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ARTICLE

A drop in the bucket? The effectiveness of nudging healthier snacks in a supermarket in a deprived neighborhood in the Netherlands

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Abstract
Nudging is often proposed as a promising policy approach for improving healthy choices among lower socioeconomic position (SEP) populations. However, nudges may not suit lower SEP contexts and empirical studies are scarce. We examined the efficacy of a repositioning nudge at a supermarket in a deprived neighborhood in improving healthier snack purchases and described customers' healthy grocery shopping needs. Daily sales were collected during 4-week control and intervention periods, where healthier snacks replaced unhealthy snacks at the checkout. Besides, questionnaires were administered. More healthier snacks were sold per day during the intervention (Median = 2.50, $Q1 = 2.00$, $Q3 = 3.50$) than control period (Median = 0, $Q1 = 0$, $Q3 = 1.00$), B = 1.77, $z = 5.50$, $p < .001$, incidence rate ratio = 5.87 (95%CI [3.52, 10.17]). Despite statistical significance, the absolute number of healthier snacks sold remains negligible. Customers report to find it important to eat healthily and to think carefully about their groceries, but to hardly buy snacks at the checkout and desire a healthy and affordable food offer. Repositioning nudges may not suit the circumstances and needs of lower SEP populations. Interventions must be tailored to lower SEP groups and integrated with system-level policies.

Keywords: deprived neighborhood; grocery shopping; healthy food choice; nudging; purchase behavior; socio-economic position

Introduction

Unhealthy food consumption is a pressing public health concern. Not meeting dietary guidelines is associated with an increased risk of several severe outcomes, such as obesity and other chronic diseases (e.g., Boeing et al., 2012). People with lower

socioeconomic position (SEP), i.e., one's standing in a societal hierarchy generally considered as encompassing income, education and occupation, as well as subjective perceptions of social status and class (American Psychological Association, 2022), are more prone to not meeting dietary guidelines (Pampel et al., 2010) and its related consequences (McLaren, 2007) than people with higher SEP. They are, for example, more likely to have lower intakes of fruits and vegetables and higher intakes of sugar, refined grains and added fats (Darmon and Drewnoski, 2008). In the Netherlands specifically, dietary intake of individuals with lower SEP tends to be less in line with existing guidelines (Hulshof et al., 2003). These findings highlight the need to stimulate healthy food choices among lower SEP groups. We aim (1) to examine the efficacy of a repositioning nudge at the checkout counter in improving healthier snack purchases among customers of a supermarket in a deprived neighborhood in the Netherlands and (2) to describe customers' experiences, preferences and needs regarding grocery shopping and healthy eating.

Adjusting the food environment with nudging

Besides more structural factors relating to unhealthy eating of people with lower SEP (e.g., higher costs of healthy food; Darmon and Drewnoski, 2015), one key modifiable factor is the food that is presented in the contexts they encounter. Food environments are found to significantly influence individual's eating behaviors, for instance due to the (in)access to affordable, healthy food (Swinburn et al., 2011). SEP strongly relates to whether people live in deprived neighborhoods, often consisting of unhealthy food environments. Such areas contain poor access to fresh, unprocessed, and nutrient-rich foods, such as fresh fruit and vegetables (in various high- and upper-middle income countries, such as Australia, America, Canada or the United Kingdom; Sawyer et al., 2021). Considering such insights, research demonstrates that people with lower SEP are more likely to purchase unhealthier food and beverages, such as sweet snacks and low-fiber bread, and are less likely to purchase healthier food categories, such as fresh fruit and high-fiber cereals (Pechey et al., 2013). Altogether, these findings demonstrate the urgence to promote healthy food purchases among people with lower SEP by adjusting their food environment. Supermarkets are the primary source of people's food purchases contributing to people's food choices (i.e., 65–70% of all food consumed in the Netherlands is bought in supermarkets; Rabobank, 2022), and are therefore suitable contexts for interventions aiming to stimulate healthy food choices. Specifically, the checkout area could be suitable for promoting healthy purchases, as all customers must pass through it and a significant number of product choices are made there (Miranda, 2008).

To adjust the food environment, nudging has gained popularity within public health policy. This is possibly because this strategy is relatively easy to implement by targeting small-scale environments and therefore requires limited administrative burden and implementation costs compared to more drastic structural macroeconomic regulations (e.g., pricing policies that entirely change existing structures and economic incentives).

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A nudge involves a small adjustment to a decision-making context to gently steer individuals' behavior in a predictable way toward a desired action, while not omitting other possible actions or changing economic incentives (Thaler and Sunstein, 2008). Hereby, a small-scale physical or social environment in which people make decisions, such as within cafeterias, workplaces or supermarkets, is (re)designed to make certain behaviors more likely. An example is offering healthy food at eyesight. Nudges are based on the idea that people often make decisions passively and unreflectively instead of actively and consciously. They are not dependent on elaborate decision-making and can therefore make use of humans' passive, intuitive mode of operation to guide actions, such as the tendency to stick to the default unless the incentive to change is compelling (Thaler and Sunstein, 2008; Van Gestel et al., 2021). Nudging can effectively stimulate healthier dietary behaviors among the general population (although with varying magnitudes of effects, generally with smaller effect sizes in field settings than in controlled settings, e.g., Arno and Thomas, 2016; Cadario and Chandon, 2020).

Nudge effectiveness among lower SEP groups

Nudging is often suggested as a promising policy approach for stimulating health behavior among people from lower SEP groups particularly (e.g., for a report, see Wetenschappelijke Raad voor het Regeringsbeleid, 2017). Such propositions are based on the theoretical assumption that due to living in harsh circumstances, people with lower SEP more often fall back on intuitive and automatic thinking, hence may be more guided by external stimuli, reflexive processing and heuristics (e.g., Marteau et al., 2012; Mullainathan and Shafir, 2013). To elaborate on this, the ability to make reasoned decisions may be cognitively impaired among people with lower SEP, due to experiencing chronic stress or resource scarcity caused by social and financial difficulties (Baum et al., 1999; Kristenson et al., 2004; Mullainathan and Shafir, 2013). This may put a tax on individual's cognitive abilities that are normally used for judgment and decision-making, and may trigger an adaptive regulatory shift in one's attentional orientation toward present, immediate needs and acute, impulsive judgment and decision-making rather than long-term needs and controlled judgment and decision-making (Fennis et al., 2020; Sheehy-Skeffington, 2019). Since nudges are not dependent on elaborate processing, it is suggested that nudging might benefit people with lower SEP.

However, the theoretical assumption that people with lower SEP would be more susceptible to the influence of nudges could be questioned. As people with lower SEP more often live in poverty, product characteristics such as price, familiarity, convenience and satiation may be of special importance to them (e.g., Harbers et al., 2021). Research demonstrates that people with lower SEP especially consider the price of products when doing groceries and that price is an important determinant of their food choices (e.g., Vos et al., 2022). People with lower SEP may thus have different considerations when doing groceries, and their purchasing behavior may actually be guided by more active and conscious processes. Adjusting the choice architecture to stimulate healthy options may not be sufficient for people who consciously need to manage their limited

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budget. Thus, while one line of research suggests that nudging might in theory be a useful technique for promoting healthy choices among people with lower SEP, another line of research questions this as their decisions may be guided by practical considerations, such as price. It remains to be examined whether nudging can actually have beneficial effects and is suitable for people with lower SEP. It is therefore important to also gain insight into what people with lower SEP drives and need when doing grocery shopping.

Current empirical research on nudge-effects among lower SEP groups is scarce and in need for expanding (De Ridder et al., 2022; Harbers et al., 2020; Schüz et al., 2021). Of the available empirical studies that did target actual health behavior, some demonstrated nudge-effects (Cameron et al., 2022; Foster et al., 2014; Huitink et al., 2020b; Payne and Niculescu, 2018; Vogel et al., 2021), while other studies did not find such significant effects (Caso and Vecchio, 2023; Hoenink et al., 2020; Huitink et al., 2020a). Besides, not all nudging studies (e.g., Caso and Vecchio, 2023; Hoenink et al., 2020) have been performed in real-world settings that capture the variety of factors at play in decision-making processes among people with lower SEP (e.g., price). Real-life experiments would thus add to the scalability of nudging at the population level (Schüz et al., 2021). It is therefore of interest to test the effect of a nudge that can be applied in the current supermarket context and adjusts how food is presented. The repositioning of healthy food products at the checkout counter is a nudge that is well tested among the general population (e.g., Kroese et al., 2016; Van Gestel et al., 2017; Winkler et al., 2016), but limited among lower SEP populations (Huitink et al., 2020a). Examining whether such a product repositioning nudge improves healthy food purchases among a lower SEP group in a real-life setting adds to the current behavior change literature about generalizability of nudging and might be informative for the way policies are designed.

The present study

The first aim of this quasi-experimental study is to test the efficacy of a product repositioning nudge among customers of a supermarket in a deprived neighborhood. Specifically, it is examined whether replacing unhealthy snacks at the checkout counter (e.g., chocolate bars) by healthier snacks (e.g., healthier bars and hazelnuts) increases the number of selected healthier snacks sold. It is hypothesized that more selected healthier products are sold when these are offered at the retail display than when they are offered somewhere else in the supermarket. In this hypothesis, we align with the line of research suggesting that nudging can be effective among lower SEP groups, because there are no clear indications yet of its ineffectiveness. Still, we will critically assess whether this repositioning nudge can actually have beneficial effects since the other line of research indicates that practical considerations may play a more dominant role. We are therefore further interested in understanding the current socioeconomic context in which the nudge was applied, and specifically into what drives and could help people with lower SEP in doing healthier groceries. The second aim of this study is therefore to describe customers' experiences, preferences and needs regarding grocery shopping and healthy eating. This was examined by administering questionnaires. Based on the insights obtained from

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these aims, as well as our experiences in conducting this study, we will reflect on the suitability of applying (repositioning) nudges in lower socioeconomic supermarket contexts.

Method

Context and study design

The current study took place in a supermarket located in a deprived neighborhood in The Hague, the Netherlands. It was developed in collaboration with local stakeholders (i.e., the supermarket owner and local general practitioner) from an existing network of collaborating organizations (Healthy and Happy The Hague, 2020), who wished to stimulate healthier choices in the local supermarket within their deprived neighborhood. In this neighborhood, almost 70% of households have a low income, with about 35% of households receiving social security benefits. Furthermore, 47% of residents have lower education and almost 74% of the houses include social rental properties (Municipality The Hague, n.d.). Given these neighborhood characteristics, we presumed that we mainly targeted people with lower SEP.

A quasi-experimental pre-post design was used, with a 4-week control period followed by a 4-week intervention period. Daily sales data of selected healthier food items and unhealthy items were examined in both periods and used as the dependent variable to examine preregistered and explorative tests respectively (first aim). Grocery shopping questionnaires were administered to outline customers' experiences, preferences and needs regarding grocery shopping and healthy eating (second aim).

Participants

Participants were customers of the supermarket. For evaluating the nudge intervention, sales data of all customers were collected (see the 'Repositioning nudge intervention' section for more details). For the grocery shopping questionnaire, data were collected on participant-level. Here, participants were eligible if they were 18 years or older and able to understand the Dutch language. In total, 90 participants finished the questionnaire. Participants (50 female, 40 male; $M_{age} = 46.83$, $SD_{age} = 15.58$) were mainly Dutch ($n = 34$, 37.8%) but had a variety of ethnicities (e.g., 20.0% Surinamese, 10.0% Moroccan, 6.7% Turkish and 4.4% Antillean). Most participants lived in the same neighborhood as where the supermarket is located ($n = 69$, 76.7%).

Procedure

This study took place from 5 October through 29 November 2022. The nudge intervention had a 4-week control period (when the healthier food items were offered in the supermarket and the unhealthy food items were offered in the retail display at the register) followed by a 4-week intervention period (when the healthier food items were offered in the retail displays at the register and the unhealthy food items were offered

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somewhere else in the supermarket). The supermarket had four cash registers in use, of which two registers contained a retail display offering snacks and had a shared aisle with registers that did not contain a display.

The grocery shopping questionnaire was administered on paper during 1 weekday and 1 weekend-day in the final week. Customers who finished doing their groceries were asked by a researcher to participate in a study about their experiences with grocery shopping. People willing to participate received an information letter and signed a paper consent form, after which they directly filled out the paper questionnaire. Participants who needed help were aided by the researcher (e.g., administering the questionnaire orally). Finishing the questionnaire took participants approximately 5 minutes, after which they were debriefed and thanked for their participation. Two supermarket gift vouchers worth 20 euros were raffled among interested participants.

The Medical Ethics Review Board of Leiden University Medical Center confirmed that the Medical Research Involving Human Subjects Act (WMO in Dutch) does not apply to the current study according to Dutch standards (10 October 2022, #22-3055). The study was preregistered at AsPredicted (19 September 2022, #107286: https://aspredicted.org/6yfq-hfft.pdf).

Repositioning nudge intervention

During the intervention period, the physical environment was restructured (Michie et al., 2013) by implementing a repositioning nudge. Hereby, unhealthy food options that were offered in the retail displays at the registers during the control period (i.e., products containing high levels of saturated fat and/or sugar, such as chocolate bars: 66.6% of the offer) were replaced by healthier food items during the intervention period (i.e., four different flavors of healthier bars and bags of hazelnuts). Therefore, we aimed to select healthy single items of similar price that were sensitive to the target group. Despite these efforts, we encountered that the food supply of the supermarket was largely unhealthy and that there were limited healthy single food items suitable to nudge. Consequently, the present study went a step further than usual repositioning nudge studies (e.g., Kroese et al., 2016), and included the reintroduction of single healthier items that were previously sold in the supermarket to the assortment prior to starting data collection. That is, the bags of hazelnuts were already part of the current regular offer, but the four flavors of healthier bars were reintroduced to the offer weeks before the start of the control period. These regular and reintroduced healthier options were offered in the aisles during the control period, and were moved to the retail display during the intervention period. The remaining 33.3% of the offer at the retail display (i.e., sugar free snacks, pepper mints and chewing gum) remained similar during both periods.

Daily sales data for the total number of healthier food items, unhealthy food items and total offer (for descriptive statistics) were provided by the supermarket owner. The number of items purchased each day represented one data point ($N = 28$ days), which was compared between the control and intervention period. In total, the grouped sales data of 5 healthier food items and of 7 unhealthy food items were included in statistical tests.

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Grocery shopping questionnaire

All questions were answered on 5-point Likert scales (unless otherwise stated), with response labels described below.

Purchasing behavior and preferences

Purchasing behavior was measured with the items 'How often do you buy a snack from the display at the checkout?' (categorical, with response options 'Never', 'Sometimes', 'Regularly', 'Often' and 'Always'), 'How carefully do you think about what you buy in a supermarket?' ('Not at all' to 'Very well') and 'How often do you buy something in a supermarket while you did not plan to buy it?' ('Not at all' to 'Very often'). Importance of different product characteristics was assessed with the items 'To what extent are [taste, brand, familiarity, price, saturation, healthiness] important for you when doing groceries?' ('Not at all' to 'Very important') and 'What other product characteristics are important for you when doing groceries?' (open-ended).

Healthy eating and health

Importance of healthy eating was measured with 'How important is it for you to eat healthily?' ('Not at all' to 'Very important'), and having health in mind with 'How often do you have other matters on your mind that you consider more important than your health? ('Not at all' to 'Very often'). Needs regarding healthy eating were measured as 'What could help you to eat (more) healthily?' (open-ended).

Financial worries and food security

Financial worries were measured with the items 'To what extent do you have financial worries?' ('Not at all' to 'Very often') and 'What are you most worried about?' (open-ended). Food security was measured as "How often can you buy the food that you would like to buy?' ('Not at all' to 5 'Very often').

Demographic information

Participants' sex (Male, Female), age, ethnicity (Dutch, Antillean, Turkish, Moroccan, Surinamese, Other, namely) and residence in the studied neighborhood (Yes, No) were measured.

Results

All analyses were performed using R Statistical Software (v4.3.3; R Core Team, 2024) and RStudio (v2023.12.1.402; Posit Team, 2024), with alpha set at $p < .05$.

Repositioning nudge intervention

During the full study period, the Median daily number of items sold in the supermarket was 10,112.50 ($Q1 = 9743.25$, $Q3 = 10{,}466.75$). Specifically, the Median number of items sold per day was 10,007 ($Q1 = 9516.50$, $Q3 = 10{,}183.75$) during the control period and 10,289.50 ($Q1 = 10{,}027.50$, $Q3 = 10{,}567.75$) during the intervention period.

We found that the count data of daily sales of healthier food items was zero-inflated and demonstrated overdispersion (i.e., the variance was significantly larger than the

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Table 1. Results of the negative binomial regression

Variable	B (SE)	*z*	*p*	IRR	95% CI
Constant	−0.62 (0.28)	−2.22	.027	0.54	0.33, 0.83
Period	1.77 (0.32)	5.50	< .001	5.87	3.52, 10.17

Note: Dependent variable = daily sales data of selected healthier food items. For period, control period is used as the reference group.
IRR, incidence rate ratio; CI, confidence interval (one-sided).

mean, $p = .001$), violating the assumption of normally distributed data. To address these issues, and in contrast to what was preregistered, a Negative Binomial regression with these variables was performed, and this model fitted the data best (e.g., A Zero-Inflated Negative Binomial model did not improve model fit). Selected healthier food items were sold more frequently during the intervention period (Median = 2.50, $Q1 = 2.00$, $Q3 = 3.50$) than during the control period (Median = 0, $Q1 = 0$, $Q3 = 1.00$), B = 1.77, $z = 5.50$, $p < .001$. The daily sales were 5.87 (one-sided 95%CI [3.52, 10.17]) times greater in the intervention period than in the control period. Please see Table 1 for full results.

To explore whether daily sales of unhealthy food items changed when they were removed from the retail display at the checkout, a nonparametric Wilcoxon signed-rank test was performed with daily sales of unhealthy food items as dependent variable and period (control versus intervention) as independent variable. This test was performed because the dependent variable was not normally distributed (but not zero-inflated). Findings showed no significant difference in sales of selected unhealthy food items during the control period (Median = 12.00, $Q1 = 9.75$, $Q3 = 16.00$) and intervention period (Median = 11.00, $Q1 = 8.00$, $Q3 = 14.00$), $z = -1.71$, $p = .090$.

We omitted a preregistered analysis examining the difference in absolute sales of selected healthier food items within the intervention period between the two registers with a display and the two registers without a display, since in hindsight we considered the data inappropriate for conducting this analysis. An explanation for this (as well as alternative exploratory analyses) can be found in Supplementary File 1.

Grocery shopping questionnaire

Since not all single-items were normally distributed and in order to provide more insight into the distributions within answer categories, we treated all items as nominal and examined their Median and quartiles. The distributions and descriptive statistics of all these items are presented in Figure 1.

Purchasing behavior and preferences

Participants report to hardly ever buy a snack from the display at the checkout (Median = 2.00, $Q1 = 1.00$, $Q3 = 3.00$), with the majority doing so never (30.7%) or sometimes (33.0%). Most participants indicated to think (very) carefully (69.7%) about what they buy in a supermarket, and no participants indicated to think not at all well about what to buy (Median = 4.00, $Q1 = 3.00$, $Q3 = 5.00$). Still, most

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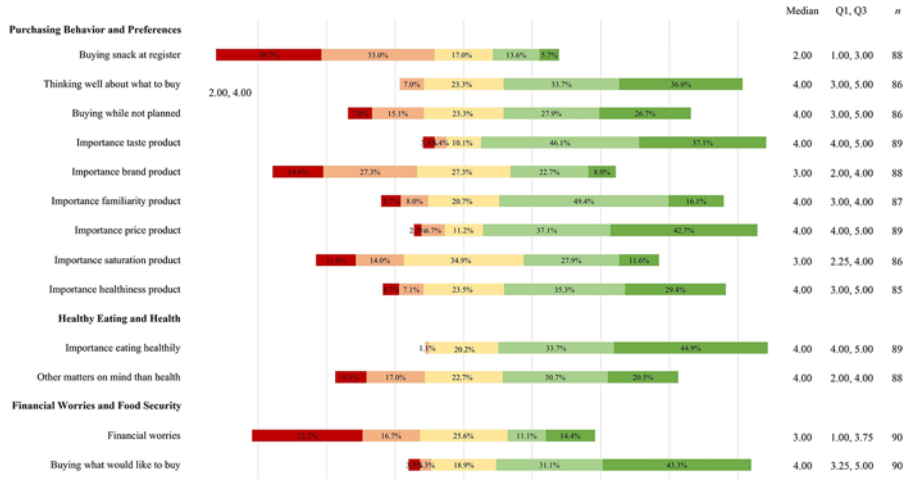

Figure 1. Distribution of all items of the grocery shopping questionnaire (%, median, *Q1, Q3* and *n*).
Note: The scale from dark red (left = 1) to dark green (right = 5) represents the response options of the 5-point Likert scales (with labels differing between items). Missing values are not included (e.g., valid percentages are used). *Q1* = lower quartile. *Q3* = upper quartile.

participants (54.6%) also reported to (very) often buy something in a supermarket while they had not planned to do so (Median = 4.00, *Q1* = 3.00, *Q3* = 5.00). The most important product characteristics were taste (83.2% find this (very) important, Median = 4.00, *Q1* = 4.00, *Q3* = 5.00), price (79.8% find this (very) important, Median = 4.00, *Q1* = 4.00, *Q3* = 5.00), healthiness (64.7% find this (very) important, Median = 4.00, *Q1* = 3.00, *Q3* = 5.00) and familiarity (65.5% find this (very) important, Median = 4.00, *Q1* = 3.00, *Q3* = 4.00).

Healthy eating and health

Most participants (78.6%) find it (very) important to eat healthily (Median = 4.00, *Q1* = 4.00, *Q3* = 5.00), with no participants finding it not important at all. At the same time, more than half of participants (51.2%) indicated to (very) often have other matters on their mind than their health (Median = 4.00, *Q1* = 2.00, *Q3* = 4.00). The most frequently mentioned needs for eating (more) healthily were related to finances and price, e.g., 'Make healthier products cheaper', 'No discount on tasty [unhealthy] products, but on healthy products' and 'Being feasible within the budget'. This was followed by needs regarding the offer in the supermarket, both in terms of absolute healthiness (e.g., 'Snack free [offer]', 'More vegetables' and 'Availability of fresh ingredients') and of the store layout (e.g., 'Healthy [products] more in the foreground', 'Kcal more visible' and 'Delicacy at checkout is tempting, can be omitted').

Financial worries and food security

Most participants indicated to have financial worries not at all often (32.2%). Still, about a quarter of the participants (25.5%) indicated to have financial worries (very)

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often (Median = 3.00, *Q1* = 1.00, *Q3* = 3.75). Moreover, the most frequently mentioned worries related to finances (e.g., 'High prices', 'Making ends meet every month' and 'Increasing prices'), although some other issues were also reported (e.g., health of self or others, future, war and climate). Finally, the majority of participants (74.4%) experienced that they could (very) often buy the food that they would like to buy (Median = 4.00, *Q1* = 3.25, *Q3* = 5.00).

Intercorrelations

We explored Spearman's Rank-Order correlations between all items (for the correlation matrix, see Table 2). Having other matters on one's mind than one's health was positively correlated with unplanned buying groceries ($r_s(83) = .314$, $p = .003$). Furthermore, there was a negative correlation between having financial worries and food security ($r_s(88) = -.444$, $p < .001$). Most other correlations were small. For a complete overview of all correlations, see Table 2.

Discussion

The present study aimed to provide insight into how healthy food choices can be stimulated among lower SEP groups. The first aim was to examine the efficacy of a product repositioning nudge in improving purchases of healthier snacks among customers of a supermarket in a deprived neighborhood. In line with our preregistered hypothesis, more selected healthier snacks were sold when they were offered at the retail display at the checkout counter than during the control period. Although this indicates that the repositioning nudge was statistically efficacious, its clinical significance can be considered negligible in light of the context in which the intervention has been applied. Our questionnaires revealed that participants generally report to find it important to eat healthily, but that they also often have other matters on their mind than their health. They reported to think carefully about their groceries (with taste, price, healthiness and familiarity being the most important product characteristics), but that they hardly ever buy snacks at the checkout and desire a healthy and affordable food offer. About a quarter reported to experience financial worries (very) often. Thus, within the supermarket environment, replacing unhealthy snacks by healthier snacks at the checkout counter is not a fruitful strategy for stimulating healthier purchases among people with lower SEP.

Key findings repositioning nudge intervention and grocery shopping questionnaire

Three main findings emerge from this study. First, while the results indicated a statistically large effect of the repositioning nudge on healthier snack purchases, the real impact of this nudge is limited. The number of selected healthier snacks sold can be considered extremely small, especially considering the total number of items daily sold in this medium-sized supermarket. That is, a Median of 2.5 selected healthier snacks compared to a Median of 10,289.50 items being sold per day during the intervention period (which most likely consists of mostly unhealthy food items, e.g., Poelman et al., 2021; Vandevijvere et al., 2023) will not substantially contribute to an improvement in overall healthy eating. Therefore, the effectiveness of this repositioning nudge on

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Table 2. Spearman's Rank-Order correlation matrix grocery shopping questionnaire

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Buying snack at register	–													
2 Thinking well about what to buy	−.011	–												
3 Buying while not planned	.148	−.128	–											
4 Importance taste product	.010	.353***	.065	–										
5 Importance brand product	.028	.020	−.018	.123	–									
6 Importance familiarity product	−.060	.206	−.018	.215*	.439***	–								
7 Importance price product	.122	.208	.178	.233*	.183	.197	–							
8 Importance saturation product	.005	.120	.085	.274*	.338**	.288**	.289**	–						
9 Importance healthiness product	−.040	.276*	.021	.288**	.214	.249*	.049	.240*	–					
10 Importance eating healthily	.104	.318**	−.113	.099	.170	.193	−.068	.133	.599***	–				
11 Other matters on mind than health	.277**	−.067	.314**	.025	.067	.055	.155	−.040	−.004	.096	–			
12 Financial worries	.225*	.026	.072	.263*	−.122	−.161	.062	.113	−.026	−.086	.279**	–		
13 Buying what would like to buy	−.076	.010	−.134	.001	.110	.218*	.065	−.122	.027	.106	−.240*	−.444**	–	
14 Age	−.078	.256*	−.253*	.003	.051	.096	−.127	.052	.124	.297**	−.105	−.175	.037	–

Note: *Significant at $p < .05$ (two-tailed). **Significant at $p < .01$ (two-tailed). ***Significant at $p < .001$ (two-tailed).

healthy purchases (and eating) of lower SEP groups can only be considered a drop in the bucket.

Secondly, our insights revealed that the current context does not lend itself for a repositioning nudge intervention. Customers seldomly buy snacks at the checkout, which is evident from both the average daily sales of healthier and unhealthy snacks (approximately 3 and 13) at the register and the questionnaire (64% reports to [almost] never do so). This finding is in contrast to previous research addressing the significant number of product choices at the checkout (e.g., Miranda, 2008), and one possible explanation based on anecdotal evidence from the supermarket manager could be that customers usually buy multi-packs, with relatively lower costs per portion. Our findings also showed that participants generally report to carefully think about what they buy in a supermarket, and may potentially make more conscious choices based on price considerations. Moreover, we encountered that the food supply within the supermarket was largely unhealthy, which could be in line with research documenting that the ratio unhealthy/healthy food items can be even more skewed in deprived neighborhoods (e.g., in Belgium; Vandevijvere et al., 2023). Consequently, we experienced difficulty in selecting appropriate and healthy single products that could be nudged. Together, these insights may explain the very limited impact of the repositioning nudge and demonstrate that nudging healthy snacks at the checkout may not be a suitable intervention to promote healthy purchases within current lower socioeconomic contexts.

Lastly, financial aspects of doing groceries are of special importance for people with lower SEP. In line with previous research (Harbers et al., 2021;Vos et al., 2022), our results demonstrate that price is one of the most important product characteristics. Participants especially mentioned price-related needs (e.g., lower prices for healthy products and discounts on healthy instead of unhealthy items) that could support them to eat (more) healthily (as also reported by Van der Velde et al., 2019). Participants also reported to be most worried about the currently high and increasing prices. Having financial worries, in turn, was negatively correlated with food security. This may indicate that people feel that they do not have the financial access to the food they would like to buy, as they perceive such food as too expensive (Van der Velde et al., 2019). Thus, high prices are experienced as a barrier for buying healthy food.

Implications for research and policy

The current findings demonstrate that behavioral interventions that seem to be effective in one specific context (e.g., among the general population), are not per definition suitable for other contexts (e.g., among lower SEP populations specifically). Interventions should align with (the needs of) the target group and their context. For nudging, particularly, this means that its effectiveness among lower SEP populations may be dependent on their specific motives and considerations (e.g., importance of price when doing groceries). For research practices, this demonstrates that more nuanced behavior change theories are required in terms of the moderating role of SEP on underlying factors and (decision-making) processes (as opposed to SEP being a control variable or completely ignored in theories; Schüz, 2017). Importantly, (nudge) interventions should be examined among lower SEP groups in real-word settings,

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thereby taking into account all elements of the (socioeconomic) context. We recommend scholars to address the difference between efficacy and effectiveness in future studies by examining (the size of) intervention effects not only in controlled settings but also in real-life particularly. As the conditions under which nudging may be effective have hardly been identified (in general, and especially not among lower SEP groups which is an understudied group in nudge studies; De Ridder et al., 2022), future research is needed to examine the assumptions underlying nudge effectiveness and the interactions between the overall (supermarket) environment and effectiveness of different types of nudges among lower SEP groups. In this way, it can be examined *when, why* and *for whom* (nudge) interventions may have their effects. That is, in which context and under which conditions among specific (socioeconomic) subgroups of the population.

In a similar vein, our findings demonstrate that policies must be tailored to (the needs of) different socioeconomic populations and the context they live in since one size does not fit all. To improve healthy eating among people with lower SEP, a shift may be required within behavioral public policies. Currently, responsibility for healthy consumption is easily placed at the individual, who is required to navigate within the abundance of mostly unhealthy options when doing groceries, and at local stakeholders and their willingness to implement interventions (Savona et al., 2017; Swinburn et al., 2015). However, to actually combat society's most pressing problems, interventions that address modifiable factors (e.g., the way food is presented) may not have sufficient impact and more macro-systematic interventions may be needed that address the system in which individuals act. Therefore, instead of mostly focusing on implementing interventions that target individual-level behaviors, such as nudging, a more rigorous approach may be required involving system-level interventions that align with the context and needs of lower SEP groups (Chater and Loewenstein, 2023, e.g., a new law that allows municipalities to ban providers of unhealthy food).

Our findings indicate the necessity to implement public policies that concurrently intervene on the healthiness and affordability of the food supply within supermarkets in deprived areas. If governments, for example, would introduce a sugar tax, a VAT removal on fruit and vegetables, or measures that oblige supermarkets to increase the offer of healthy foods, this could create (healthier and fair) boundaries within which supermarkets can compete, while removing the responsibility of local initiatives to voluntarily implement interventions. In this way, a healthier supermarket environment is created that does not rely on customers' individual responsibility and stimulates health across all socioeconomic groups. This does not mean that we discourage interventions that target individual-level behaviors, such as nudging, among lower SEP groups at all. In fact, behavioral interventions like nudging are not stand-alone solutions to public health issues, but should be (better) integrated with stricter macro-systematic policies (Ewert, 2020). When the offer in supermarkets is healthier, the conditions for nudging healthier choices may become more fertile. Importantly, nudges should align with the product preferences (e.g., taste, healthiness and costs), information needs (e.g., nutrition information) and beliefs about the food environment (e.g., freedom of autonomous choice) of lower SEP groups (Harbers et al., 2021).

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Lessons learned

To conduct the present study, a transdisciplinary research approach was required, integrating knowledge from (non-academic) stakeholders (e.g., the supermarket owner) and scientific disciplines. In designing the intervention, we aimed to align with practical feasibility and the target group. However, as described in the procedure section, we encountered during this stage the challenge of few healthy single-item snacks being available within the regular food supply that could be nudged. Despite efforts to select products to nudge at the checkout that are sensitive to the target group and have similar prices as the products regularly offered at the display, the current repositioning nudge did not fit the way the target group does groceries. While nudging is based on the idea that people often make decisions passively and unreflectively (Thaler and Sunstein, 2008), the present findings demonstrate that other factors, like price and taste, may be important for people with lower SEP when doing groceries. Altogether, the current socioeconomic context did not lend itself for the current repositioning nudge.

For designing and implementing future research and behavioral public policies among people with lower SEP, scholars and policy makers should be aware that interventions are not per definition suitable for and cannot be copied one-to-one to every context. In this study, measuring the efficacy of the intervention and better understanding the target group and their socioeconomic context (with the questionnaires) took place simultaneously. An important lesson learned here, is that it is essential to first get a better sense of the context in which interventions are implemented, and to tailor the intervention accordingly. This includes an understanding of both the physical context (its practical features) and the social context (what drives the target group and how do they respond to their environment, e.g., what are important considerations for them in doing groceries). This, importantly, can be achieved by not only engaging local stakeholders but also citizens in the co-creating process, ensuring their active contributions and identifying and adapting to their preferences and needs (e.g., Verhage et al., 2024).

Strengths and limitations

A strength of the current study is that it was designed based on the need of local stakeholders to stimulate healthy choices among residents by testing the effects of an intervention within the local supermarket. Furthermore, this quasi-experimental study tested the efficacy of nudging within a supermarket in a deprived neighborhood, providing evidence on what works for whom in a less-controlled, real-life setting. This study thereby allowed for an examination of the assumption often mentioned in current policies that such interventions would be promising among lower SEP groups. Importantly, also their experiences and needs were described and these findings shed light on whether nudge interventions would be suitable for such populations.

However, the current findings should be interpreted considering several limitations. Firstly, as all adult customers of the supermarket were eligible, we cannot guarantee that we actually reached individuals with lower SEP. Furthermore, answers on the questionnaire may have been subject to self-report bias (when reflecting on habitual behavior) and social desirability bias (due to the presence of the researchers). Moreover, due to the limited healthy single food items available in the regular offer, healthier snacks were selected for the nudge intervention and this may have resulted in other findings

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than when healthy snacks would have been nudged. Furthermore, we did not correct for confounding factors while this may be valuable in quasi-experimental studies. We, however, did not have data beyond the daily sales data. Finally, as the present study has only been performed in a supermarket in a deprived neighborhood, the nudge-effect and questionnaire data could not be compared to people with relatively higher SEP. Even though multiple studies have found desirable effects of similar nudges (Kroese et al., 2016; Van Gestel et al., 2017; Winkler et al., 2016), on the basis of this specific study it remains unknown whether the nudge-effect could be observed at all in another (higher SEP) context, and whether the results of the questionnaire only pertain to customers of a supermarket in a deprived neighborhood or are also applicable to other SEP populations. To learn which interventions can combat health inequalities, future research should compare effects among different SEP groups.

Conclusion

Nudging is often proposed within current policies as a promising approach for stimulating health behavior among people with lower SEP by adjusting the context they encounter. Our findings, however, demonstrate that nudge interventions (and specifically product repositioning nudges) may not suit the current context and needs of people with lower SEP. When the overall food environment is not stimulating, the effectiveness of repositioning healthier snacks at the checkout may only be considered a drop in the bucket. We therefore propose that interventions must be tailored to the context and needs of lower SEP groups, which should be further examined in future research. Instead of only focusing on interventions that target individual-level behavior, these should be imbedded in more rigorous system-level public policies that make it easy to act in a healthy way. Only when the context in which individuals act is supportive for all individuals within society, socioeconomic health inequalities may be combatted and a better way may be found to effectively 'fill the bucket'.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/bpp.2024.65.

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