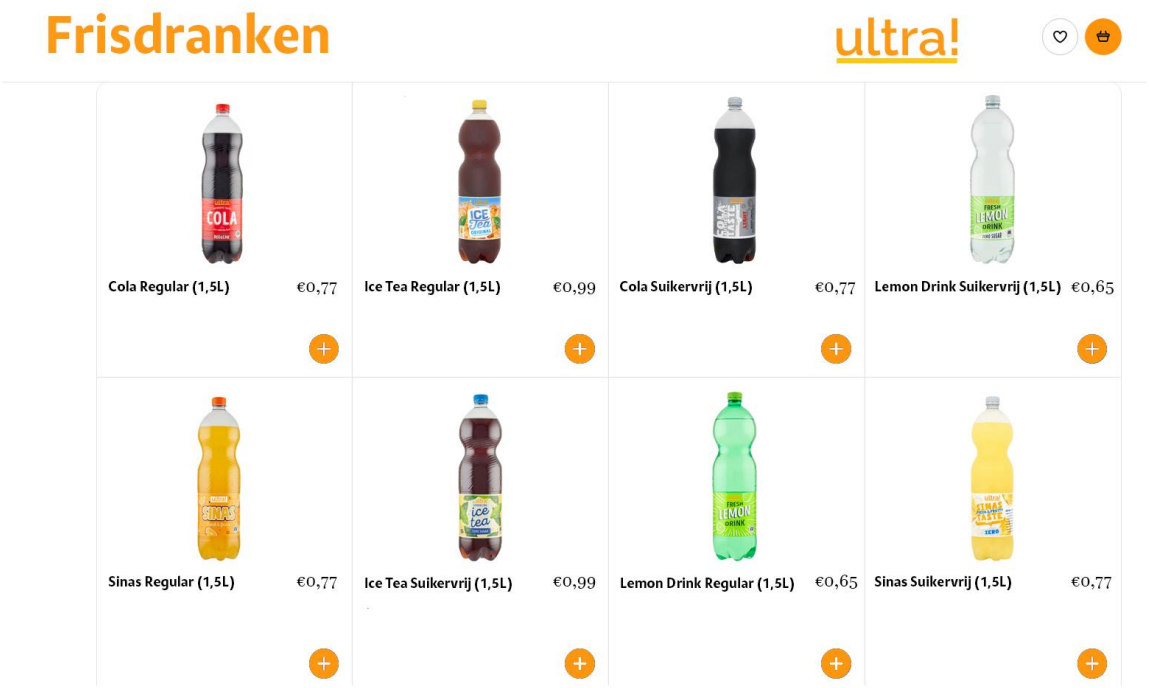

Figure 1. Sodas product page shown to the control group.

Participants in the salience nudge group were shown a different product category page compared to the control group. According to the study by Blom et al. (2021), surrounding the healthiest product by an orange colored border increases the healthiness of food choices in a virtual reality supermarket. Therefore, in the salience nudge condition, the healthiest product within each category was surrounded by an orange border. Note that the participants were not informed about the existence, nor the meaning of this border. An example of the salience nudge can be seen in Figure 2.

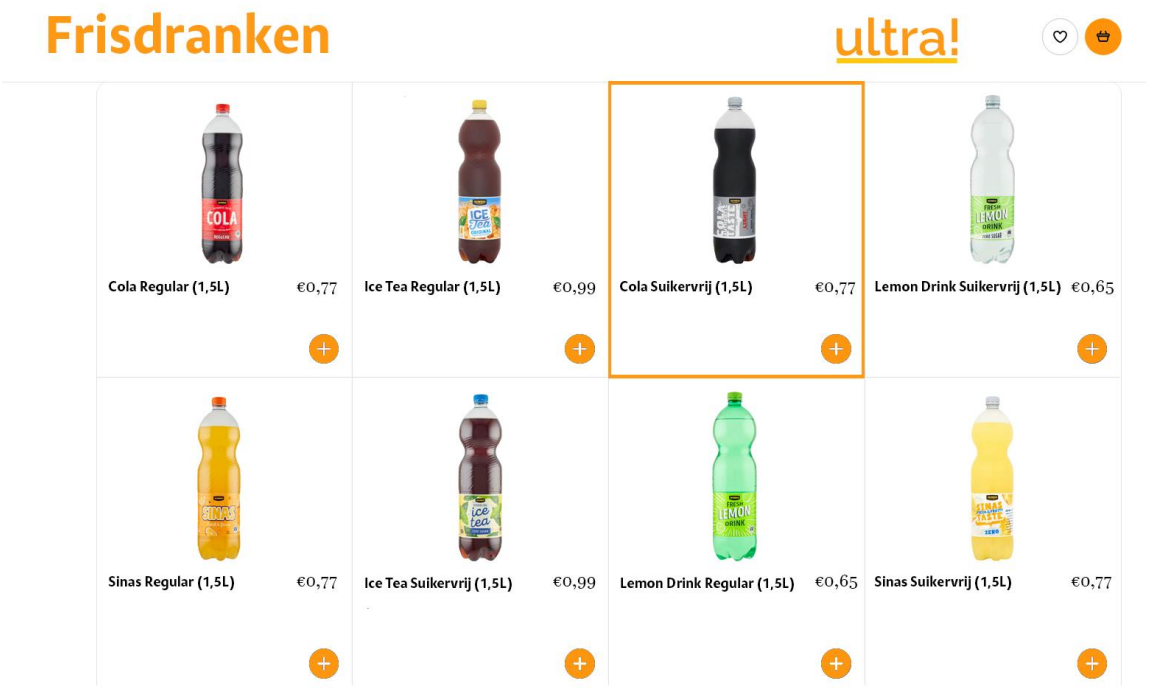

Figure 2. Sodas product page shown to the salience nudge group.

Next, participants in the social proof nudge group were also shown a variation of the control product category page. As proven in research by Huitink et al. (2020) and Gonçalves et al. (2021), providing consumers in physical supermarkets with a social norm about the behavior of other supermarket customers can influence the healthiness of their food choice. Therefore, participants in the social proof nudge condition were given the following social norm message about the Dutch population: *"2/3 of people living in The Netherlands make food choices in line with the Wheel of Five"*. The *Wheel of Five* (in Dutch: *Schijf van Vijf*) mentioned in this message is a well-known dietary guideline for healthier eating in The Netherlands (Brink et al., 2019). In addition to this standard message, each product category would have a customized sentence informing the participant about what unhealthy nutrients would be common in that specific category. These unhealthy nutrients were in line with the Nutri-Score system. Figure 3 shows the sodas category example for the social proof nudge condition. As can be seen, the social norm informs participants that in the sodas category the unhealthiest options contain a lot of sugar.

Figure 3. Sodas product page shown to the social proof group.

Finally, after finishing the grocery list task, all participants performed a healthy foods knowledge test. This part of the survey consisted of information on the Nutri-Score system and presented the images of the control versions of the remaining five product categories in random order. In addition to this, with each image, participants were asked to choose the product with the highest Nutri-Score and the product with the lowest Nutri-Score. Specifically, respondents were asked: *"Which of the above products do you think has the highest (lowest) Nutri-Score and is therefore the healthiest (unhealthiest) product?"*. The answer options were given as multiple choice answers and consisted of the titles of the products shown in the main image.

3.4. Nutri-Score

As mentioned before, the healthiness of the products was measured using their Nutri-Scores. The Nutri-Score is a method used to measure whether a food product fits into a healthy diet or not, and can be shown on the packaging of products in supermarkets (Foodwatch, 2020). The score can be helpful for consumers to better understand whether they are making healthy choices. Furthermore the method can also motivate producers to develop healthier products and increase their Nutri-Score. The Nutri-Score ranking consists of the letters A through E, with A being the healthiest and E being the unhealthiest. Furthermore, these letters are accompanied by a color range

from dark green to dark red, the former again being the healthiest. The Nutri-Score looks at both healthy and unhealthy nutrients to judge whether a product is healthy. In short, the system assigns a value to the unhealthy nutrients (energy density, sugars, saturated fats and natrium) from 0 to 10, and to healthy nutrients (fiber and protein) from 0 to 5. Next, the healthy score is subtracted from the unhealthy score and the remaining value is compared to the letter scale. Figure 4 shows the Nutri-Score letters and their corresponding value ranges.

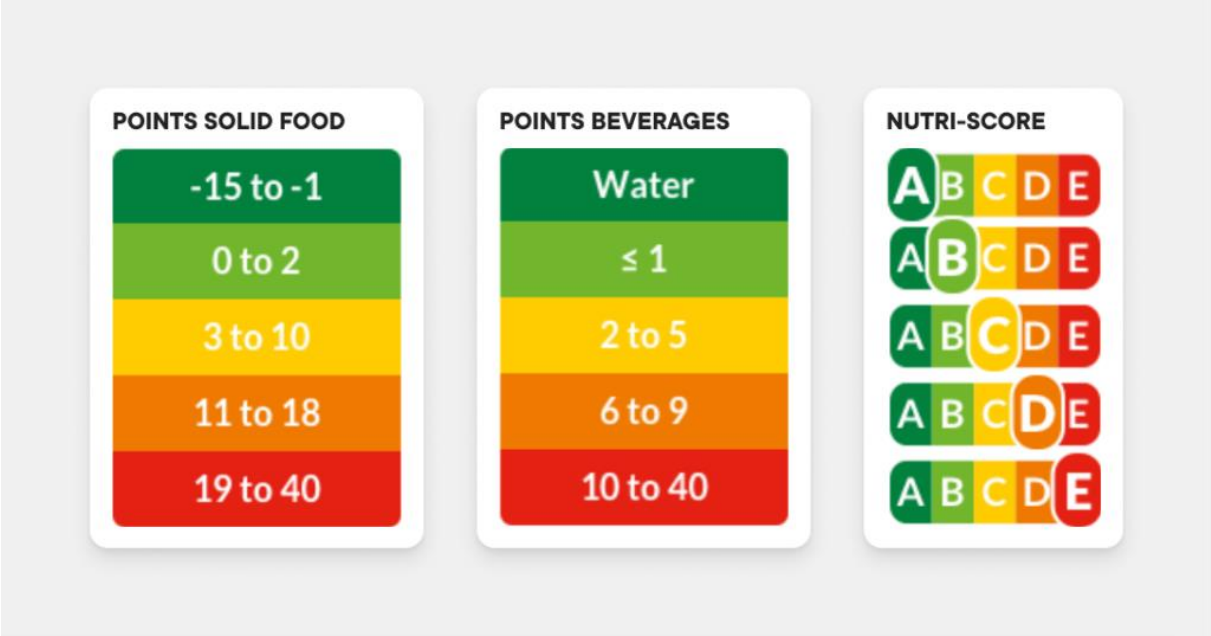

Figure 4: Nutri-Score points ranking (Brabants, n.d.)

Several European countries, such as for example Germany, France and Belgium, have chosen to use the Nutri-Score logo on food products. Furthermore, in early 2022, the Dutch government has also chosen for the Nutri-Score logo to be used as guideline for healthy food choices (Rijksoverheid, 2022a). In the second half of 2022, companies in The Netherlands are allowed to use the logo on their packaging (Rijksoverheid, 2022b). However, the Dutch government does mention that the Nutri-Score does not always connect to the Dutch dietary guidelines and the Wheel of Five of the Dutch Voedingscentrum. Furthermore, some online supermarkets currently include product images with the Nutri-Score visible. However, this is merely part of the product packaging which is visible on the product images. The Nutri-Score and further explanation on its use is mentioned nowhere on the website of Dutch supermarkets as of writing this thesis.

3.5. Power calculations

To get an estimate of the required sample size of the research, an a priori power analysis was performed before the online survey was distributed. The statistical software *G*Power 3.1* was used for this. The minimum required sample size was estimated using α = 0.05 and power = 0.8 and using a previously determined moderate effect size of d = 0.3 (Broers, De Breucker, Van den Broucke & Luminet, 2017, as cited in Blom et al., 2021). The calculations show that an ANOVA with three groups requires a minimum sample size of 111 observations This comes down to 37 observations per group.

3.6. Participants

Although the tasks in the survey are made to look like real life, participants are aware that they are partaking in an experiment. Subjects were recruited using snowball sampling in the personal network of the author. Access links to the online survey were send to friends and family of the author and posted on social media. Furthermore, anyone currently living in The Netherlands and fluent in the Dutch language was eligible for participation. All participants were required to give consent before starting and participants under the age of eighteen were required to have a parent's permission to be able to participate in the survey. After removing those who were not eligible for the study and those who did not complete the grocery shopping task, the dataset consisted of a total of 117 observations**.**

3.7. Measures

3.7.1. Main variables of interest

Grocery health score – The dependent variable of the research is the healthiness of the food choices made in grocery shopping task. The healthiness of each product was measured by looking at the Nutri-Score, where each rank was assigned a score from 0 to 4, with the A-rank being the healthiest and having a score of 4. The food choice healthiness variable contains the total of the scores of all five categories in the grocery list task added together. Thus, this variable can take on any integer value from 0 to 20.

Treatment – The main independent variable is the treatment variable. This variable is categorical and can take on three values: 0 when assigned to the control group, 1 when assigned to the salience nudge group and 2 when assigned to the social proof nudge.

Healthy food choice knowledge – To measure how well participants understand what products are healthy, the participants' knowledge on healthy food was measured using

a health knowledge test. Similar to the food choice healthiness variable, this was measured using the Nutri-Score. Within each category, products were ranked based on their Nutri-Score grade, where identical grades would get an identical ranking. Next, the variable combines the answers to the two healthy food choice knowledge questions. When asking about the product with the highest Nutri-Score grade, the highest ranked product(s) is assigned a score of 4. Every rank down from the highest rank reduces 1 point from this score, with a minimum score of 0 in case a category contains products from all five Nutri-Score grades. For the question about the product with the lowest Nutri-Score grade, this scoring system is reversed. Here, picking the product(s) with the lowest rank awards participants 4 points. Finally, for all five categories, the food choice knowledge scores are combined. In total two categories consisted of products with all five different Nutri-Score grades, leading to a score range of 0 to 4 per category per question. However, as the categories are randomly assigned, not all participants are shown either or both of these categories. The remaining eight categories consisted of products with only four of the five Nutri-Score grades. These categories had a score range of 1 to 4 per category per question. Thus, in total, this variable can take on any integer value from 6 to 40.

3.7.2. Control measures

In addition to the three variables mentioned above, the survey gathered information on several personal characteristics and online supermarket behavior and general food choice behavior of participants. The following variables were measured:

Household groceries responsibility – To understand how important grocery shopping was for each respondent, participants were asked *"Are you responsible for doing the groceries for your household?"*. Participants could choose either *Yes*, *No* or *Sometimes*.

Online supermarket experience – To see whether participants were familiar with online grocery shopping, they were asked *"What is your experience with online grocery shopping?"*, where they could choose between the following answers: *I have never done this*; *I have used this in the past, but I am currently not using this; I am currently*

using this daily; I am currently using this weekly; I am currently using this monthly; Other[1].

Diet – As food choices can be influenced by potential dietary restrictions participants have, respondents were asked *"Are you following a diet that influences your food choices?"*. Here, participants could answer *No; Yes, I am on a vegetarian/vegan diet; Yes, I am on a weight loss diet; Yes, I follow a religious diet; Other*.

Self-assessed healthiness of daily food choices – To better understand whether people's beliefs about the healthiness of their food choices are in line with the actual healthiness of food choices, participants were asked *"How healthy do you estimate your own daily food choices?"*. Here participants could answer using a slider ranging from 0 to 10.

Demographic variables – In addition to the measures mentioned above, several question were asked regarding the age, gender, income and education level of the participants. The detailed variable categories can be found in Table A2 and Table A3, which also shows the relevant descriptive statistics.

3.8. Statistical analyses

First, all control variables were compared between the three different treatment groups using one-way ANOVA tests, to test whether randomization was successful. To be able to perform the one-way ANOVA tests, several assumptions need to hold (Moore, McGabe, Alwan, Craig & Duckworth, 2016). This section will briefly discuss each of these assumptions. First, the dependent variable needs to be continuous. As mentioned before, the grocery health score can take on any integer value within the range of 0 to 20 and is therefore continuous. Secondly, the treatment variable must consist of two or more independent categories. As treatment was assigned randomly and there are three groups, this assumption also holds. Thirdly, as participants were only able to partake in the survey once and treatment was randomly allocated, the assumption of independence of observations holds. The fourth assumption requires there to be no significant outliers in the data. Figure A1 shows the boxplot of the dependent variable. As can be seen, there is a single outlier in the top of the figure. As this outlier has a value of 19, and the grocery health scores ranges from 0 to 20, it is

[1] Several questions included the answer option "Other", where participants were able to write their own answer in a text box.

assumed that this outlier will not have a large influence on the results. However, the ANOVA analysis in this thesis were also ran after removing this outlier to check if there would be large differences. As expected, removing the outlier did not cause any large changes in the results. For the fifth assumption, a histogram of the dependent variable was made to check whether this variable approximately follows a normal distribution. As can be seen in Figure A2, it can be argued that the distribution does not follow a normal distribution, as the median does not seem to be balanced. To check whether the grocery health score is not normally distributed, a skewness and kurtosis test for normality as well as a Shapiro-Wilk W test were performed. Table A4 and Table A5 show the results of these tests, with the null hypothesis that the variable is normally distributed. As can be seen in the tables, both the skewness and kurtosis test for normality (p =) and the Shapiro-Wilk W test show that the hypothesis of normality cannot be rejected. Although this does not confirm that the variable is normally distributed, it does provide more confidence that the assumption of normality holds. Finally, to use ANOVA there must be homogeneity of variances. To test this, Levene's robust test was performed. The results of this test confirm that this assumption also holds: regardless of whether the test statistic was centered at the mean (W0(2, 114) = 0.870, p-value = 0.422), the median (W50(2, 114) = 0.841, p-value = 0.434) or the ten percent trimmed mean (W10(2, 114) = 0.838, p-value = 0.435), there were no statistically significant differences in the grocery health scores. Therefore, although one of the assumptions potentially does not completely hold, an ANOVA analysis will be performed for the main results.

Next, the hypotheses were tested by performing a one-way ANOVA analysis of the grocery health score for all treatment conditions. This will be the main analysis of this thesis. Furthermore, several additional analyses will be performed. Firstly, the reasons why participants made their grocery shopping choices will be analyzed. This will be done by looking at the means, as well as comparing these means per treatment group in a one-way ANOVA test. Secondly, it will be tested whether other variables have an influence on the grocery health scores by running an ANCOVA analysis. The ANCOVA method allows for covariates to be added to the main ANOVA analysis of treatment on grocery health scores. More specifically, the treatment variable and variables for personal characteristics will be added to the model as control variables.

4. Results

4.1. Randomization check

To see whether randomization was successful and personal characteristics do not significantly differ between treatment groups, several Chi-squared tests were performed for the three groups. The results of these tests show that there were no significant differences across the groups for the categorical variables for age, $\chi^2(12, 114) = 9.43$, $p = 0.666$; gender, $\chi^2(4, 114) = 4.879$, $p = 0.300$; income, $\chi^2(16, 114) = 11.300$, $p = 0.791$; education $\chi^2(8, 114) = 7.644$, $p = 0.469$; experience with online groceries $\chi^2(8, 114) = 9.111$, $p = 0.333$; responsibility for doing groceries $\chi^2(4, 114) = 4.383$, $p = 0.357$ and diets, $\chi^2(6, 114) = 4.384$, $p = 0.625$. Furthermore, an ANOVA test was performed to see if the healthy food knowledge differed across treatment groups. Interestingly enough, results of this test show no significant differences $F(2, 117) = 0.1$, $p = 0.901$.

4.2. Main analysis

Next, Table A6 shows the summary statistics of the grocery health score for each treatment condition. As can be seen, there appear to be no large differences in the mean grocery health score between treatments. However, to really test the effect of the salience nudge and social proof nudge on the healthiness of the food choices of the participants (hypothesis 1 and hypothesis 2), a one-way ANOVA test with all three conditions was performed. The ANOVA test was executed with the between-subjects treatment variable for the nudges and the grocery health score as the dependent variable. The results show that there are no significant differences in grocery health scores between the treatment groups, $F(2, 117) = 0.83$, $p = 0.437$. As the one-way ANOVA test shows no significant effect, it is not necessary to perform Tukey post-hoc testIs and both hypothesis 1 and hypothesis 2 do not seem to hold.

4.3. Reasons for food choices

After the grocery shopping task, all participants were asked to rate how important the product characteristics taste, price, packaging and healthiness were to them when making a food choice. More specifically, they were asked how much they agreed with the statement "*When choosing a product, taste/price/packaging/healthiness of the product is important to me"* on a 5-point Likert scale ranging from *completely disagree* to *completely agree*. Table 1 gives an overview of the mean scores for each product attribute. As can be seen, on average, taste seems to be the most important factor for deciding which product to pick with a mean of 4.573 out of a maximum of 5.

Furthermore, people seem to find healthiness slightly more important than the price of a product, but clearly care the least about the packaging of a product. This could imply that showing the Nutri-Score on the product packaging in the future might not be effective. However, this reaches beyond the aim of the current study. When taking a look at the reasons for making a certain food choice for each treatment, no clear differences between the conditions were found. Furthermore, one-way ANOVA analyses for each product attribute and the three treatments conditions showed no significant differences between treatments, as can be seen in Table 2. This confirms that participants in either condition does not consciously care more about the product's healthiness in their food choice.

Table 1. Descriptive statistics grocery shopping reasons.

Reason variable	Mean	Standard deviation	Observations
Healthiness	3.923	0.745	117
Packaging	2.812	0.937	117
Price	3.590	0.902	117
Taste	4.573	0.530	117

Table 2. One-way ANOVA analyses results for treatment conditions per grocery shopping reason.

Reason variable	F-value	p-value	Observations	Degrees of freedom
Healthiness	0.6	0.553	117	2
Packaging	0.14	0.873	117	2
Price	0.27	0.764	117	2
Taste	0.23	0.797	117	2

In addition to the Likert-scale questions about the four product attributes, participants were able to report additional factors that are important in their food choice in a text box. In total, fifteen participants mentioned additional reasons. The most frequently reported reason (six participants) was that the participant chose a product out of habit, familiarity or previous experience or with that specific product. Furthermore, three people reported that they looked at the product's brand and their experience with that brand. This finding and its possible explanation will be described in more detail in the discussion section of this thesis.

4.4. Additional analyses

Next, the main model was expanded by adding the health knowledge score variable and the variables for personal characteristics. The results of the ANCOVA analysis of this model are shown in Table 3. As can be seen, there are no significant effects found for either the treatment variable or the healthy knowledge score. Furthermore, looking

into the relationship between treatment and the healthy knowledge score, an ANCOVA analysis was performed. However, no significant differences were found F(2, 117) = 0.1, p = 0.901. This is logical, as the nudges are not designed to increase people's understanding of what is healthy. Next, as can be seen in the table, the variables for age, F(6, 114) = 2.78, p-value = 0.016, income, F(8, 114) = 2.94, p-value = 0.017 and the self-reported healthy food choice, F(1, 114) = 4.08, p-value = 0.047 seem to have a significant effect on the grocery health score at a 5 percent significance level in this model.

Table 3. ANCOVA analysis of treatment and control variables on grocery health score.

Variables	**F-value**	**p-value**	**Observations**	**Degrees of freedom**
1. Treatment	0.39	0.675	114	2
2. Health knowledge	0.53	0.468	114	1
3. Age	2.78	0.016	114	6
4. Gender	0.28	0.758	114	2
5. Education	0.30	0.822	114	3
6. Income	2.94	0.017	114	8
7. Grocery responsibility	1.35	0.266	114	2
8. Online experience	1.34	0.261	114	4
9. Diet	0.96	0.416	114	3
10. Healthy choices (*SR*)	4.08	0.047	114	1

Next, Table 4 shows the ANCOVA model as a regression table. Unexpectedly, the table shows no significant effects. However, this can be explained as the ANCOVA F-test looks at the joint significance of the categories of the categorical variables. This does not have to imply that there also is a single significant category within those significant variables. On the other hand, Table 4 does confirm the significantly positive effect of the self-reported healthy choices on a 5 percent significance level (p = 0.047). This means that a one point increase in the self-reported healthy choices rating leads to a 0.592 increase in the grocery health score, ceteris paribus.

Table 4. Regression table of ANCOVA analysis of treatment and control variables on grocery health score.

Variables	**Coefficient**	**Standard error**	**P-value**

1. Treatment			
Salience nudge	-0.187	0.765	0.808
Social proof nudge	0.459	0.758	0.546
2. Total health knowledge	-0.060	0.082	0.468
3. Age			
18 to 20 years	0.885	3.734	0.813
21 to 29 years	1.546	3.428	0.653
30 to 39 years	-2.520	3.799	0.509
40 to 49 years	2.086	3.776	0.582
50 to 59 years	-2.926	3.644	0.424
60 years or older	0.485	3.616	0.894
4. Gender			
Male	-0.441	0.642	0.494
Other	0.731	3.194	0.819
5. Education			
Dutch high school	0.663	1.320	0.617
HBO/University without degree	-0.046	0.956	0.962
Bachelor's degree	0.553	0.840	0.512
6. Income			
500 to 1000 euros	-1.312	0.918	0.157
1000 to 2000 euros	-0.599	0.953	0.531
2000 to 4000 euros	1.898	1.246	0.131
4000 to 7500 euros	0.980	1.198	0.415
7500 euros or more	-3.212*	1.855	0.087
7. Grocery responsibility			
No	-1.584	1.009	0.120
Sometimes	-0.757	0.728	0.302
8. Online grocery experience			
Only used in the past	-1.174	0.776	0.134
Currently monthly	-0.593	1.077	0.584
Currently weekly	0.635	1.062	0.551
Other	2.575	2.248	0.255
9. Diet			
Vegetarian/vegan	0.813	1.007	0.422
Weight loss	1.649	1.311	0.212
Other	-0.574	1.003	0.569
10. Healthy choices (SR)	0.592**	0.293	0.047

Notes: Standard errors can be found in parentheses. Furthermore, *** for p<0.1.

5. Discussion

Health issues as a result of poor nutrition are still a large problem, even though there is scientific evidence of the positive effect of behavioral nudges on healthy eating. As popularity of online supermarkets is increasing, the aim of this thesis was to find out whether there is an effect of existing types of nudges on the healthiness of the food choices consumers make in an online supermarket. This was tested using an online supermarket environment where participants were asked to choose one out of eight products, ranging from unhealthy to healthy, from five different product categories. Participants were either exposed to a salience nudge a social proof nudge or the control condition. In the salience nudge the healthiest product was surrounded by an orange border. For the social proof nudge, the product page included a social norm message about healthy eating.

After analyzing the data, no significant effects of any of the nudges on the healthiness of participants' food choices were found. This means that Hypothesis 1, which expected the salience nudge to have a positive effect, and Hypothesis 2, which expected the social proof nudge to have a positive effect, do not hold. Surprisingly, this contradicts existing literature, which found both nudges to be effective in increasing healthy food choices in different supermarket settings. It can be argued that the differences between a physical supermarket and an online supermarket also result in a different decision making process for the consumer. Here, the main difference between the supermarket settings in existing literature and the current experiment is the look and feel of the environment. For example, in the researches by Huitink et al. (2020), Blom et al. (2021) and Gonçalves et al. (2021), participants were able to see the products presented on shelves and were able to walk around in the supermarket, albeit digitally. However, in the current experiment, participants were presented products in a web shop lay-out, meaning there were pictures of the products instead of actual products and shelves. This could be a reason why the nudges did not work in the online supermarket setting. However, explaining how the difference in physical shelves versus online shelves influences the healthiness of a food choice is beyond the scope of the current study. Furthermore, the studies by Huitink et al. (2020) and Gonçalves et al. (2021) were aimed at increasing the fruit and vegetable purchase, whereas the current thesis did not include any fruit or vegetable products. Finally, both of these studies had social proof messages about consumers shopping at the specific

supermarket the experiment took place. The current thesis, on the other hand, used a social proof message about the Dutch society in general. It could be that participants did not relate to this more general statement and therefore were not influenced by the social proof message.

Next, the current study provides some interesting findings outside of the main analysis. Firstly, it shows how consumers in the experiment found the taste of a product the most important factor and the packaging of the product the least important factor in making a food choice. This is in line with existing literature (Contento et al., 2006), which mentions taste as the primary reason why consumers choose certain food. Secondly, when asked about other factors that influenced their food choice, nine out of the 25 participants that left an answer, mentioned familiarity with the product or the brand. This finding can be linked to the concept of the availability heuristic invented by Kahneman & Tversky (2005). This concept suggests that people judge things that come to mind easily as more important. Therefore, it can be argued that products or brands that are rooted in the minds of consumers are more likely to be chosen, regardless of their healthiness or informative health labels. Finally, the extensive ANCOVA model shows that the self-reported healthy choices rating significantly increases the grocery health score. This means that those who have a more positive perception of their healthy food behavior do in fact make more healthy food choices.

5.1. Limitations

As the results of the experiment show no significant effects, it could be the case that there is in fact no true effect of the nudges used in the survey. However, as existing literature has provided evidence of the effect of the same types of nudges in different supermarket settings, it is relevant to discuss the potential limitations of the current experiment that could have influenced the results.

First, a common limitation is that the sample data was not completely representative of the target group of this study. The current research targets people living in The Netherlands and 34 percent of the Dutch society is between ages forty and 65 (Centraal Bureau voor de Statistiek, 2021). However, in the used sample, only 25.44 percent was more than forty years old. At the same time, 68.42 percent of the participants in the dataset were between twenty and 40 years old, whereas in the Dutch society this is only 25 percent. It makes sense that this age group is overrepresented in the sample, as data was collected online and on platforms where a lot of students

are active. However, it makes it hard to generalize the results for The Netherlands as a whole and thus threatens the external validity.

Secondly, participants were aware that they were partaking in an online experiment and therefore it is possible that they did not make the choices they would have made in a real life situation. There are several factors that could potentially influence participants' food choices in real life, that did not exist in the experimental setting. For example, although participants were shown the prices of the products, they did not have to worry about any financial budgetary constraints when making their choice. However, it is possible that part of the participants would have made a different decision under budgetary constraints. More specifically, as healthier products are generally more expensive in supermarkets, participants with a budgetary restriction could be choosing more healthy in the experiment than in real life. Furthermore, participants in the experiment, although instructed to answer honestly, were in no way incentivized to answer to their actual preference. Whereas in real life, if someone would choose to buy a certain products, they would also be able to enjoy the benefits of owning that product (i.e. consumption). This could potentially influence the choices participants made in the experiment. For example, someone would pick a healthier option in the experiment that they dislike in real life, because they would never have to actually consume the product. However, for both of these examples it must be noted that treatment was randomized successfully. Therefore, any influence of these factors should be represented equally in all treatments groups. Thus, this should not influence the differences between groups.

Thirdly, the selection of products and product categories in the experiments could influence the scores that participants were able to get. As mentioned before, not all product categories had the exact same distribution of healthy and unhealthy products. However, most categories had roughly the same average product healthiness score. Nevertheless, as product categories were randomly assigned, it could be possible that a participant was mainly assigned product categories that were unhealthier than the average product categories. This would then mean that even if the participant would choose the healthiest product from each category, their total score would be lower than that of a participant with mainly healthy product categories. However, commonness of the grocery product categories was prioritized over exactly equal healthiness distributions when selecting product categories for this experiment. The differences in

healthiness between the product categories used in the experiment might limit the trustworthiness of the results. In addition to this, even though the chosen product categories are common in The Netherlands, participants might have been asked to choose from a category they normally do not buy from. Therefore, they might not have a clear preference in some of their food choices. However, as randomization was successful, this should effect the results equally across treatment conditions and therefore not influence the main results.

Fourth and final, there was one product category that did not contain at least one vegetarian or vegan option. Therefore, participants following a specific diet could have been forced to make a choice that they would never make in real life. However, the selection of products was made carefully and aimed to take into account dietary options. Out of the 117 observations, twelve participants reported to follow either a vegetarian or vegan diet. Six of these participants were assigned the cookies category which did not have a vegan option. Note that it could be possible that these participants were vegetarian and that the cookies category did contain at least a vegetarian option. However, the dataset is not detailed enough to confirm this. In addition to this, all the fourteen participants who said to follow a diet that was not included in the diet question reported dietary reasons such as weight gaining, allergies or a partially vegetarian diet. Therefore, although more care should have been taken in the survey design, is it unlikely that this mistake forced participants to make a food choice conflicting with their diet.

5.2. Recommendations

Finally, the current thesis will provide several recommendations for future research into the subject of healthy food decisions in online supermarkets. Firstly, other nudges that have been proven to work in physical supermarkets can be studied in the online supermarket environment. Future research could, for example, look into the effects of the order in which products are presented on the product page. As existing literature proves the effect of food positioning in real life settings (Bucher et al., 2016), it could be that this also works in an online supermarket. Secondly, the current experimental design could be replicated with a different selection of products or using a different system for measuring healthiness of food. A third and final recommendation would be to look into potential differences in the effects of behavioral nudges on food choices

between food categories of different degrees of healthiness. More specifically, it could be that certain nudges have a larger effect in increasing healthy food behavior when implemented in a healthy food category than in an unhealthy food category. Examples of a healthy food category would be dairy products and vegetables, whereas salted snacks or cookies would be an example of an unhealthy category.

5.3. Conclusion

The current thesis shows there is no significant effect of a salience nudge, nor a social proof nudge on the healthiness of food choices in an online supermarket. Furthermore, it confirms that in general consumers pay the most attention to taste of the food product when making a food choice, whereas product packaging was the least important. Although the nudges tested in this thesis show no significant effect, it is important to further study the potential power behavioral nudges have in improving healthy eating and increasing the overall health of society.

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Appendix A: Additional figures and tables

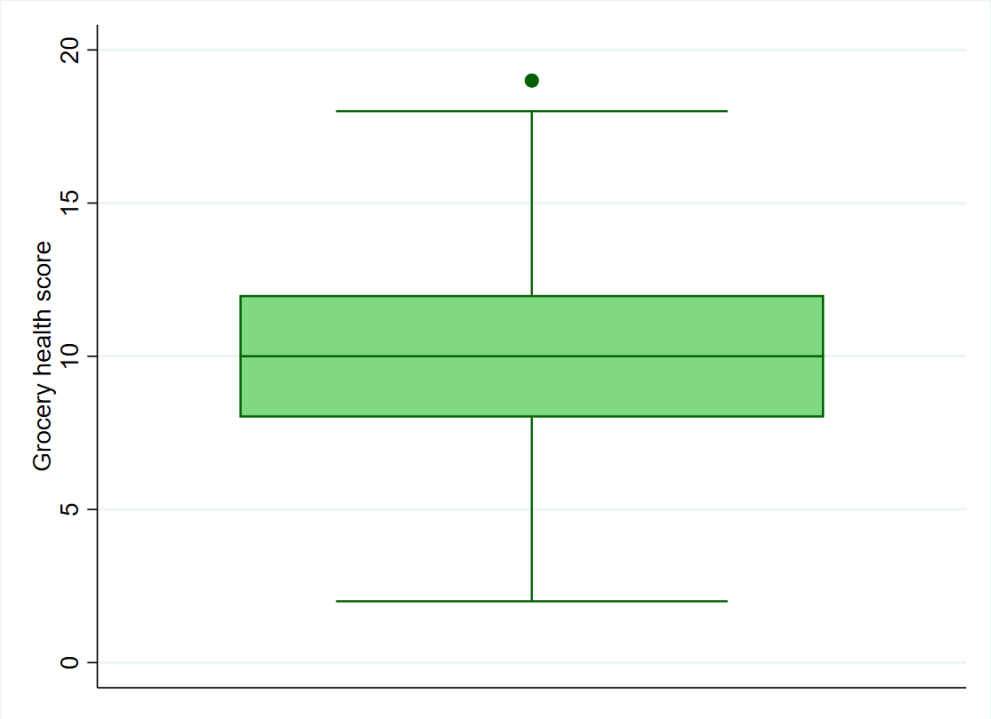

Figure A1. Boxplot of distribution grocery health score

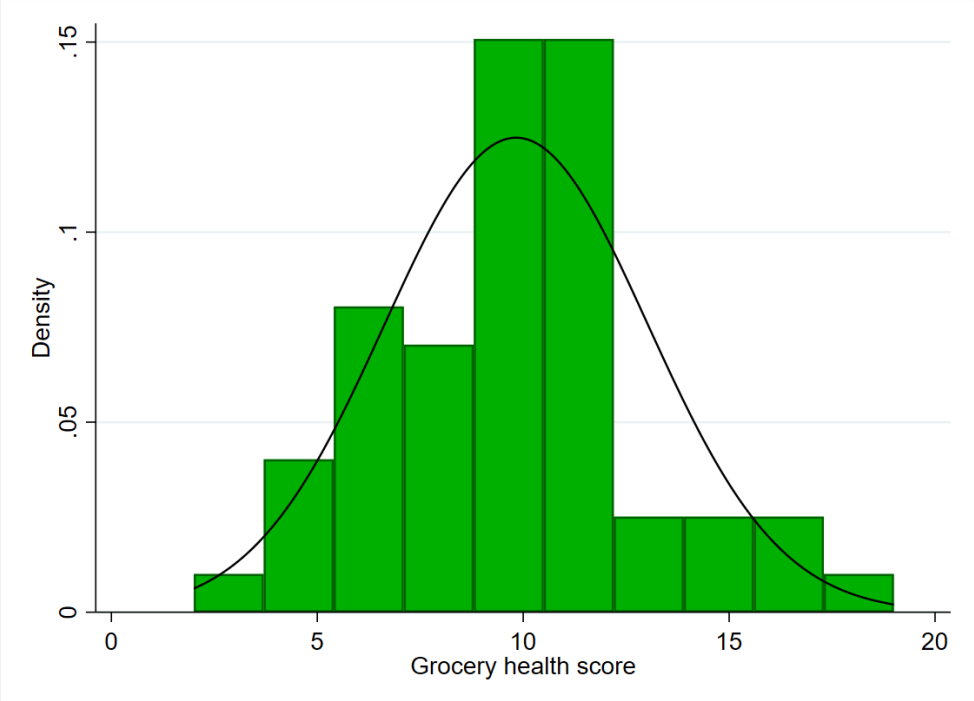

Figure A2. Histogram of distribution grocery health score

Table A1. Detailed overview of products used in survey.

Product (category)	Nutri-Score rank	Healthy points	Unhealthy points
Breakfast cereals			
Cola Light	A	4	1
Crystal Clear Cranberry	A	4	1
Lemon Drink Zero	B	3	2
Sinas Zero	B	3	2
Ice Tea Regular	C	2	3
Lemon Drink Regular	C	2	3
Sinas Regular	D	1	4
Cola Regular	D	1	4
Candy			
De Bron Fruit-Gums Suikervrij	A	4	0
Fruit Forest Frambozen Crispy Bites	B	3	1
Food2Smile Gummy Mix Gluten- en Suikervrij	C	2	2
Let's Biet & Aardbei Fruit Snoep	C	2	2
Fruittella Summer Fruits Snoep Suikerbewust	D	1	3
Lonka Sinas Snippers	D	1	3
Werther's Original Klassieke Roomsnoepjes	E	0	4
Lonka Fudge Caramel	E	0	4
Condiments			
Heinz Tomaten Ketchup zonder toegevoegde suikers & zout	B	4	1
Jumbo Ketchup	C	3	2
Remia American Fritessaus	C	3	2
Remia Fritessaus Zero Sugar	C	3	2
Calvé Pot Yofresh	D	2	3
Van Wijngaarden's Zaanse Halfvolle Mayo	D	2	3
Hela Kruiden Ketchup Curry Original	D	2	3
Hellmann's Vegan Mayo	E	1	4
Cookies			
Céréal Koekjes Kokos	A	4	1
Jumbo Meergranenbiscuits Appel	C	3	2
Liga BelVita Chocolade Koekjes	C	3	2
Liga BelVita Meergranen Koekjes	D	2	3
Verkade San Francisco Volkoren	D	2	3
LU Time Out Granenbiscuits Koekjes Naturel	D	2	3
LU Time Out Granenbiscuits Koekjes Melkchocolade	E	1	4
Verkade Nizza Kokos	E	1	4
Desserts			
Alpro Plantaardige Yoghurt Bosbes	A	4	1
Ehrmann High Protein Chocolate Mousse	A	4	1
Jumbo Yoghurtje met Bosfruit	B	3	2
Danio Romige Kwark Vanille	B	3	2
Jumbo Stracciatella Yoghurt	C	2	3
Almhof Hoekje Choco Balls Naturel Yoghurt	C	2	3
Jumbo Choco Mousse met Chocoladestukjes	D	1	4
Mona Toetje Van De Maand	D	1	4

Juices			
DubbelFrisss 1kcal Framboos-Zwarte Bes (suikervrij)	B	4	1
Cranberry 0% Sugar	B	4	1
Sourcy Vitamin Water	B	4	1
Jumbo Tomatensap	C	3	2
Spa Duo Blackberry Raspberry Koolzuurvrij	D	2	3
Jumbo TintelFris Rood Fruit	D	2	3
Jumbo Fruitsap Sinaasappel	E	1	4
Cranberry Classic: E score	E	1	4
Meat (replacements)			
Jumbo Lekker Veggie Kruimgehakt Vegan	A	4	0
Jumbo Lekker Veggie Krokante Kipburger Vegan	A	4	0
Jumbo Schnitzel Varken	B	3	1
Jumbo Vegetarische Braadworstjes	B	3	1
Jumbo Kipkrokant Schnitzel	C	2	2
Jumbo Gemengd Gehakt Rund & Varken	D	1	3
Jumbo Hamburger Rund	D	1	3
Jumbo Varken Bratwurst	E	0	4
Pizza			
Garden Gourmet Veggie Lovers pizza groente vegan	A	4	1
Dr. Oetker Ristorante vegan pizza rossa vegetale	A	4	1
WAGNER BIG city pizza sydney kip bbq saus	B	3	2
Dr. Oetker Ristorante pizza mozzarella	B	3	2
Dr. Oetker Ristorante pizza margherita	C	2	3
Jumbo Pizza Hawaii	C	2	3
Dr. Oetker Big Americans BBQ Pulled Pork	D	1	4
WAGNER BIG city pizza boston spinazie kaas	D	1	4
Sandwich spreads			
Jumbo Houmous Gegrilde Groenten: B score	B	4	2
Danone Hüttenkäse Original: B score	B	4	2
Jumbo Houmous Pikant: C score	C	3	3
Jumbo Houmous Zongedroogde Tomaat: C score	C	3	3
Jumbo Komkommersalade	D	2	4
Jumbo Kip Kerrie Salade: D score	D	2	4
Jumbo Smeerkaas Naturel 48+: E score	D	2	4
Veggie Chef Kip-Kerriesalade	D	2	4
Soda			
Cola Light	B	4	1
Crystal Clear Cranberry	B	4	1
Lemon Drink Zero	B	4	1
Sinas Zero	C	3	2
Ice Tea Regular	D	2	3
Lemon Drink Regular	D	2	3
Sinas Regular	E	1	4
Cola Regular	E	1	4

Table A2. Descriptive statistics of relevant variables in dataset.

Variable	Mean	Standard deviation	Minimum	Maximum	N
Grocery health score	9.829	3.196	2	19	117
Health knowledge score	31.103	6.367	0	39	117
Self-reported healthy choice	6.789	1.117	3	9	117

Table A3. Frequencies of baseline characteristics

Variable	Frequency	Percentage	Cumulative percentage
Treatment			
Control	40	34.19	34.19
Salience nudge	37	31.62	65.81
Social proof nudge	40	34.19	100.00
Age			
17 years or younger	1	0.88	0.88
18 to 20 years	6	5.26	6.14
21 to 29 years	74	64.91	71.05
30 to 39 years	4	3.51	74.56
40 to 49 years	6	5.26	79.82
50 to 59 years	12	10.53	90.35
60 years or older	11	9.65	100.00
Gender			
Female	68	59.65	59.65
Male	45	39.47	99.12
Other	1	0.88	100.00
Education			
Lower than Dutch high school	1	0.88	0.88
Dutch high school	11	9.65	10.53
HBO/University without degree	27	23.68	34.21
Bachelor's degree	53	46.49	80.70
Master's degree	22	19.30	100.00
Candidate/PhD	0	0	100.00
Income			
0 to 500 euros	21	18.42	18.42
500 to 1000 euros	25	21.93	40.35
1000 to 2000 euros	23	20.18	60.53
2000 to 4000 euros	22	19.30	79.82
4000 to 7500 euros	19	16.67	96.49
7500 euros or more	4	3.51	100.00
Grocery responsibility			
Yes	60	52.63	52.63
No	17	14.91	67.54
Sometimes	37	32.46	100.00
Online grocery experience			
Never	55	48.25	48.25
Only used in the past	33	28.95	77.19
Currently monthly	12	10.53	87.72
Currently weekly	12	10.53	98.25
Currently daily	0	0	98.25
Other	2	1.75	100.00
Diet			
None	80	70.18	70.18
Vegetarian/vegan	12	10.53	80.70
Weight loss	8	7.02	87.72
Religion	14	12.28	100.00

Table A4. Skewness and kurtosis tests for grocery health score.

Variable	N	Prob(skewness)	Prob(kurtosis)	Joint Prob > X^2
Grocery health score	117	0.1362	0.2561	0.166

Table A5. Shapiro-Wilk W test for grocery health score.

Variable	N	W	V	z	Prob > z
Grocery health score	117	0.985	1.390	0.736	0.231

Table A6. Summary statistics of healthy food knowledge score per treatment.

Treatment condition	Summary of mean	Standard deviation	Minimum	Maximum	N
Control	10.225	3.519	4	19	40
Salience nudge	9.297	2.856	3	18	37
Social proof nudge	9.925	3.165	2	17	40