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# Assessing the Impact of Nutri-Score Labelling and Product Availability on Consumer Choice

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Abstract

Nutritional labelling is a means of communicating the nutritional content of food to consumers. When a nutritional label is salient and understandable, consumers tend to make more healthy choices. Nutritional labelling policies can also influence providers by incentivising manufacturers to reformulate recipes or to introduce healthier products to their range. While existing strands of research investigate the effect of nutritional labels on both consumer behaviour and provider behaviour, less is known about the relationship between the two. This study tested the effects of the nutritional label, Nutri-Score, and the availability of healthier options on real consumer decisions in an online purchasing task in Ireland. Consumers who saw Nutri-Score applied to snack products made healthier purchases, on average, than consumers who did not. Consumers who shopped in a market with more healthy options made healthier purchases than those who shopped in the current market. Our results are consistent with these two effects being additive. Hence, if the label is taken up widely, positive effects are possible via both changes to consumer choice and alterations to product ranges. Although effect sizes were relatively small, such modest dietary changes can generate meaningful effects across populations and over the lifespan.

Keywords: Food choice; Nutritional Labels; Nutri-Score; Availability; Consumer Behaviour

## 1. Introduction

Nutritional labels are a way to communicate the nutritional content of food to consumers to allow them to make an informed decision. Many nutritional labels, including the most common Guideline Daily Amounts (GDA) labels, focus on provision of information, but not necessarily on the salience or comprehensibility of that information. According to the most recent review on nutritional labelling, best practice suggests that a nutritional label should be simple, understandable, highly salient, target automatic associations and incorporate informational and emotional messaging.[1] Labels that harness these features increase comprehension of the nutritional content of packaged foods and also reduce the amount of unhealthy food products that consumers buy.[1]

Nutritional labelling can have an additional effect, over and above that on individual consumers. Both voluntary and mandated nutritional labelling policies can induce a provider response whereby food manufacturers make changes to existing product recipes or make new products available as a response to the policy.[1] The provider response may therefore influence what consumers consume, with or without changing active consumer choice. While research often considers either the effects of nutritional labelling on consumer behaviour, or the effect of nutritional labelling on provider response, it tends not to address the interaction between labelling and provider response on consumer behaviour. This paper investigates how a nutritional label, Nutri-Score, and the availability of different products interact to influence what consumers choose to buy.

Nutri-Score is a nutritional label based on the British Food Standards Agency (FSA) nutritional score. It is a colour-coded 5-point scale (ranging from A to E) that is intended to indicate the healthfulness of a food product. The underlying FSA score ranges from -15 to 40 with lower scores indicating a healthier score. Points are added for sugar, salt and saturated fat. Points are taken away for fruits, vegetables, nuts, rapeseed oil, walnut oil, olive oil, fibre and protein. There is generally high consistency between nutritional recommendations and Nutri-Scores within and between food groups.[2-4]

A body of international evidence, while not definitive, strongly suggests that Nutri-Score is effective. It shows that consumers tend to prefer Nutri-Score to other types of food labels and report that they intend to purchase healthier foods following exposure to it.[5,6] A cross-country comparison found that in all 12 countries tested, Nutri-Score led to better objective comprehension than multiple traffic lights, reference intake labels, the Health Star Rating system, and the Warning symbols system.[7] Of course one caveat is that even if consumers prefer one label type over another, understand it better, and intend to purchase healthier foods following exposure to it, it does not necessarily mean that the label will influence healthier real purchase decisions. However, some evidence in both the lab and the field does suggest that Nutri-Score can lead to healthier real purchasing decisions.[21] A large lab study in France found that the nutritional quality of participants' real grocery purchases was higher when participants saw Nutri-Score labels while shopping compared to when they saw no nutritional labels or one of 5 alternative labels.[8] A randomised controlled trial in 60 supermarkets across France obtained similar results; purchases from supermarkets where Nutri-Score was displayed had higher nutritional quality than purchases from supermarkets in which any of 3 other nutritional labels were displayed.[9]

Both studies on actual purchases were carried out in France before Nutri-Score had been introduced as a labelling scheme. They showed how Nutri-Score would affect purchasing decisions if the label were applied to the existing market. However, experience shows that nutritional labelling schemes can change the behaviour of both consumers and providers. For instance, manufacturers in Chile are required to display a black octagonal-shaped "high-in" warning label if products have high levels of specific nutrients such as sugar and sodium. Since the law was introduced in 2016, the percentage of

products with a "high-in sodium" warning dropped from 74% to 27% and products with a "high-in sugar" warning dropped from 80% to 60%.[1] The results for voluntary labelling schemes are similar but not as clear cut, as manufacturers may selectively choose which products to label. Like Chile, New Zealand introduced a new labelling system in 2014, but theirs was implemented by manufacturers on a voluntary basis. This "Health Star Rating" system gives nutritional information in the form of 1-5 stars, with more stars given to healthier products. An analysis of products 2 years after implementation found that 83% of labelled products had been reformulated; the recipes had been changed to give healthier ratings.[10] However, as the system was voluntary, manufacturers could choose what products to label and labelled products tended to be healthier than unlabelled products. Nevertheless, when reformulation is widespread it can have significant effects on consumption, as observed in the UK following the introduction in 2016 of a levy on soft drinks whose sugar content exceeded a set threshold sales data in the following 3 years showed a large reduction in calories consumed from soft drinks per annum per UK resident, some of which was due to consumer behaviour and some due to reformulation. Nearly all the studied brands reformulated their soft drinks and most did so in the 2 years after the levy was announced but before it was formally implemented.[11]

The sugar levy is an example where a policy changes both consumer and provider behaviour.[12] However, the relationship between consumer and provider behaviour may be cyclical. A policy may influence consumer demand, which may influence provider supply, which may then further influence consumer behaviour and demand. Much food labelling research investigates how a particular label would influence consumers' behaviour in the existing market, but not how it would influence consumer behaviour in a market that has been changed by a provider response to labelling. This is important because consumer behaviour can be influenced both by nutritional labels and by the availability of different options. For example, increasing the proportion of healthier options available to consumers has been found to increase purchases of healthier items, even though the unhealthier items are still available for purchase.[13-15] However, there are multiple ways in which the availability of healthier options can be changed. A recent review suggested a conceptual framework of three dimensions by which the availability of products can be altered to influence consumer behaviour: (1) the absolute availability of products is changed (more or less of everything); (2) the relatively availability is changed (the overall number of products remains constant but the proportion of healthier options changes); (3) the absolute and relative availability of products is changed (healthier products are added to the existing range, which also changes the proportions).[16] It is easy to imagine how all three, but particularly (2) and (3) could describe a provider response to a mandatory labelling policy. Providers may reformulate existing products, thus changing the relative availability of healthier options (2), and/or develop new healthier products to add to the existing range, thus changing the absolute and relatively availability (3). There is some evidence that all three availability dimensions influence consumers to make healthier choices, although it is not clear which has the strongest influence.[16]

Thus, a strand of existing research shows that good nutritional labelling affects consumer behaviour, another strand demonstrates a relationship between nutritional labelling policies and provider response, and a third addresses how availability of options influences consumer behaviour. There is not, to our knowledge, a literature on how the combination of these three aspects of nutritional labelling policies influences consumer behaviour. We are only aware of one study examining combined effects of food availability and calorie information in a virtual setting.[23] The aim of this paper is to investigate whether consumers make different food choices depending on the availability of options and whether the Nutri-Score label is present or absent.

The study focused on snack foods and was undertaken in Ireland, where Nutri-Score was not in use in the market.. The primary research questions were: (1) Do consumers in Ireland make different choices of snacks (by healthiness or quantity) if a Nutri-Score label is used? (2) Do consumers' choices vary with the distribution of the healthiness of snack foods across the product range? (3) Are any effects additive, or does the presence of the label interact with the range? A full list of specific, pre-registered hypotheses is provided at the end of the Methods section (Table 2).

## 2. Methods

Participants took part in two online shopping tasks for snack foods. In the first task, they were randomly assigned to see Nutri-Score on products or not, and to shop from products with a distribution of Nutri-Scores representative of the current market or from products with a distribution of Nutri-Scores representative of what could be expected in a healthier market. Participants made "real" decisions, as they were told they may be randomly selected to receive the products they chose. The second, hypothetical, shopping task, was designed to replicate findings from the first task while also testing additional distributions of Nutri-Scores. Participants chose their favourite product from each of eight categories of food. The main outcomes of interests were average FSA score of items purchased, number of items purchased, average grams of items purchased, knowledge of Nutri-Score, attention paid to nutritional information whilst shopping in the tasks and attention paid to healthfulness when shopping generally.

Both the pre-registration and data are available on the Open Science Framework.[1]

### 2.1. Participants

Participants (N = 800) were recruited by a market research company to take part in a 20-minute study on consumer behaviour in an online shopping environment. They were paid €4 for participating. To incentivise participants to choose products they actually wanted, they were told at the start that they may be selected to receive the products they chose. Fifty participants were randomly selected to receive their products, of whom 46 wanted to receive them. The products were shipped out to them after the study period ended. The final sample of 800 was broadly representative of the national population based on observable characteristics: 55% were men, mean age was 50 with a range from 19 to 87, 39% had a higher education degree, and 58% were employed. Participants were unaware of the experimental condition they had been assigned to.

### 2.2. Products

We created a database of all of the product names, prices and nutritional content of products within eight categories of snack foods from one of the largest supermarket chains in Ireland. The eight categories were sweet biscuits, savoury biscuits/crackers, cereal/protein bars, chocolate, sweets/mints, popcorn, nuts, and crisps. We used the nutritional information provided by the supermarket chain to calculate the Nutri-Score of each product and the underlying British Food Standards Agency nutrient profiling score (FSA score). The components necessary to calculate the score were kilojoules, saturated fatty acids, sugars, proteins, fibres, sodium, and fruits, vegetables, pulses, nuts, rapeseed, walnut and olive oils per 100g of product. We used this database to visualise the distribution of Nutri-Scores of products in the existing Irish market. We then compared these distributions to the distributions in one of the largest French supermarket chains, where Nutri-Score has been in place voluntarily since 2017. The French distributions were generally shifted to the left of the distributions in the Irish market, indicating that the French market consists of products with

[1] https://osf.io/nqs3f/?view_only=47b69ab6421445809ecc30116279885c

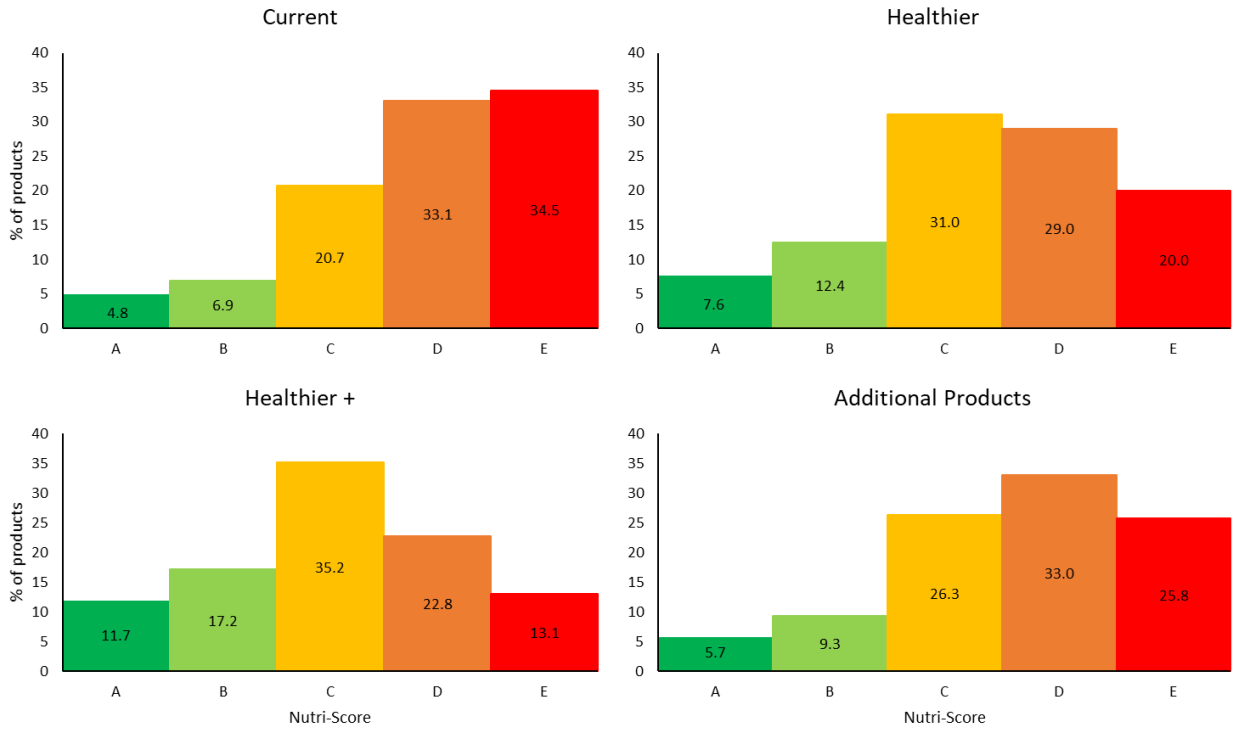
healthier Nutri-Scores. The distributions of the same product categories in the French supermarket chain allowed us to visualise what distributions may be possible in a market in which Nutri-Score already exists and where some manufacturers may have either already reformulated products or introduced new products to the market with healthier Nutri-Scores. This allowed us to see what distributions of Nutri-Scores would be realistic in the Irish market, were the market to shift to healthier snack food products.

We then selected products from the Irish supermarket chain to create four different distributions (See Table 1. For a detailed description of the distributions):

1) A distribution representative of the current Irish market (current distribution)
2) A distribution representative of the current French market; i.e. with a higher proportion of products with lower FSA scores than in the Irish market (healthier distribution)
3) A distribution with a higher proportion of products with lower FSA scores than currently exists in the Irish or French market (healthier+ distribution)
4) A distribution created by adding new healthier products to the current distribution (additional products).

Figure 1 shows the percentage of Nutri-Scores across all food categories in each of the four manipulated distributions. The current distribution (1) was created by selecting a subset of the products (10-25 depending on category) available in the Irish supermarket whilst maintaining the same proportion of Nutri-Scores as in the full set of products in the Irish market. The healthier distribution (2) was created by comparing the proportions of Nutri-Scores in the current distribution to the proportions in the French market for the same product category and then replacing some of the products (3-9 depending on category) in the current distribution to match the proportions in the French market. The healthier+ distribution (3) was created by replacing additional products (2-5 depending on category) in the healthier distribution to further increase the proportion of healthy food products. The additional products distribution (4) was created by taking the products in the current distribution and adding the replacement products from the heathier distribution. Distributions 1-3 had 145 products each to choose from across 8 categories. Distribution 4 had 194 products. Across all four distributions there was a 60% overlap of products shown.

**Figure 1. Percentage of Nutri-Scores in each of the four manipulated distributions.**




Note. A-E indicate the Nutri-Score of the product. A is considered the to have the most preferable nutritional score, and E the least.

We created the distributions using only products already sold in the Irish supermarket to avoid introducing products that consumers were not familiar with.

## 2.3 Online shop

The online shop was programmed using Gorilla (www.gorilla.sc).[17] Participants were introduced to the shop on a landing page that told them that they had €10 to spend on anything in the shop. Participants were not given change from the €10 as this was not possible in the online setting. The eight categories of products were shown at the top of the page, with the order randomised between participants. Participants could move freely between categories of products and select any number of items from any of them. The order of products within categories was also randomised between participants. Participants could see all products in one category with information on price and grams displayed on each. Participants in the Nutri-Score condition also saw Nutri-Score labels below product photographs on the landing page for each category. Participants in both conditions could click on individual products to get additional information including the description, ingredients, nutritional table and, in the Nutri-Score condition, Nutri-Score and a description of what Nutri-Score is. A box on the side of the screen showed participants the content of their basket and the total price. They could choose to clear the basket or checkout at any time after selecting at least one product. Prices were the prices of products in Tesco at the time of data collection. The average price of products was the same for the current distribution ($M$ = 2.06, $SD$ = 0.78) and healthier distribution ($M$ = 2.08, $SD$ = 0.79). Figure 2 shows an example of the online shop for the no Nutri-Score compared to the Nutri-Score condition.

In the second shopping task, participants again saw a version of the online shop, but this time made hypothetical choices by choosing their preferred product from each of the eight categories. In this

task, participants saw one category at a time and were not able to move on from that category until they had selected their preferred product.

2.4 Experimental Manipulations

Participants were randomised to a control condition (no Nutri-Score) in which they saw only the normal nutritional information table on products, or to an intervention condition (Nutri-Score) in which Nutri-Score was also shown on the products. In the first shopping task, they were randomised to see a range of products representative of the distribution of Nutri-Scores in the current market, or to see a range of products representative of the distribution of Nutri-Scores in a healthier market. Participants in all conditions chose from the same number of products.

In the subsequent shopping task involving hypothetical choices, participants remained in the control or intervention conditions but distributions were randomised within-person between categories. In this task, participants were asked to choose their favourite product from each of the eight categories and each category had one of the four possible distributions: current (current market availability), healthier (relative change in availability of healthier products), healthier+ (a more extreme relative change in availability of healthier products) or additional products (relative and absolute change in availability of healthier products). See Table 1 for a description of the four distributions. As well as seeking to replicate any effects from the real shopping task, this within-person experimental design allowed us to test effects of the two additional distribution manipulations while retaining statistical power.

Table 1. Descriptions of the four distributions of products.

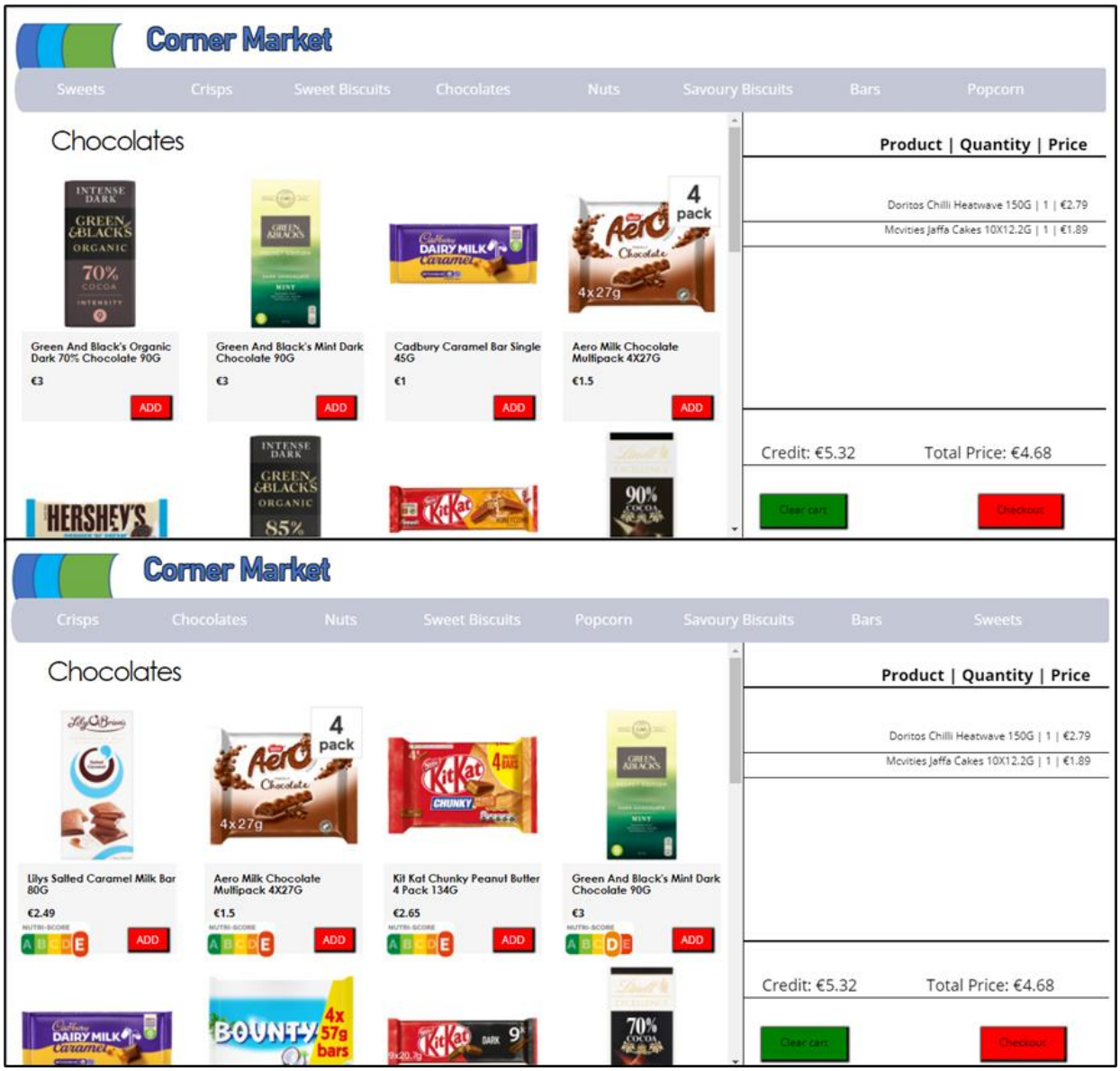
| Distribution | Description | Type of change from Irish market |
|---|---|---|
| Current | Reflects products currently available in Irish market | |
| Healthier | Reflects products currently available in the French market | Relative increase in healthier products |
| Healthier+ | Reflects healthier products than the Irish and French market | Larger relative increase in healthier products |
| Additional products | Reflects products in the Irish market with healthier products added | Absolute and relative increase in healthier products |

2.5 Additional Measures

Before the first shopping task, participants were asked how often they shop for groceries online. After the two shopping tasks, participants responded to some additional questions. The first question asked participants to say what they thought the study aims were. Participants were then asked how often they purchase food from the eight categories in the shop and to rate how much attention they had paid to the nutritional information while doing the shopping task. They were then shown a list of 16 products that had been randomly selected from the 70 products that were common across conditions. For each product, they were asked to guess the correct Nutri-Score. The selection of products from those that were common across conditions was to ensure that participants only saw products they had seen earlier in the task. After this, they were asked to rate, on a scale of 1-7, how much attention they normally pay to taste, value, healthfulness and familiarity with the brand of products when shopping for groceries like the ones they had seen in the shop.

Finally, we collected socio-demographic information, including age, gender, education level, employment status, social class and whether they had a child under the age of 18 in their household.

**Figure 2. Screenshots taken from the online shop for the no Nutri-Score (top) and Nutri-Score (bottom) conditions.**




## 2.6 Procedure

Participants took part online. They were told that the purpose of the study was to assess consumer behaviour in an online shopping environment. To incentivise real decisions, participants were told that they would be given €10 to spend in an online shop and that they may be selected to have their products delivered to them. Participants were asked to choose at least one product but could choose as few or as many other products as they liked within their budget. Participants were randomised to see Nutri-Score or not, and to see the current or healthier distribution of products across all categories.

After completing the real shop, participants were asked to do the shopping task again but were told that this time the choices were hypothetical and that they should choose the product from each

category that they would buy if they had to buy one. Participants made 8 decisions, two from each of the 4 possible distributions.

**Table 2. List of pre-registered hypotheses.**

| **Primary hypotheses** |
|---|
| **H1a**. Participants who see Nutri-Score labels on products will have baskets with a lower mean FSA score than participants who do not see Nutri-Score. |
| **H1b.** Participants who choose products from a shop with a higher proportion of healthier options available to choose from compared to the current market will have baskets with a lower mean FSA score. |
| **H1c.** The effect of seeing Nutri-Score labels and a healthier distribution of products will interact such that participants who see both will have a basket with a lower mean FSA score than participants who see only one or neither. |
| **H2a.** Participants who see Nutri-Score labels on products will buy fewer items than those who do not. |
| **H2b.** The number of items purchased will differ between participants who see a shop with a higher proportion of healthier options than those who see a shop with products representing the current market. |
| **H2c.** There will be an interaction between seeing Nutri-Score labels or not and seeing a healthier distribution of products or not. |
| **H3a.** Participants who see Nutri-Score labels on products will have baskets with a lower mean weight (measured in grams) of snack foods than those who do not. |
| **H4a.** Participants who see Nutri-Score labels on products will choose an item with a lower FSA score than participants who do not see Nutri-Score. |
| **H4b.** The healthier the range of options available to participants, the more likely they will be to choose an item with a lower FSA score compared to when choosing from a range representative of the current market. |
| **H4c.** There will be a difference in the FSA score of the item chosen by participants who see a category range in which the relative number of healthier options has been manipulated compared to the absolute number of healthier options, but we do not specify a direction. |
| **H4d.** There will be an interaction between seeing Nutri-Score labels and seeing a healthier distribution of products such that participants who see both will choose an item with a lower FSA score than participants who see only one or neither. |
| **H5a.** Participants who see Nutri-Score labels on products will choose a lower weight item (measured in grams) than participants who do not see Nutri-Score. |
| **H6a.** Participants who see Nutri-Score applied to products during the shop will be better able to identify the Nutri-Score of products in a subsequent task. |
| **H6b.** Participants who are better able to guess the Nutri-Score of products will choose baskets with lower mean FSA scores, fewer items and lower weights in the real shopping task and will choose items with lower FSA scores and lower weights in the hypothetical shopping task. |
| **Secondary hypotheses** |
| **H7.** Participants who see Nutri-Score on products will be more likely to report having paid attention to nutritional information during the shop than participants who did not see Nutri-Score. |
| **H8.** There will be an interaction between the extent to which people normally pay attention to the healthfulness of products and whether people see Nutri-Score or not on all DVs, but we do not specify a directional hypothesis. |
| **H9.** Men will be more affected on all DVs by seeing Nutri-Score than women. |
| **H10.** Households with children will be more affected on all DVs by seeing Nutri-Score than households without children. |

Participants then completed the questionnaire. They were told if they had been chosen to receive the products they had selected and they were asked for their contact details if they wished to receive them. The study complied with institutional ethics policy, including data protection procedures.

## 3. Results

In total, 59% of participants responded that they shop online for groceries occasionally to frequently, while 41% said that they rarely or never do. We also asked how frequently they purchased food from each of our eight categories of products; 83% of participants regularly purchase sweet biscuits, 62% regularly purchase bars, 92% regularly purchase chocolate, 83% regularly purchase savoury biscuits/crackers, 53% regularly purchase popcorn, 84% regularly purchase crisps and 75% regularly purchase nuts.

### 3.1. Real Purchasing Decisions

The mean FSA score of the shopping baskets was 14.33 (SD = 5.26) with a range from -0.5 to 28. Participants bought an average of 5.42 products (SD = 1.56) with a range of 1-17 and most spent close to the maximum of €10 (9.34, SD = 1.34, range 1-10). Distributions of socio-demographic characteristics by condition are shown in Table 3.

**Table 3. Sociodemographic characteristics of conditions**

| | **No Nutri-Score + Control Distribution** | **Nutri-Score + Control Distribution** | **No Nutri-Score + Healthier Distribution** | **Nutri-Score + Healthier Distribution** |
|---|---|---|---|---|
| Age | 47.85 (15.72) | 51.43 (16.07) | 52.22 (15.02) | 49.58 (15.52) |
| Gender (% male) | 54.7% | 62.5% | 54.0% | 51.4% |
| Employed | 57.0% | 55.9% | 59.4% | 60.6% |
| Degree + | 41.6% | 36.6% | 36.9% | 41.3% |
| Social Grade (ABC1)[a] | 45.8% | 50% | 47.6% | 48.8% |
| Child under 18 | 29.0% | 25.3% | 23.5% | 29.6% |

a. Social grade is a socio-economic classification that has six categories (A, B, C1, C2, D and E) and is based on occupation.

**Does Nutri-Score or availability influence the healthiness of what people buy?**

Figure 3 shows the distribution of mean FSA scores by condition. The distribution for participants who saw Nutri-Scores shifted towards lower (healthier) FSA scores relative to those who did not see Nutri-Scores. Similarly, participants who shopped from the healthier market compared to the current one had shopping baskets with lower mean FSA scores. As the distributions in Figure 3 suggest, participants who saw Nutri-Score labels had shopping baskets with a lower mean FSA score than participants who did not see Nutri-Score, suggesting that their purchases were healthier on average. Participants who shopped from the healthier distribution of products also made healthier purchases on average than those who shopped in the current market.

**Figure 3. Distribution of mean FSA score of baskets for a) Nutri-Score vs no Nutri-Score and b) current distribution vs. healthier distribution.**

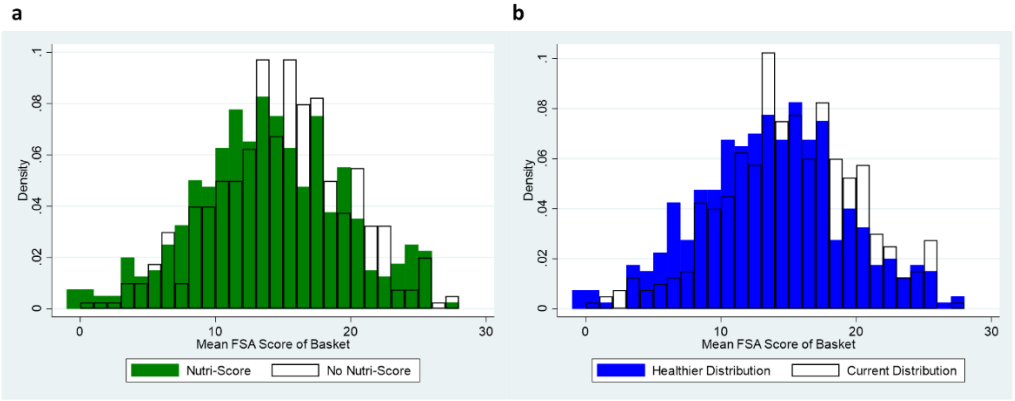
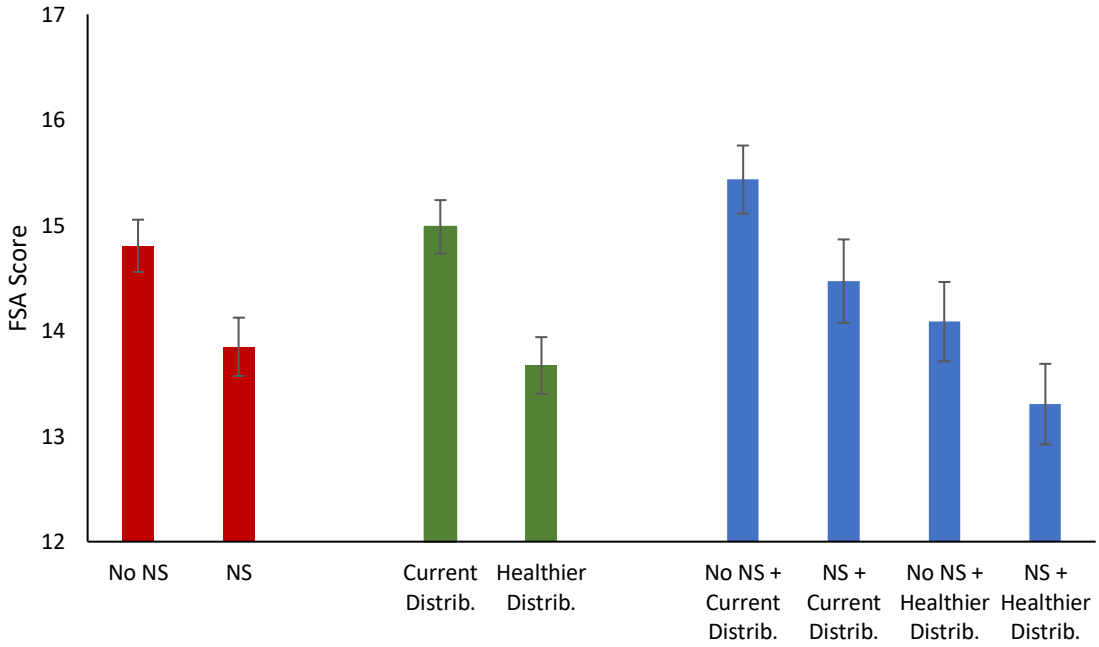



Figure 4 shows the mean FSA score of baskets across participants in each of the four conditions separately. The final four bars of Figure 4 show that the healthiest purchases were made by participants who saw Nutri-Score labels applied to products and who shopped from the healthier distribution of products.

**Figure 4. Mean FSA score of baskets for Nutri-Score vs no Nutri-Score, current distribution compared to the healthier distribution, and all four conditions separately.**




*Note.* No NS = No Nutri-Score shown, NS = Nutri-Score shown. Error bars represent standard error of the mean. Vertical axis scales to approximately 1 SD (5.26) in line with the recommendation from Witt (2019).[18]

We ran linear regression analyses to test differences in FSA score between conditions. In line with our hypotheses, participants who had seen Nutri-Score and participants who had seen a healthier distribution of products had baskets with lower FSA scores (Table 4, Model 1). Compared to the control group who shopped in the current market without Nutri-Scores, the three other groups each

had significantly lower scores (Table 4, Model 2). Participants who chose products from an online shop in which Nutri-Scores were on products and the distribution was healthier had the healthiest baskets. Equivalence tests of coefficients indicated a statistically significant difference compared to participants who shopped in the current market with Nutri-Score, $F(1, 796) = 4.96$, $p < 0.05$, one-tailed, but a more marginal difference compared to participants who shopped in the healthier market without Nutri-Score, $F(1, 796) = 2.24$, $p = 0.07$, one-tailed. There was no significant interaction effect between Nutri-Score and availability (Table 4, Model 3). These results are consistent with an additive relationship between the presence of Nutri-Score and the healthier distribution of options.

We also ran the analyses excluding the 60 participants who guessed that nutritional labelling was one of the aims of the experiment. This did not change the results.

**Table 4. Linear regression analyses with the mean FSA scores of baskets as the dependent variable and condition as the independent variables.**

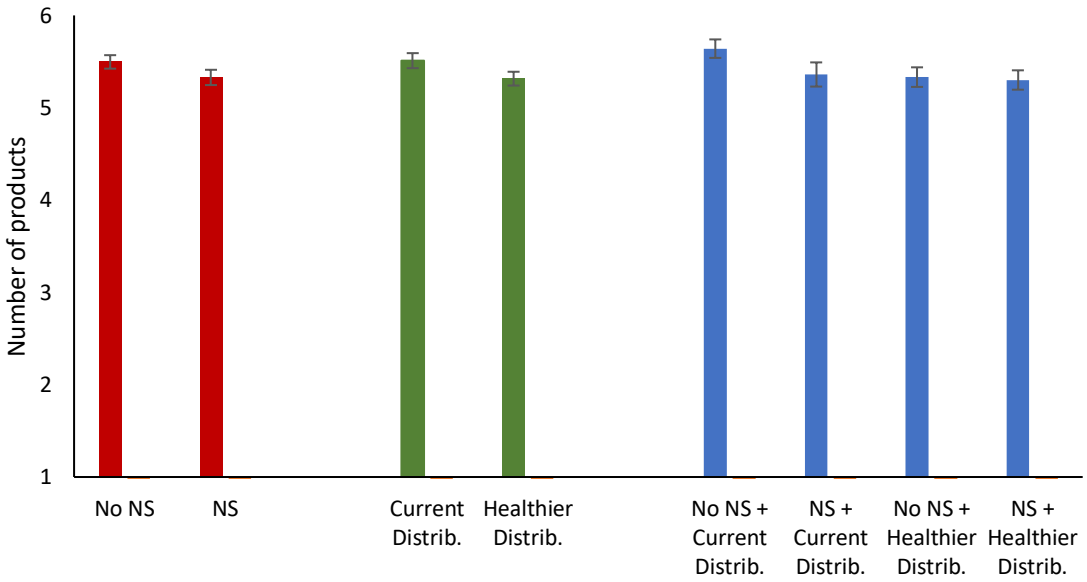
| | Model 1 B(SE) | Model 2 B (SE) | Model 3 B (SE) | Model 4 B (SE) | Model 5 B (SE) |
|---|---|---|---|---|---|
| Nutri-Score (ref. No Nutri-Score) | **-0.87 (0.37)*** | | **-0.96 (0.52)‡** | **-0.76 (0.35)*** | **-0.44 (0.36)** |
| Healthier Distribution (ref. Current Distribution) | **-1.26 (0.37)**** | | **-1.35 (0.52)*** | **-1.23 (0.36)**** | **-1.27 (0.35)***** |
| Nutri-Score*Healthier Distribution | | | 0.18 (0.74) | | |
| Distribution + NS (ref. No NS + Current Distribution) | | | | | |
| NS + Current Distribution | | **-0.96 (0.52)‡** | | | |
| No NS + Healthier Distribution | | **-1.35 (0.52)**** | | | |
| NS + Healthier Distribution | | **-2.13 (0.50)***** | | | |
| Normally pay attention to health | | | | -0.74 (0.11)*** | -0.53 (0.39)*** |
| Paid attention to nutritional information during shop | | | | | -0.41 (0.11)*** |
| Ability to guess Nutri-Scores | | | | | **-0.23 (0.08)**** |
| Socio-demographic controls? | No | No | No | Yes | Yes |
| N | 800 | 800 | 800 | 797 | 797 |
| $R^2$ | 0.02 | 0.02 | 0.02 | 0.10 | 0.12 |

***Note.*** No NS = No Nutri-Score shown, NS = Nutri-Score shown. Model 4 and 5 controlled for Age, Gender, Degree, Employment, Child under 18, Social Grade (ABC1, C2DE, F). Full models can be found in supplementary materials, Table S1.
‡ p = 0.07, *$p < .05$, **$p < .01$, ***$p < .001$, one-tailed in **bold**.

**Do Nutri-Scores or availability influence how many items people buy?**

Figure 5 shows the total number of products purchased by participants in each condition. The differences between groups were small. The number of products purchased ranged from 1 to 17 but few participants purchased less than 4 or more than 8 products, so we transformed the dependent variables into a 7-level variable that grouped these extreme values.

**Figure 5. Number of products purchased for Nutri-Score vs No Nutri-Score; Normal Distribution vs. Healthier Distribution and all four conditions separately.**




**Note:** No NS = No Nutri-Score shown, NS = Nutri-Score shown. Error bars represent standard error of the mean.

We ran an ordinal logistic regression with the 7-level variable as the dependent variable and condition as an independent variable (Table 5). Contrary to our hypotheses, there was not a significant reduction in the number of items purchased by participants who saw Nutri-Scores (versus not), nor was there a change in number of items purchased by participants who saw a healthier distribution (versus current distribution) (Table 5, Model 1). This may in part be because the €10 credit was non-fungible. The interaction between seeing Nutri-Scores and a healthier distribution was non-significant (Table 5, Model 2). However, participants who did not see Nutri-Score and who saw the current distribution of products did buy slightly more products compared to those in the other three conditions (Table 5, Model 3). The size of this effect was less than one product.

These results are unchanged by excluding participants who guessed that nutritional labelling was one of the aims of the experiment or by using the original (untransformed) total count variable.

**Table 5. Ordinal logistic regression analyses with the number of products purchased as the dependent variable and condition as the independent variables.**

| | Model 1 B(SE) | Model 2 B (SE) | Model 3 B (SE) | Model 4 B (SE) | Model 5 B (SE) |
|---|---|---|---|---|---|
| Nutri-Score (ref. No Nutri-Score) | **-0.19 (0.13)** | **-0.35 (0.18)*** | | **-0.18 (0.13)** | **-0.19 (0.13)** |
| Healthier distribution (ref. current distribution) | -0.15 (0.13) | -0.32 (0.18)‡ | | -0.16 (0.13) | -0.16 (0.13) |
| Nutri-Score*Healthier Distribution | | 0.33 (0.25) | | | |
| NS + Current Distribution (ref. No NS + Current Distribution) | | | -0.36 (0.18)* | -0.32 (0.18) | |
| No NS + Healthier Distribution | | | -0.32 (0.18)‡ | -0.29 (0.18) | |
| NS + Healthier Distribution | | | -0.34 (0.18)* | -0.34(0.18)‡ | |
| Normally pay attention to health | | | | -0.13 (0.04)** | -0.13 (0.04)** |

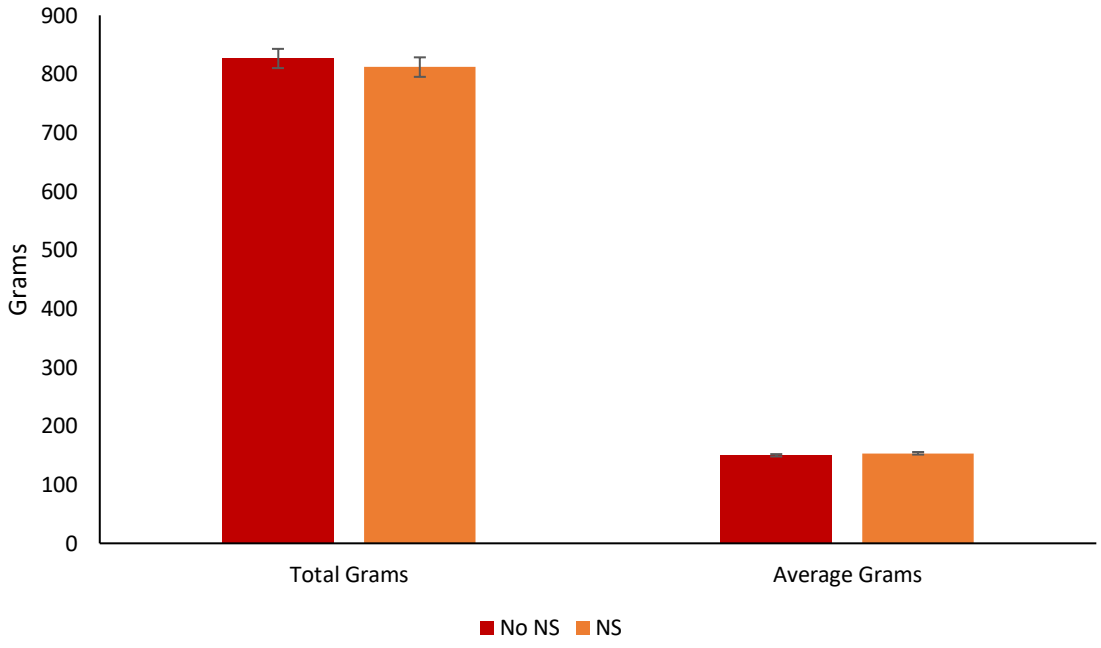
| | | | | | |
|---|---|---|---|---|---|
| Paid attention to nutritional information during shop | | | | | 0.01 (0.04) |
| Ability to guess Nutri-Scores | | | | | **0.004 (0.03)** |
| Socio-demographic controls? | No | No | No | Yes | Yes |
| N | 800 | 800 | 800 | 797 | 797 |

**Note.** No NS = No Nutri-Score shown, NS = Nutri-Score shown. Model 4 and 5 controlled for Age Gender Degree Employment, Child under 18, Social Grade (ABC1, C2DE, F). Full models can be found in supplementary materials, Table S2. ǂ $p$ = 0.07, *$p$ < .05, ** $p$ < .01, *** $p$ < .001, one-tailed in **bold**.

### Do Nutri-Score or availability influence how much people buy?

Contrary to our hypotheses, participants in the Nutri-Score condition did not buy fewer total grams or smaller products on average compared to participants in the control condition, β = 3.42, SE = 2.98, p = 0.13, one-tailed (See Figure 6). This may in part be because participants were incentivised to spend the full €10 as they would not receive change.

**Figure 6. Total grams and average grams of products in basket by Nutri-Score vs no Nutri-Score conditions.**




**Note.** No NS = No Nutri-Score shown, NS = Nutri-Score shown. Error bars represents standard error of the mean.

### Does exposure to Nutri-Score increase people's ability to guess the Nutri-Score on products?

Participants guessed the Nutri-Score of 16 products randomly selected from the 70 products that were common across conditions. On average participants correctly guessed the Nutri-Score of just 5.13 (SD = 2.17) products, and no one scored more than 12/16. Of the 12,800 estimations made in total, 41% guessed that products had a healthier Nutri-Score than in reality and 27% guessed a less healthy Nutri-Score than in reality. 24% of people performed no better than chance (3 or less correct). In line with our hypothesis, participants who had seen Nutri-Score in the online shopping tasks provided more correct estimates, averaging 5.32 compared to 4.95 for those in the control condition, $Z$(-2.55), $p$ = .005, one-tailed.

**Does exposure to Nutri-Score increase the attention people report paying to nutritional information while shopping?**

Participants reported how much attention they had paid to nutritional information while shopping on a scale from 1-7. In line with our hypothesis, participants who saw Nutri-Score reported paying more attention to nutritional information (M = 3.57, SD = 1.98) compared to participants in the control condition (M = 2.93, SD = 1.88), $Z(-4.66)$, $p < .001$ one-tailed. The difference remained the same even after excluding those who guessed that the nutritional labelling was part of the experiment aims.

**Do comprehension, attention or socio-demographic differences mediate the effect of Nutri-Score and distribution on purchasing decisions?**

The effect of Nutri-Score on the mean FSA score of baskets purchased remained after controlling for socio-demographic variables, B = -0.76, SE = 0.35, p < .05, one-tailed. Contrary to our hypothesis, there was no reduction in the FSA score for men, B = 0.25 SE = 0.37, p > .05, one-tailed, or those with children under 18, B = 0.25, SE = 0.42, p > .05, one-tailed. Results from the full model can be found in Supplementary material Table S1, Model 4. Participants who reported that they pay more attention to the healthfulness of foods when shopping generally tended to purchase baskets with lower mean FSA scores (Table 4, Model 4). We checked for the hypothesised interaction effects and found that the effect of seeing Nutri-Score on FSA scores was greater for participants who normally pay more attention to the healthfulness of products when shopping, β= -.49, SE = .21, p < 0.05. There was no significant interaction between Nutri-Score and normally paying more attention to health on grams, β = .06, SE = 0.07, p = 0.46, or on number of products purchased, β = 12.16, se = 13.67, p = 0.37.

We assessed whether knowledge of Nutri-Score or attention paid to nutritional information mediated the effect on purchases by adding them the model as covariates separately and together. In line with our hypotheses, ability to guess Nutri-Scores was associated with lower mean FSA scores (Table 4, Model 5). Increased attention paid to nutritional information was also associated with lower mean FSA scores. However, the effect of seeing Nutri-Score on purchases was only reduced when attention paid to nutritional information was added to the model, and not when ability to guess Nutri-Scores was. This suggests that Nutri-Score drives attention towards nutritional information and this is what influences healthier purchases. The same mediation effects are not seen for the distribution manipulations. The effect of shopping in a healthier market than the current one remains statistically significant when attention and knowledge variables are added. This suggests that the two manipulations may act through different mechanisms to influence purchasing behaviour. Nutri-Score increases attention paid to nutritional information, which increases the healthfulness of purchases. Distribution manipulations do not necessarily draw attention to nutritional information, but may constrain choice and therefore increase healthier purchases.

There was no effect of socio-demographic variables (Supplementary materials, Table S2, Model 4), ability to guess Nutri-Scores, or attention to nutritional information (Table 5, Models 4-5) on the number of products purchased. The small effect of seeing Nutri-Score and shopping in a healthier market was no longer statistically significant when socio-demographics and the extent to which people normally pay attention to the healthfulness of products were controlled for (Table 5, Model 4). People who reported that they normally pay more attention to the healthfulness of products while shopping tended to purchase fewer products β = -.13, SE = .04, p = 0.001.

### 3.2 Hypothetical Purchasing Decisions

For the subsequent hypothetical decisions, the mean FSA score of items chosen was 12.44 (SD = 8.15, range = -6 to 29). Selections from the chocolate category had the highest FSA score and selections from the nuts category had the lowest.

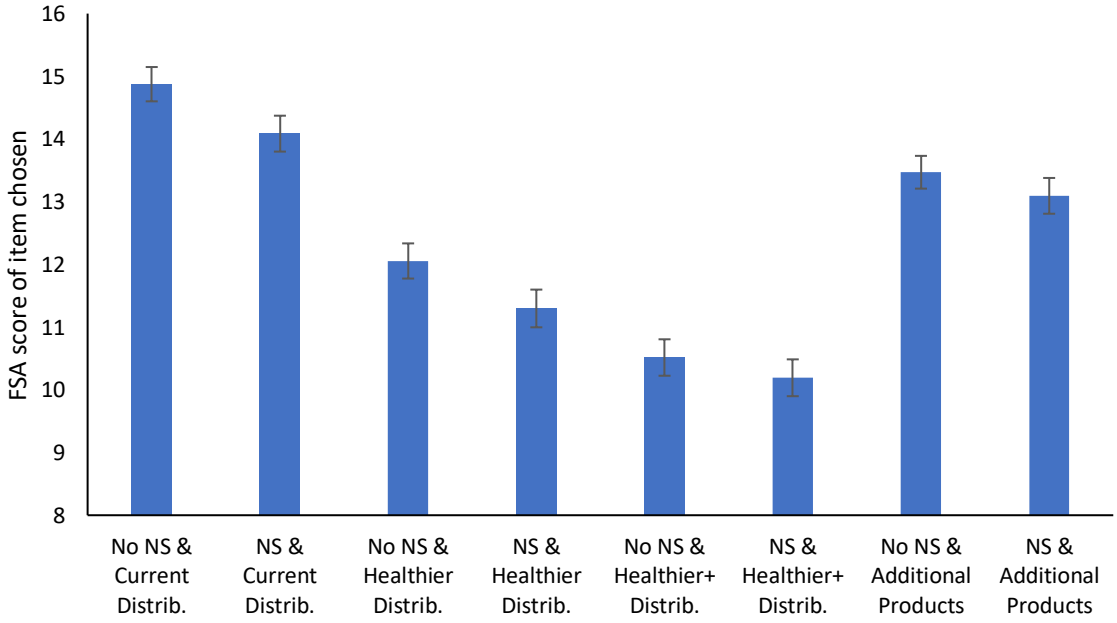
**Does Nutri-Score or availability influence the healthiness of what people choose in a hypothetical task?**

Figure 8 shows the FSA scores of the item chosen for each of the eight conditions. Participants who saw no Nutri-Score and who shopped from the current market distribution of products made selections with the highest FSA scores. Participants who saw Nutri-Scores and who shopped from the healthier+ distribution of products made selections with the lowest FSA scores.

We ran a multi-level linear regression with random effects for individual participants and fixed effects for the type of category (Supplementary material, Table S3, Model 1). In support of our hypotheses, participants who saw Nutri-Score chose products with lower FSA scores than participants who did not see Nutri-Score, as did participants who saw any of the three healthier distributions than the current market (Table 6, Model 1). Similar to in the real shopping task, attention paid to nutritional information while shopping mediated the relationship between Nutri-Score and healthier FSA scores, but not between the distribution and healthier FSA scores. (Table 6, Model 2).

We did not find any difference in the size of the products chosen by condition (Table 6, Model 3).

**Figure 8. FSA scores of the item chosen for each of the four distribution manipulations and whether Nutri-Score was shown or not.**




Note. No NS = No Nutri-Score shown, NS = Nutri-Score shown. The distribution manipulations were: Current Distrib. (distribution of Nutri-Scores that exists in the current market), Healthier Distrib. (increased relative availability of healthier products), Healthier+ Distrib (greater increased relative availability of healthier products), Additional Products (additional of healthier products to existing market). Error bars represent standard error of the mean. We have scaled the Y-axis to be approximately 1 SD (8.15) in line with the recommendation from Witt (2019).[18]

**Is there a difference between absolute and relative manipulations?**

We also tested for differences between the two types of distributional manipulations – relative increase in availability and relative and absolute increase in availability – by testing the difference in coefficients. Both manipulations had a significant effect on FSA score but the effect of shopping in an environment where the relative distribution of healthier products had been manipulated (healthier distribution) was greater than shopping in an environment where healthier products had been added to the current distribution, $\chi^2$ (1)=67.63, $p < .001$.

**Table 6. Linear regression analyses with the FSA score of items chosen or the grams of the item chosen as the dependent variable and condition as the independent variable.**

| | **Model 1 B (SE)** | **Model 2 B (SE)** | **Model 3 B (SE)** |
|---|---|---|---|
| | **DV: FSA Score** | **DV: FSA Score** | **DV: Grams** |
| *Fixed Effects* | | | |
| Nutri-Score (ref. Control) | **-0.56 (0.19)**** | **-0.23 (0.18)** | **-2.11 (2.05)** |
| Distribution (ref. normal distribution) | | | |
| Healthier distribution | **-2.36 (0.21)***** | **-2.35 (0.21)***** | |
| Healthier+ distribution | **-3.58 (0.21)***** | **-3.57 (0.21)***** | |
| Additional products | **-0.66 (0.21)***** | **-0.65 (0.21)**** | |
| Normally pay attention to health | | -0.36 (0.06)*** | |
| Paid attention to nutritional information during shop | | -0.29 (0.05)*** | |
| Ability to guess Nutri-Scores | | **-0.10 (0.04)*** | |
| *Random Effects* | | | |
| Individual | 2.98 (0.37) | 1.69 (0.31) | 69.82 (44.16) |
| N (obs), N (groups) | 6342 (797) | 6318 (794) | 6342 (797) |

**Note:** Mode 1-3 included fixed effects for category of food. Model 2 controlled for Age Gender Degree Employment, Child under 18, Social Grade (ABC1, C2DE, F). Full models can be found in supplementary materials, Table S3. ǂ $p = 0.07$, * $p < .05$, ** $p < .01$, *** $p < .001$, one-tailed in **bold**.

## 4. Discussion

In this study, consumers purchased healthier (lower FSA score) snack foods when Nutri-Score labels were applied to products and also when there was a higher proportion of healthier foods to choose from. While these findings are consistent with prior research on both Nutri-Score and the availability of healthier choices, this is the first study to our knowledge to examine the combined effects of labelling and product availability, by simulating potential provider responses to the introduction of afront-of-package labelling policy within the experimental design.[8,9,14-16,19] Our results are consistent with an additive relationship between the effect of Nutri-Score and the effect of a more healthy distribution of products in a range on consumers' choices.

In this section, we discuss three important aspects of our results and policy implications that stem from them: 1) effect sizes are small but may be meaningful at a population level; 2) consumers are willing to purchase healthier alternatives when the option is made available to them, but reformulating existing products may be more powerful than adding new healthier products; 3) nutritional labelling continues to have an influence on decisions, even when the market changes.

4.1 Effects of Nutri-Score

Previous lab and field trials have shown that consumers tend to purchase foods with lower FSA scores when Nutri-Score labels are applied to products.[8,9,19] The sizes of these effects vary between studies, with two lab trials finding a difference of -1 and -2.5 FSA points respectively, and a field trial finding a difference of -0.1 FSA points.[8,9,19] Our difference was approximately -1 FSA points when comparing the purchases of those who saw Nutri-Score to those who did not, and -2 FSA points when comparing those who saw Nutri-Score while shopping from a healthier market compared to those who did not while shopping in the current market. Our effect-sizes thus broadly concur with previous lab studies. Importantly, we studied purchasing decisions only of snack foods, while most other studies have investigated purchases across a whole range of grocery products. Although nutritionists recommend only irregular consumption of the types of snack foods in our range, most of our participants reported regularly purchasing them. That we find an effect of applying Nutri-Score labels to these categories is important as it may be easier to shift consumers to healthier versions of snack products than to shift them away from consuming them entirely. Although the absolute differences in FSA scores are small, there is some evidence that small changes in FSA scores can have substantial impacts on health. For instance, one study found a 1-point increase in FSA score across the whole diet was associated with a 16% higher risk of obesity in men.[20] Note also that the differences we observed resulted from a one-time purchase. If these choices replicated over time, the cumulative effect of Nutri-Score on repeated purchases might become large. Research on longer-term impacts is needed.

### 4.2 Effects of Availability of Healthier Products

Lab and field trials have also shown that when consumers shop in markets offering a relatively higher proportion of healthier products, they tend to make healthier purchases.[13-16] Consistent with these findings, we observed a 1 point difference in the average FSA score of purchases when participants shopped in a healthier market than the current one. Crucially, we manipulated the relative availability of healthier options without removing the opportunity to make unhealthier choices. In the shop that was representative of the current Irish market, 68% of products had the lowest nutritional ratings of 'D' or 'E' compared to 49% in the healthier market and 36% in the healthier+ market. A distinction can be drawn between a relative increase in healthier options and a relative and absolute increase in healthier options.[16] In the first, the number of options remains the same but some unhealthier items are exchanged for healthier ones. In the second, healthier options are added to an existing range. The first is analogous to food providers reformulating existing products so that the unhealthier options become healthier. The second is analogous to food providers adding healthier products to an existing range. We tested both manipulations and consumers made healthier choices in both cases, compared to when they shopped in the current market. This suggests that consumers are willing to purchase healthier alternatives when that option is made available to them. However, the relative increase in healthier options led to healthier purchases than merely adding healthier products to an existing range, which may suggest that reformulation of existing products could have a stronger impact on choices than adding new products to an existing market.

### 4.3 Combined Effects of Nutri-Score and Availability of Healthy Foods

This is the first study to our knowledge to test whether the effect of Nutri-Score may differ if a provider response were to change the availability of products in the market. Our study is consistent with an additive effect on consumer choices of Nutri-Score and of increased availability of healthier products. The two effects likely act through separate pathways. For instance, Nutri-Score may attract more attention to nutritional information, increasing the weight it receives in the decision process, while availability may influence the relative internal psychological scaling of product

attributes (including healthiness). If so, it is important to ensure that the Nutri-Score label is salient enough to capture attention. Displaying information about Nutri-Score in additional places as well as on the front of packaging (e.g., on information leaflets, store displays, etc.) could also increase attention drawn to the label and thereby further increase its potential effect.[21]

4.4 Strengths and Limitations

The strengths of this study are, firstly, that it incentivised real decision-making by telling participants in advance that they may receive the products they chose. This should have limited potential effects of experimenter demand. Secondly, by using a database of nutritional information for all products in each of eight categories from one of Ireland's largest supermarket chains, we can be confident that our control condition was representative of products currently available to Irish consumers. Moreover, when creating our version of a healthier market, we determined what was realistic by checking the distributions of Nutri-Scores in one of the largest supermarket chains in France. Hence, the healthier marketplace we created represented a realistic scenario for the provider response to a policy introducing Nutri-Score. Third and related, the products that we chose all existed in the contemporaneous Irish market. They were available in the largest supermarket chains in the country and, therefore, were familiar to the participants.

There are of course limitations to this study. Firstly, participants were aware that their shopping was part of a study, which may have influenced choices. A small percentage (7.5%) indicated correctly that a study aim was to examine the effect of nutritional labelling on decisions. However, our results are unaffected by excluding these participants. Secondly, the study was conducted online. While the online study context may be representative of the context when people shop online (e.g., similar likelihood of interruption and desire to complete the task and do something else, etc.), it may result in different effect sizes compared to when similar interventions are carried out in field settings, such as supermarkets, where other influential contextual factors are present (e.g. a larger number of visible products, the presence of other shoppers, etc.). While we recorded relative differences between conditions, effect sizes may not be predictive of population level impacts. Nevertheless, small changes to diet can make big differences across a population and over a lifespan. Thirdly, we offered only dry pre-packaged snack foods. This was in part because we were interested in the effects of Nutri-Score on snack foods and for practical reasons of sending products to participants. Our effects do not necessarily translate to other food products. This is particularly important considering the effectiveness of nutritional labels can vary depending on food category.[22] Finally, a one-off exposure to Nutri-Score may not translate straightforwardly to repeated exposure as people become used to paying attention to it, or perhaps stop paying attention.

Throughout this paper we have described products with lower FSA scores as being 'healthier', but we are aware that assessing the healthfulness of diet and of different products is complicated by factors such as portion sizes and frequency of consumption. Our aim was not to test whether Nutri-Score is nutritionally the most appropriate label, but to illustrate its potential impact on behaviour.

4.4 Conclusion

In conclusion, Nutri-Score labelling is likely to influence consumers to choose snack products with lower FSA scores by increasing the attention they pay to nutritional information. Increasing the availability of snack products with lower FSA scores additionally leads consumers to choose snack products with lower FSA scores. This suggests that if a policy aim is to encourage consumers to choose snack products with lower FSA scores, then policies to target both labelling and changes to the current market would likely be effective in parallel.

**References**


1. Roberto CA, Ng SW, Ganderats-Fuentes M, Hammond D, Barquera S, Jauregui A, et al. The Influence of Front-of-Package Nutrition Labeling on Consumer Behavior and Product Reformulation. Annu Rev Nutr. 2021;41:529-50.
2. Dréano-Trécant L, Egnell M, Hercberg S, Galan P, Soudon J, Fialon M, et al. Performance of the Front-of-Pack Nutrition Label Nutri-Score to Discriminate the Nutritional Quality of Foods Products: A Comparative Study across 8 European Countries. Nutrients. 2020;12(5):1303.
3. Szabo de Edelenyi F, Egnell M, Galan P, Druesne-Pecollo N, Hercberg S, Julia C. Ability of the Nutri-Score front-of-pack nutrition label to discriminate the nutritional quality of foods in the German food market and consistency with nutritional recommendations. Archives of Public Health. 2019;77(1):28.
4. Hafner E, Pravst I. Evaluation of the Ability of Nutri-Score to Discriminate the Nutritional Quality of Prepacked Foods Using a Sale-Weighting Approach. Foods. 2021;10(8).
5. Ducrot P, Julia C, Méjean C, Kesse-Guyot E, Touvier M, Fezeu LK, et al. Impact of Different Front-of-Pack Nutrition Labels on Consumer Purchasing Intentions: A Randomized Controlled Trial. Am J Prev Med. 2016;50(5):627-36.
6. Julia C, Hercberg S. Nutri-Score: Evidence of the effectiveness of the French front-of-pack nutrition label. Ernahrungs Umschau. 2017;64(12):181-7.
7. Egnell M, Talati Z, Hercberg S, Pettigrew S, Julia C. Objective Understanding of Front-of-Package Nutrition Labels: An International Comparative Experimental Study across 12 Countries. Nutrients. 2018;10(10):1542.
8. Crosetto P, Lacroix A, Muller L, Ruffieux B. Nutritional and economic impact of five alternative front-of-pack nutritional labels: experimental evidence. Europ Rev Agr Econ. 2019;47(2):785-818.
9. Dubois P, Albuquerque P, Allais O, Bonnet C, Bertail P, Combris P, et al. Effects of front-of-pack labels on the nutritional quality of supermarket food purchases: evidence from a large-scale randomized controlled trial. Journal of the Academy of Marketing Science. 2021;49(1):119-38.
10. Mhurchu CN, Eyles H, Choi YH. Effects of a Voluntary Front-of-Pack Nutrition Labelling System on Packaged Food Reformulation: The Health Star Rating System in New Zealand. Nutrients. 2017;9(8).
11. Dickson A, Gehrsitz M, Kemp J. Does a Spoonful of Sugar Levy Help the Calories Go Down? An Analysis of the UK Soft Drinks Industry Levy. Institute of Labor Economics; 2021.
12. Halpern D. Inside the nudge unit: How small changes can make a big difference: Random House; 2015.
13. Grech A, Allman-Farinelli M. A systematic literature review of nutrition interventions in vending machines that encourage consumers to make healthier choices. Obes Rev. 2015;16(12):1030-41.
14. Pechey R, Marteau TM. Availability of healthier vs. less healthy food and food choice: an online experiment. BMC Public Health. 2018;18(1):1296.
15. Pechey R, Cartwright E, Pilling M, Hollands GJ, Vasiljevic M, Jebb SA, et al. Impact of increasing the proportion of healthier foods available on energy purchased in worksite cafeterias: A stepped wedge randomized controlled pilot trial. Appetite. 2019;133:286-96.
16. Pechey R, Hollands GJ, Carter P, Marteau TM. Altering the availability of products within physical micro-environments: a conceptual framework. BMC Public Health. 2020;20(1):986.
17. Anwyl-Irvine AL, Massonnié J, Flitton A, Kirkham N, Evershed JK. Gorilla in our midst: An online behavioral experiment builder. Behav Res Methods. 2020;52(1):388-407.
18. Witt JK. Graph construction: an empirical investigation on setting the range of the y-axis. Meta-psychology. 2019;3.
19. Julia C, Blanchet O, Méjean C, Péneau S, Ducrot P, Allès B, et al. Impact of the front-of-pack 5-colour nutrition label (5-CNL) on the nutritional quality of purchases: an experimental study. Int J Behav Nutr. 2016;13(1):101.

20. Julia C, Ducrot P, Lassale C, Fézeu L, Méjean C, Péneau S, et al. Prospective associations between a dietary index based on the British Food Standard Agency nutrient profiling system and 13-year weight gain in the SU.VI.MAX cohort. Preventive Medicine. 2015;81:189-94.

21. European Commission. Joint Research Centre. (2020). Front-of-pack nutrition labelling schemes: A comprehensive review. Publications Office. https://data.europa.eu/doi/10.2760/436998

22. Ikonen, I., Sotgiu, F., Aydinli, A., & Verlegh, P. W. J. (2020). Consumer effects of front-of-package nutrition labeling: An interdisciplinary meta-analysis. Journal of the Academy of Marketing Science, 48(3), 360–383. https://doi.org/10.1007/s11747-019-00663-9

23. Marty, L., Jones, A., & Robinson, E. (2020). Socioeconomic position and the impact of increasing availability of lower energy meals vs. menu energy labelling on food choice: Two randomized controlled trials in a virtual fast-food restaurant. International Journal of Behavioral Nutrition and Physical Activity, 17(1), 10. https://doi.org/10.1186/s12966-020-0922-2

**Supplementary Material**

**Table S1. Linear regression analyses with the mean FSA scores of baskets as the dependent variable and condition as the independent variables.**

| | Model 1<br>B(SE) | Model 2<br>B (SE) | Model 3<br>B (SE) | Model 4<br>B (SE) | Model 5<br>B (SE) |
|---|---|---|---|---|---|
| Nutri-Score (ref. No Nutri-Score) | **-0.87 (0.37)*** | | **-0.96 (0.52)‡** | **-0.76 (0.35)*** | **-0.44 (0.36)** |
| Healthier Distribution (ref. Current Distribution) | **-1.26 (0.37)**** | | **-1.35 (0.52)*** | **-1.23 (0.36)**** | **-1.27 (0.35)***** |
| Nutri-Score*Healthier Distribution | | | 0.18 (0.74) | | |
| Distribution + NS (ref. No NS + Current Distribution) | | | | | |
| NS + Current Distribution | | **-0.96 (0.52)‡** | | | |
| No NS + Healthier Distribution | | **-1.35 (0.52)**** | | | |
| NS + Healthier Distribution | | **-2.13 (0.50)***** | | | |
| Age | | | | -0.01 (0.01) | -0.02 (0.01) |
| Male | | | | 0.25 (0.37) | 0.22 (0.36) |
| Degree+ | | | | -0.20 (0.40) | -0.08 (0.40) |
| Employed | | | | -0.42 (0.42) | -0.36 (0.42) |
| Child under 18 | | | | 0.25 (0.42) | 0.26 (0.42) |
| Social Grade (ref. ABC1) | | | | | |
| C2DE | | | | 0.54 (0.29) | 0.53 (0.39) |
| F | | | | 1.91 (1.20) | 1.99 (1.18) |
| Normally pay attention to health | | | | -0.74 (0.11)*** | -0.53 (0.39)*** |
| Paid attention to nutritional information during shop | | | | | -0.41 (0.11)*** |
| Ability to guess Nutri-Scores | | | | | **-0.23 (0.08)**** |
| N | 800 | 800 | 800 | 797 | 797 |
| $R^2$ | 0.02 | 0.02 | 0.02 | 0.10 | 0.12 |

‡ $p = 0.07$, *$p < .05$, **$p < .01$, ***$p < .001$, one-tailed in **bold**.

**Table S2. Ordinal logistic regression analyses with the number of products purchased as the dependent variable and condition as the independent variables.**

| | Model 1<br>B(SE) | Model 2<br>B (SE) | Model 3<br>B (SE) | Model 4<br>B (SE) | Model 5<br>B (SE) |
|---|---|---|---|---|---|
| Nutri-Score (ref. No Nutri-Score) | **-0.19 (0.13)** | **-0.35 (0.18)*** | | **-0.18 (0.13)** | **-0.19 (0.13)** |
| Healthier distribution (ref. current distribution) | -0.15 (0.13) | -0.32 (0.18)‡ | | -0.16 (0.13) | -0.16 (0.13) |
| Nutri-Score*Healthier Distribution | | 0.33 (0.25) | | | |
| NS + Current Distribution (ref. No NS + Current Distribution) | | | -0.36 (0.18)* | | |
| No NS + Healthier Distribution | | | -0.32 (0.18)‡ | | |
| NS + Healthier Distribution | | | -0.34 (0.18)* | | |
| Age | | | | -0.01 (0.005) | -0.01 (0.004) |
| Male | | | | -0.06 (0.13) | -0.06 (0.13) |
| Degree+ | | | | -0.17 (0.14) | -0.18 (0.14) |
| Employed | | | | -0.04 (0.15) | -0.05 (0.15) |
| Child under 18 | | | | 0.26 (0.15) | 0.26 (0.15) |
| Social Grade (ref. ABC1)<br>C2DE | | | | 0.03 (0.14) | 0.03 (0.14) |
| F | | | | -0.16 (0.44) | -0.17 (0.44) |
| Normally pay attention to health | | | | -0.13 (0.04)** | -0.13 (0.04)** |
| Paid attention to nutritional information during shop | | | | | 0.01 (0.04) |
| Ability to guess Nutri-Scores | | | | | **0.004 (0.03)** |
| N | 800 | 800 | 800 | 797 | 797 |

‡ $p = 0.07$, *$p < .05$, ** $p < .01$, *** $p < .001$, one-tailed in **bold**.

**Table S3. Linear regression analyses with the FSA scores of items chosen or the grams of the item chosen as the dependent variable and condition as the independent variable.**

| | Model 1<br>B (SE) | Model 2<br>B (SE) | Model 3<br>B (SE) |
|---|---|---|---|
| | **DV: FSA Score** | **DV: FSA Score** | **DV: Grams** |
| **Fixed Effects** | | | |
| Nutri-Score (ref. Control) | **-0.56 (0.19)**** | **-0.23 (0.18)** | **-2.11 (2.05)** |
| Distribution (ref. normal distribution) | | | |
| Healthier distribution | **-2.36 (0.21)***** | **-2.35 (0.21)***** | |
| Healthier+ distribution | **-3.58 (0.21)***** | **-3.57 (0.21)***** | |
| Additional products | **-0.66 (0.21)***** | **-0.65 (0.21)**** | |
| Category (ref. chocolate) | | | |
| Sweets | -9.35 (0.29)*** | -9.34 (0.29)*** | 13.89 (3.92)*** |
| Bars | -12.59 (0.29)*** | -12.58 (0.29)*** | 14.52 (3.92)*** |
| Popcorn | -12.63 (0.29)*** | -12.63 (0.29)*** | 62.91 (3.92)*** |
| Nuts | -16.80 (0.29)*** | -16.79 (0.29)*** | 77.61 (3.92)*** |
| Crackers | -15.57 (0.29)*** | -15.56 (0.29)*** | 44.37 (3.92)*** |
| Crisps | -13.17 (0.29)*** | -13.15 (0.29)*** | 10.36 (3.91)** |
| Biscuits | -5.48 (0.29)*** | -5.48 (0.29)*** | 60.63 (3.92)*** |
| Age | | -0.03 (0.01)*** | |
| Male | | -0.16 (0.18) | |
| Degree+ | | -0.28 (0.20) | |
| Employed | | 0.09 (0.20) | |
| Child under 18 | | -0.06 (0.21) | |
| Social Grade (ref. ABC1)<br>C2DE | | 0.27 (0.19) | |
| F | | 0.07 (0.58) | |
| Normally pay attention to health | | -0.36 (0.06)*** | |
| Paid attention to nutritional information during shop | | -0.29 (0.05)*** | |
| Ability to guess Nutri-Scores | | -0.10 (0.04)* | |
| *Random Effects*<br>Individual | 2.98 (0.37) | 1.69 (0.31) | 69.82 (44.16) |
| N (obs), N (groups) | 6342 (797) | 6318 (794) | 6342 (797) |

‡ $p = 0.07$, *$p < .05$, ** $p < .01$, *** $p < .001$, one-tailed where in bold.

**Table S4. linear regression analyses with grams of products purchased as the dependent variable and presence of nutriscore as the independent variables.**

| | Model 1 B(SE) | Model 2 B (SE) | Model 3 B (SE) | Model 4 B (SE) | Model 5 B (SE) |
|---|---|---|---|---|---|
| Nutri-Score (ref. No Nutri-Score) | -13.37 (23.37) | -14.84 (35.13) | -22.08 (27.27) | -66.65(63.27) | -83.34 (73.42) |
| Male | | -14.29 (33.16) | | | -14.40(33.53) |
| Nutri-Score*Male | | 2.36 (47.16) | | | 11.50(47.68) |
| Child under 18 | | | 43.11(37.32) | | 50.30 (38.43) |
| Nutri-Score*Child under 18 | | | 24.99(52.49) | | 36.19 (53.02) |
| Normally pay attention to health | | | | -7.76(9.62) | -7.94 (9.72) |
| Nutri-Score*Normally pay attention to health | | | | 12.16 (13.67) | 12.64 (13.80) |
| Age | | | | | 0.21 (0.89) |
| Degree+ | | | | | 12.11 (0.89) |
| Employed | | | | | -43.92 (27.57) |
| Social Grade (ref. ABC1) C2DE | | | | | -18.95 (26.00) |
| F | | | | | -68.58 (78.32) |
| N | 800 | 797 | 800 | 800 | 797 |

‡ $p = 0.07$, *$p < .05$, ** $p < .01$, *** $p < .001$.