Are nudging and pricing strategies on food purchasing behaviors equally effective for all? Secondary analyses from the Supreme Nudge virtual supermarket study

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ABSTRACT

Nudging and pricing strategies are effective in promoting healthier purchases. However, whether the effects are equal across individuals with different personal characteristics is unknown. This exploratory study aimed to examine differential effects of nudging and pricing strategies on food purchases across individuals’ levels of impulsivity, price sensitivity, decision-making styles, and food choice motives. Data from a virtual supermarket experiment where participants were exposed to five study conditions (control, nudging, pricing, salient pricing, and salient pricing with nudging) was used. Participants completed questionnaires assessing their impulsivity, price sensitivity, decision-making styles, and food choice motives. The outcome was the percentage of healthy food purchases. Effect modification was analyzed by adding interaction terms to the statistical models and post-hoc probing was conducted for statistically significant interaction terms. We used data from 400 Dutch adult participants (61.3% female, median age 30.0 years (IQR 24.0)). The effects of the nudging and pricing conditions on healthy food purchases were not modified by impulsivity, price sensitivity, decision-making styles, and the food choice motives 'health' and 'price'. Only the interactions of the food choice motive ‘natural content of foods’ x pricing (B = 1.02, 90%CI = 2.04; 0.01), the food choice motive ‘weight control’ x nudging (B = 2.15, 90%CI = 3.34; 0.95), and ‘weight control’ x pricing (B = 1.87, 90%CI = 3.11; 0.62) were statistically significant. Post-hoc probing indicated that nudging and/or pricing strategies were more effective in individuals who gave lower priority to these food choice motives. The effects of nudging and pricing strategies on increasing healthy food purchasing behaviors, at least in a virtual environment, do not seem to be influenced by personal characteristics and may therefore be implemented as general health promoting strategies.

1. Introduction

Non-communicable diseases (NCDs) cause around 41 million deaths each year, which is equivalent to 71% of all deaths globally (Forouzanfar et al., 2016). A key risk factor for NCDs is an unhealthy diet (Afshin et al., 2019). In the Netherlands, adults spend around 66% of their food purchasing budget in the supermarket (Wetenschappelijke Raad voor het Regeringsbeleid, 2014). Therefore, supermarkets are important entry-points for population-level approaches to improve dietary behaviors.

Several strategies within the supermarket environment can be used to promote healthy food purchasing behaviors and generally include environmental (e.g., nudging) and economic (e.g., pricing) interventions (Hartmann-Boyce et al., 2018). Environmental interventions such as...
Furthermore, price sensitive individuals may have more consumer pricing strategies that target the automatic decision-making process. Therefore, it is relevant to investigate possible differential effects by factors that are react less to nudging and pricing strategies compared to those who find these motives of less importance (Naughton et al., 2015). Therefore, it is to purchase healthier food products compared to individuals that find 'natural content' decision-making processes, evidence suggests that individuals who find certain food choice motives such as ‘health’, ‘natural content’, and ‘weight control’ of high importance, tend to purchase healthier food products compared to individuals that find these motives of less importance (Naughton et al., 2015). Therefore, it is possible that individuals who find these food choice motives important react less to nudging and pricing strategies compared to those who find these food choice motives less important.

The current study used secondary data from an experimental study that investigated the effects of nudging and pricing strategies on food purchasing behaviors in a virtual supermarket setting. Experimental studies in virtual settings allow for feasible and cost-effective collection of individual level data and can therefore also be used to compare the responses of different groups and examine the interactions between personal characteristics (Mizdrak et al., 2015; Waterlander, Jiang, Steenhuis, & Ni Mhurchu, 2015). This study aimed to explore the modifying role of the personal characteristics impulsivity, general decision-making styles, price sensitivity, and food choice motives in the relation between nudging and (salient) pricing strategies and healthy food purchases within a virtual supermarket environment.

2. Methods

2.1. Study design

In this exploratory study, data from the Supreme Nudge Virtual Supermarket (SN VirtuMart) study was used (Hoenink et al., 2021). The development, design, and procedure of the SN VirtuMart have been described in detail elsewhere (Hoenink et al., 2020, 2021). Briefly, the virtual supermarket was designed to simulate a real-life shopping experience by imitating a typical Dutch supermarket (i.e., layout of the shelves, colors, products and product prices) (Hoenink et al., 2020, 2021). The SN VirtuMart study used a within- and between-subjects design consisting of three experimental arms (i.e., exposure to taxes on unhealthy foods, exposure to subsidies on healthy foods, and exposure to both taxes and subsidies) and five experimental conditions (control, nudging, pricing, salient pricing, and salient pricing combined with nudging). Participants were randomized to one of the three study arms and were instructed to conduct five shopping trips within the virtual supermarket over five consecutive weeks. Participants’ shopping budgets were based on self-reported actual usual weekly grocery shopping budgets and participants were only able to leave the supermarket at check-out if they had spent between 50% and 125% of their budget. Each week, participants were exposed to a different condition. The control condition represented the prices and design of an average Dutch supermarket. The nudging condition included salience nudges by means of orange colored arrows pointing from unhealthy low-fiber products to healthier high-fiber variants, orange colored frames around sections of the frozen vegetables’ division, and smaller, individual orange colored frames around healthy low-fat dairy products. The pricing condition included a change in the price of several products. Depending on the arm that participants were allocated to, the prices of unhealthy products were increased by 25% (price increase arm), the prices of healthy products were decreased by 25% (price discount arm), or both (price increase and discount arm). The salient pricing condition included the price changes conform to the pricing condition as described above, with additional active communication regarding these price changes to the participants. The last shopping condition included a combination of the nudging and salient pricing condition.

Participants were recruited in the Netherlands, mostly via a social media campaign using Facebook and Instagram (Hoenink et al., 2020, 2021). For inclusion, respondents had to be 18 years or older, able to communicate in Dutch, have access to a computer with internet, have a valid email address, and were responsible for the household groceries. More information on randomization, flow of participants, blinding, data collection, and sample size calculation was previously described (Hoenink et al., 2020, 2021). All participants provided informed consent, and ethical approval of the study design and procedures was obtained from the Medical Ethics Review Committee of the VU University Medical Centre Amsterdam (OHRP: IRB00002911).

The results regarding the effects of nudging and pricing strategies on healthy food purchases within the SN VirtuMart have been previously reported (Hoenink et al., 2020). In short, we found that combining price increases and discounts and combining these salient pricing strategies with nudges effectively increased healthy food purchases for both low and high SEP adults.

2.2. Data collection and measurements

2.2.1. Outcome

The outcome measure was the percentage of healthy food purchases calculated by dividing the amount of healthy products purchased (in grams) by the total amount of products purchased within one shopping trip (in grams). Healthy products were defined according to the 2015 Dutch dietary guidelines (Kromhout et al., 2016).
2.2.2. Effect modifiers

2.2.2.1. Hypotheses. Given the limited research conducted on the modifying role of specific personal characteristics in the relation between nudging/pricing strategies and food purchases, we labelled this study as exploratory. To limit the number of analyses, we do have some specific hypotheses as to the relation between effect modifiers and the different intervention strategies. We expect that impulsivity and spontaneous and intuitive decision-making styles are related to nudging and salient pricing strategies, but not pricing strategies. Furthermore, we expect that price sensitivity and the food choice motive ‘price’ influence the relation between pricing (both non-salient as well as salient) strategies and healthy food purchases, but not nudging strategies. Lastly, we expect that the food choice motives ‘health’, ‘natural content’, and ‘weight control’ influence the relation between nudging/pricing strategies and healthy food purchases. Before every purchasing task, participants were asked to complete questionnaires assessing their impulsivity, decision-making styles, price sensitivity, and food choice motives.

2.2.2.2. Impulsivity. The shortened and previously validated form of the Barratt Impulsiveness Scale (BIS) was used to assess participants’ levels of impulsivity (Spinella, 2007). The BIS 15 was designed to examine common impulsive or non-impulsive behaviors and preferences and included 15 items measured on a 4-point Likert scale. The internal consistencies of all 15 items combined showed a Cronbach’s alpha of 0.82 in our data. The items were combined and then averaged, resulting in a total score that ranged from one to four, with higher scores representing greater impulsivity.

2.2.2.3. General decision-making styles. The previously validated General Decision Making Style questionnaire (GDMS) was designed to assess the decision-making style(s) that individuals are more inclined to use (Scott & Bruce, 1995; Spicer & Sadler-Smith, 2005). Only two out of the five decision-making styles were used. This questionnaire consisted of 10 items measured on a 5-point Likert scale and distinguished between an intuitive and spontaneous decision-making style. The internal consistencies of intuitive and spontaneous decision-making styles showed a Cronbach’s alpha of 0.77 and 0.74, respectively in our data. Given that participants could have both an intuitive as well as a spontaneous decision-making style, these styles were assessed separately. The corresponding items were combined and averaged, creating total scores that ranged from one to five, with higher scores representing greater intuitive/spontaneous decision-making styles.

2.2.2.4. Price sensitivity. A shortened version of the Price Perceptions questionnaire (Lichtenstein et al., 1993) was used to assess participants’ levels of price sensitivity. The previously validated Price Perceptions questionnaire was designed to assess different ways in which consumers may react to price and price promotions (Lichtenstein et al., 1993). The current questionnaire version consisted of 18 items measured on a 5-point Likert scale and included the constructs value consciousness (seven items), price consciousness (five items), and sale proneness (six items). The internal consistencies of the constructs’ corresponding items combined showed a Cronbach’s alpha of 0.65 for value consciousness, 0.83 for price consciousness, and 0.80 for sale proneness in our data. Given that individuals could be classified within all constructs, the three constructs were assessed separately. The corresponding items were combined and averaged, creating total scores that ranged from one to five, with higher scores representing greater price sensitivity as measured by their value consciousness, price consciousness, and sale proneness.

2.2.2.5. Food choice motives. The Food Choice Questionnaire (FCQ) (Steptoe et al., 1995) was used to assess the importance that participants felt towards factors associated with food choice. This previously validated questionnaire was designed to create an understanding of the factors governing food choice and consisted of 36 items (measured on a 5-point Likert scale) including nine food choice factors (Steptoe et al., 1995). In this study, only the food choice motives ‘health’ (six items), ‘natural content’ (three items), ‘weight control’ (three items), and ‘price’ (three items) were used. The internal consistencies of the included food choice motives showed a Cronbach’s alpha ranging from 0.70 (for price) to 0.87 (for the natural content of foods) in our data. The corresponding items were combined and averaged, creating total scores that ranged from one to five, with higher scores representing greater importance of the food choice motives ‘health’, ‘natural content’, ‘weight control’, and ‘price’.

2.2.3. Covariates

To gain insights into the socio-demographic context of the study population, the baseline questionnaire included questions about the age, sex, weight, height, family composition, educational attainment (e.g., low, medium, high), employment situation, and net family month income of participants. Self-reported height and weight were used to calculate Body Mass Index (BMI - kg/m²). Since covariates were unlikely to be related to the independent variables (i.e., the experimental conditions), no confounders were included in the statistical models.

2.3. Statistical analyses

Descriptive statistics for socio-demographic variables, the outcome variable, and all potential modifying variables were reported using percentages, means, and standard deviations (SD), or medians and interquartile ranges (IQR) in case of non-normality. To help interpret the results, the relationships between the modifying variables were examined by performing correlation analyses. The cut-off value indicating a correlation was set at Pearson’s correlation coefficient ≥0.30 (Chan, 2003). As not all participants conducted all shopping trips, this resulted in varying numbers of participants for each questionnaire. Missing values for the characteristics of the study population included 2.3% for BMI and 1.0% for net family month income. Participants who conducted at least one shopping trip in the virtual supermarket were included in the study and missing values were deleted listwise.

Generalized Estimating Equations (GEE) was used to account for the clustering of conditions within participants (Twisk, 2019). As we did not expect any differences in the differential effects of nudging and pricing strategies by personal characteristics across the three study arms, all arms were analyzed jointly. Effect modification was investigated by including all four experimental conditions, the potential modifying variable, and interaction terms between all four experimental conditions and the modifier in the statistical models, separately for each potential modifying variable. However, only experimental conditions for which we hypothesized a-priori that a variable could modify the association were reported (e.g., sale proneness x pricing, but not sale proneness x nudging). Therefore, we reported on n = 33 interaction terms. Following significant interaction terms (i.e., p-value ≤ 0.10 (Hayes & Montoya, 2017)), post-hoc probing was used to gain insight into the nature of the interaction(s) by examining the relationship(s) between the relevant experimental condition(s) and the percentage of healthy food purchases at different values of the modifying variable (Hayes & Montoya, 2017). These values varied from ‘very low’ (i.e., the mean value + 2SD) to ‘very high’ (i.e., the mean value – 2SD). This was done by creating models that included all four experimental conditions, one of the five newly created values of the modifying variable, and interaction terms between all four experimental conditions and the newly created value of the modifier, separately for each of the five newly created values of a modifying variable. Again only findings concerning the experimental conditions for which we hypothesized a-priori that a variable could modify the association were reported. For the probed models, statistical significance was set at a p-value ≤ 0.05 (Twisk, 2006). Secondary analyses included interaction analyses between the conditions and the potential modifiers.
stratified for the three intervention arms. Post-hoc probing was not conducted for these secondary analyses. All analyses were conducted using SPSS IBM version 25.

In the original SN VirtuMart study, we conducted a sample size calculation (level of significance 0.05 and power >0.90) that determined that 300 participants were sufficient to detect a target difference of 135 (SD: 370) grams of vegetables per week between the control condition and the nudging condition stratified by dichotomous SEP indicators (Hoennink et al., 2020). For the current study, a power calculation was performed to determine whether we had sufficient power to detect significant interaction effects by continuous variables. As, to the best of our knowledge, there is no appropriate power calculation for continuous interaction terms, the power in this study was estimated using the rule of thumb that approximately 4 times as many participants are needed to detect interaction effects as are needed to detect main effects. Using the difference between two dependent means (in this case 0.29), an alpha of 0.05 and a sample size of n = 100 resulted in a power of 0.90, which was deemed sufficient to detect statistically significant interaction terms.

3. Results

A total of 400 participants conducted at least one shopping trip (Table 1). The majority of the study population was female (61.3%), the median age was 30.0 years (IQR 24.0), and the mean BMI was 24.7 (SD 4.8). Overall, most households consisted of ≤2 adults (84.0%) and ≤1 children (85.8%). Furthermore, 45.3% was highly educated, 25.5% was student, and a little over 42% had a monthly net income between 1701 and 3150 Euros which is in the range of the average Dutch income. In the control condition, an average of 46.3% (SD 15.1) of the purchases was considered healthy. On average, participants had a score of 3.0 (SD 0.4) on the impulsivity scale. The mean scores for value consciousness, price consciousness, and sale proneness were 2.4 (SD 0.5), 2.5 (SD 0.8), and 2.6 (SD 0.6), respectively. Regarding the two decision-making styles, the mean score was highest for a spontaneous decision-making style (3.0 ± 0.6). The mean scores for all four food choice motives ranged from 2.2 to 2.9 (Table 1).

According to the outcomes of the correlation analyses (Supplementary File 1), there were some correlations between personal characteristics and all of these were found to be fair (r = 0.30–0.50) (Chan, 2003). For example, impulsivity was positively correlated with a spontaneous decision-making style (r = 0.39), and value consciousness was positively correlated with price consciousness (r = 0.34) and the food choice motive price (r = 0.30).

Overall, there were few statistically significant interaction terms between the experimental conditions and the personal characteristics (Table 2). The associations between any of the hypothesized experimental conditions and the percentage of healthy food purchases were not modified by impulsivity, price sensitivity (i.e., value consciousness, price consciousness, and sale proneness), the general decision-making styles (i.e., an intuitive and spontaneous decision-making style), and the food choice motives ‘health’ and ‘price’. Three statistically significant interactions were found: ‘natural content of foods’ as a food choice motive x pricing (β = −1.02, 90%CI = −2.04; −0.01), ‘weight control’ as a food choice motive x nudging (β = −2.15, 90%CI = −3.34; −0.95), and ‘weight control’ as a food choice motive x pricing (β = −1.87, 90% CI = −3.11; −0.62) (Table 2). The post-hoc probing outcomes are displayed in Table 3. Overall, the trends of the post-hoc probing results were similar across the different modifying variables and showed that the particular nudging and/or pricing strategies were more effective in individuals with lower values of the food choice motives ‘natural content of foods’ and ‘weight control’ compared to the control condition, and less effective in individuals with higher values of these modifying variables compared to the control condition.

Results regarding the interactions stratified for the three pricing arms can be found in Supplementary File 2. There were few statistically significant interaction terms. In none of the pricing arms did sale proneness, a spontaneous decision-making style, and ‘price’ as a food choice motive modify the relation between the hypothesized experimental conditions and the percentage of healthy food purchases. Of the n = 13 (12.8%) statistically significant interactions, most were found in the salient pricing combined with nudging condition including impulsivity, price consciousness, and the food choice motives ‘health’, ‘natural content’, and ‘weight control’.

4. Discussion

In this study we examined whether the effects of nudging and (salient) pricing strategies on food purchasing behaviors differed across individuals’ levels of impulsivity, price sensitivity, decision-making styles, and specific food choice motives in a virtual supermarket environment. We found no evidence for a modifying role of impulsivity, price sensitivity, decision-making styles, and the food choice motives ‘health’ and ‘price’ in the association between any of the experimental

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Table 1

| Sample characteristics of the analytical study population. | N | Percentage or Mean ± SD unless stated otherwise |
|---|---|---|
| Socio-demographic variables | | |
| Age (years - median/IQR) | 400 | 30.0; 24.0 |
| Sex (% women) | 245 | 61.3% |
| Body Mass Index (BMI – kg/m²) | 391 | 24.7 ± 4.8 |
| Number of adults in the household | 400 | |
| % ≤2 adults | 336 | 84.0% |
| % >2 adults | 64 | 16.0% |
| Number of children in the household | 400 | |
| % ≤1 children | 343 | 85.8% |
| % >1 child | 57 | 14.2% |
| Educational level | 400 | |
| % Low | 24 | 8.5% |
| % Medium | 185 | 46.3% |
| % High | 181 | 45.3% |
| Employment situation | 400 | |
| % Full time job | 100 | 25.0% |
| % Part time job | 97 | 24.3% |
| % Student | 102 | 25.5% |
| % Other¹ | 101 | 25.3% |
| Net family income per month | 396 | |
| % ≤1700 Euros | 150 | 37.9% |
| % 1701–3150 Euros | 107 | 42.2% |
| % >3150 Euros | 79 | 19.9% |
| Dependent variable | | |
| Percentage of healthy products (based on 0.6% grams) purchased in control condition | 368 | 46.3 ± 15.1 |
| Potential modifying variables | | |
| Impulsivity | 364 | 3.0 ± 0.4 |
| Price sensitivity | 370 | 2.4 ± 0.5 |
| Value consciousness | 308 | 2.5 ± 0.8 |
| Price consciousness | 307 | 2.6 ± 0.6 |
| Sale proneness | 307 | 2.6 ± 0.6 |
| General decision-making styles | | |
| An intuitive decision-making style | 366 | 2.3 ± 0.6 |
| A spontaneous decision-making style | 366 | 3.0 ± 0.6 |
| Food choice motives | | |
| Health | 369 | 2.2 ± 0.6 |
| Natural content of foods | 286 | 2.6 ± 0.9 |
| Weight control | 286 | 2.9 ± 0.8 |
| Price | 286 | 2.2 ± 0.6 |

Abbreviations N; number; IQR; Interquartile range; SD; Standard Deviation.

¹Low educational level included those who completed primary education, primary vocational education, or lower secondary vocational education. Medium educational level included those who completed higher secondary vocational education, higher general secondary education, or pre-university education. High educational level included those who completed higher professional education.

Other; Retired; Unemployed; Housewife/man; Unable to work/Receiving social benefits; Student with part time job; Entrepreneur; Other.
conditions and healthy food purchases conform to any of the hypotheses. We only observed that the effectiveness of nudging and (non-salient) pricing strategies decreased in individuals with higher importance for food choice motives ‘natural content’ and ‘weight control’.

The few studies that also investigated effect modification by personal characteristics showed mixed results. Contrary to our results, a study investigating the effect of health-related taxes and subsidies within a virtual supermarket found that more impulsive individuals adjusted their calorie consumption with regard to the price changes, whereas less impulsive individuals were less influenced by these price changes (Giesen et al., 2012). However, it is unclear if this study used salient or non-salient price changes. Another study within a virtual supermarket investigating the effect of a 25% discount on healthy food purchases found that price perception or habit strength did not modify this association (Waterlander et al., 2012). Furthermore, a study investigating the effect of nudging (increasing availability of healthy foods and energy labelling) on total energy ordered within a virtual fast-food restaurant found that the personality traits healthiness motivation or weight control motivation (two food choice motives), executive functioning, and self-control did not modify this association (Marty et al., 2020). These results are comparable to our study. Interestingly, multiple studies that investigated interactions similar to this study have been conducted in virtual environments, probably due to the easier implementation of nudging and pricing strategies in virtual environments compared to a real environment.
Given the very limited differential effects of nudging and pricing strategies on healthy food purchases by the personal characteristics under study, we can reject our hypothesis that personal characteristics modify the association between nudging/pricing strategies and healthy food purchases. The few significant interaction terms that were found indicated that the effectiveness of nudging decreased in individuals with higher importance for the food choice motive ‘weight control’ and that the effectiveness of pricing strategies decreased in individuals with a higher importance of the food choice motives ‘weight control’ and ‘natural content’. The post-hoc probing results indicated that nudging and pricing strategies (mostly) statistically significantly increased the amount of healthy food purchases by approximately 2%–4% in individuals who did not find ‘natural content of foods’ and ‘weight control’ important food choice motives. However, it should be noted that these significant interaction terms are potentially false positives (i.e., that these were found based on chance due to multiple testing).

4.1. Strengths and limitations

A strength of this study is the relatively large sample size, which ensured sufficient power to detect actual effects. Another strength is its within-subjects design, as this enabled participants to act as their own control, resulting in less bias and more reliable results (Charness et al., 2011). A limitation of this study includes the limited external validity. For example, the current study population included more females and highly educated participants compared to the general Dutch population (Hoenink et al., 2021). Also, while virtual supermarket environments are regarded as a valid tool to investigate the effects of pricing strategies on food purchasing behaviors (Waterlander et al., 2011; Wilma Ezeline Waterlander, 2015), virtual supermarkets do not completely mimic a real-life supermarket (e.g., participants do not spend real money or receive their shopping basket when shopping in virtual supermarkets) (Hoenink et al., 2020). Another limitation includes the issue of multiple testing. The investigation of multiple interactions increases the probability of finding statistically significant interactions, which is why it can be argued that we needed to adjust for multiple testing (Ranganathan et al., 2016). However, adjustments for multiple testing is not strictly required or relevant in exploratory studies (Althouse, 2016; Bender & Lange, 2001). Given the exploratory nature of this study, we did not formally adjust for multiple testing. Furthermore, formal adjustment for multiple testing would not influence the conclusion that personal characteristics do not modify the relation between nudging/pricing strategies and healthy food purchases in a virtual supermarket environment.

4.2. Implications for practice and suggestions for future research

A previous study using the same data found that the effects of nudging and pricing strategies on the percentage of healthy food purchases were not modified by the SEP indicators income and educational level (Hoenink et al., 2020). Combining the results from this study with the previous SN VirtuMart study (Hoenink et al., 2020), it seems that the effects of nudging and (salient) pricing strategies on food purchasing behaviors, at least in a virtual environment, are not influenced by personal characteristics. Furthermore, although the independent effects of nudging and pricing strategies are relatively small, combining nudges with pricing strategies could result in an effect size relevant at the population level (Hoenink et al., 2020). Given the effectiveness of nudging and pricing strategies in real-world supermarkets in increasing favorable food purchasing behaviors (An, 2013; Kiesel & Villas-Boas, 2013; Ni Mhurchu et al., 2010; Bakx et al., 2013; Sutherland et al., 2010) and the finding that these strategies seem equally effective across subgroups with different personal characteristics, the results are favorable as they suggest that nudging and pricing strategies can be implemented as generic health promoting interventions. Nevertheless, it is recommended to confirm our findings in a subsequent study with preplanned hypotheses and to explore the modifying role of other personal characteristics (e.g. dietary restraint and habit) in the association between nudging and (salient) pricing strategies on dietary behaviors in the real world.

4.3. Conclusion

We found limited evidence for differential effects of nudging and (salient) pricing strategies on food purchasing behaviors across different levels of personal characteristics. The findings suggest that nudging and (salient) pricing strategies are equitable across individuals with different personal characteristics. Given the effectiveness of nudging and (salient) pricing strategies in increasing healthy food purchases, the results suggest that these strategies can be implemented in supermarket settings as general health promoting strategies.

Ethics approval and consent to participate

The study complies with the Declaration of Helsinki and was approved by the Institutional Review Board of the VU University Medical Centre Amsterdam (OHRP: IRB00002911). Informed consent was obtained from all the participants before starting the study.

Consent for publication

Not applicable.

Availability of data and materials

Requests for de-identified individual participant data or study documents will be considered where the proposed use aligns with public positive purposes, does not conflict with other requests or planned use by the steering committee, and the requestor is willing to sign a data access agreement. Contact is through the corresponding author. The original protocol is available from the corresponding author on request.

Declaration of competing interest

None.
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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2021.105655.

Author contributions

AEHvdM, JCH, JDM and JWJB helped design the study. JCH collected the data and AEHvdM conducted the analyses and drafted the paper. AEHvdM, JCH, JDM, JL, WW, and JWJB interpreted the results. All authors reviewed and edited the manuscript.

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