



The American Journal of Clinical Nutrition
Official publication of the American Society for Nutrition

The American Journal of Clinical Nutrition
AJCN/2017/171256
Version 4

The effects of health claims on choice of foods in the presence of
front-of-pack labels

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Trial registered: [Australian New Zealand Clinical Trials Registry \(ANZCTR\)](http://www.anzctr.org.au) Reg No.
ACTRN12617000015347

Information for Authors: <http://www.ajcn.org/site/misc/ifa.xhtml>

A randomized trial assessing the effects of health claims on choice of foods in the presence of front-of-pack labels

RUNNING TITLE: Health claims, FoPLs and food choice

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Sources of support:

This work was supported by an ARC Linkage grant (LP130100428), with contributions from the South Australian Health and Medical Research Institute, the National Heart Foundation, Cancer Council NSW and Cancer Council Victoria. KB was supported by an NHMRC Principal Research Fellowship (ID 1042442).

Abbreviations:

FoPL: Front-of-pack label

NFP: Nutrition Facts Panel

DIG: Daily Intake Guide

HSR: Health Star Rating

MTL: Multiple Traffic Light

NFP: Nutrition Facts Panel

SEIFA: Socio-Economic Indexes for Areas

CI: Confidence Intervals

Clinical Trial Registry number: ACTRN12617000015347

24 **Conclusions:** FoPLs are most effective in helping consumers make better food choices when
25 nutrient and health claims are not present. Policies are required to control how nutrient and
26 health claims are applied to less healthy foods.

27

28 **Keywords:** front-of-pack label, daily intake, traffic light, health star rating, nutrient and health
29 claims.

30 **Introduction**

31 Front-of-pack labels (FoPLs) summarising a product's overall nutritional profile,
32 which have increasingly appeared on packaged foods around the world over the last decade,
33 are considered an important obesity prevention tool (1,2). Research shows that FoPLs are
34 easier to understand, facilitate faster and more accurate processing, and help consumers better
35 differentiate between healthier and less healthy products compared to the Nutrition Facts
36 Panel (NFP) that appears on the back or side of food packs in many countries (3–9).

37 Many different FoPL formats exist, ranging from reductive/nondirective to
38 interpretive/directive variations (10,11). Reductive FoPLs (e.g., the Daily Intake Guide
39 (DIG)) provide little interpretation of nutrient information, while more interpretive FoPLs
40 (e.g., the Multiple Traffic Lights (MTL) and Health Star Rating (HSR)) provide visual cues to
41 help consumers form a judgment about the food (e.g., colors to signify the level of nutrients
42 within a food or a rating scale assessing the overall healthfulness of the food) (10,11).
43 Research suggests that consumers prefer and are generally better at gauging product
44 healthfulness with interpretive FoPLs than reductive FoPLs (12–14). However, there is some
45 evidence to suggest that FoPLs (particularly reductive FoPLs) may create a positivity bias
46 whereby consumers are more favorable towards a food when a FoPL is present compared to
47 absent, regardless of food healthfulness (4,5,10,15,16).

48 Nutrient/health claims are additional sources of nutrition information that also often
49 appear, written as text, on the front of food packs. Nutrient claims refer to the level of a
50 nutrient within a product while health claims describe how this nutrient relates to physical
51 outcomes (general level health claims) or is linked to a serious disease (higher level health
52 claims). These claims provide less balanced nutrition information than FoPLs as they often
53 highlight the presence or absence of isolated nutrients and/or any associated health benefits
54 (17). Given their marketing function, claims are especially capable of creating a positivity bias

55 (16,18). This appears to apply more to higher level (5,19–21) and general level health claims
56 (16,20–24) than nutrient claims (25–28). The existence of a positivity bias is particularly
57 concerning when it occurs among less healthy foods due to the potential for these foods to be
58 purchased and consumed more as a result (29).

59 Even though nutrient/health claims and FoPLs frequently occur together on-pack, few
60 studies have examined consumers' responses to foods containing both (18). The aim of the
61 present study was to better understand how consumers' food choices are affected when both
62 claims and FoPLs appear on-pack. The tested FoPLs included a reductive FoPL (DIG) and an
63 interpretive FoPL (HSR) that currently appear on pre-packaged foods in Australia (the context
64 of the present study). The MTL; a nutrient-based interpretive FoPL that has been
65 implemented elsewhere and widely studied, was also included to allow for comparisons with
66 international research. The tested claims included three types currently widely used in
67 Australia: nutrient claims, general level health claims, and higher level health claims.

68

69

Subjects and Methods

70 Participants

71 Adults and children ($n = 2069$) completed the study online from their personal computer in a
72 location of their choice. Children were included in this study because they increasingly exert
73 power over the foods they consume, either through direct purchases or by influencing their
74 parents' purchasing decisions (30,31). Ethics approval for this study was granted by the
75 Curtin University Human Research Ethics Committee. Consent was obtained from the adults,
76 children, and the children's parents prior to participation in the survey. Respondents were
77 recruited through a large web panel provider (PureProfile) and quotas were used to ensure
78 adequate representation by gender and age. Respondents residing in areas of low socio-
79 economic position (Socio-Economic Indexes for Areas (SEIFA) deciles 1 – 4) (32) were

80 deliberately oversampled to reflect their higher risk of diet-related diseases (33). **Table 1**
81 provides a breakdown of the sample characteristics. Sample size was predetermined to
82 comply with the recommended minimum of at least 20 respondents per choice set (34), and
83 this minimum was exceeded with 51 respondents on average per choice set. Respondents
84 were also screened to ensure they at least occasionally purchased or consumed two or more of
85 the products used in the choice sets: cookies, cornflakes, pizzas, and yoghurts. Choice sets
86 that included products that the respondent reported 'never' consuming were excluded from
87 analyses.

88

89

TABLE 1 ABOUT HERE

90

91 **Design and stimuli**

92 The present study was part of a larger project (35,36) examining consumers' choice of mock
93 food products across a range of attributes that were developed into choice sets using NGene,
94 maximising D-efficiency. Price (which varied across foods within a choice set) and food type
95 (which varied between choice sets) were manipulated in the larger study, with results reported
96 elsewhere (36), and thus were not analysed in the present study. The NGene design used to
97 create the choice sets meant that the variables manipulated in the larger project did not
98 interact with other variables since levels within each variable (e.g., the levels of healthiness:
99 unhealthy, moderately healthy, healthier) co-occurred in roughly equal frequency with the
100 levels of the other variables. Thus, price or food type could not systematically bias the results.
101 **Figure 1** shows the attributes relevant to the current study.

102

103 The mock packs (which were created by a graphic designer) and the prices used were
104 developed to mimic real products found in Australian supermarkets and have been used in

105 previous studies (4,37). These packs featured fake products and brand names to avoid any
106 influence of familiarity or loyalty. For 3 out of the 12 products it was necessary to slightly
107 change some nutrient values to ensure the overall nutrient profiles differed substantially. The
108 foods chosen (i.e., cookies, cornflakes, pizza, yoghurt) represent frequently purchased foods
109 for which nutrition information is often consulted by consumers (38,39). These foods were
110 also considered to be desirable to both children and adults. The healthier, moderately healthy,
111 and less healthy nutrition profiles for each food type were also adapted from real products.
112 Within each food type, nutrition profiles varied from less to more healthful based on Nutrient
113 Profiling Scoring Criterion (NPSC) scores (40).

114

115 The three levels of claims (i.e., nutrient claims, general level health claims, and higher level
116 health claims) were applied to each food category. As shown in Figure 1, within each food
117 type the claims described a common nutrient and, in the case of general and higher level
118 health claims, the associated bodily function or disease relationship relevant to that food (e.g.,
119 calcium being good for bones in the case of yoghurt). To address the aims of this study, all
120 levels of claims appeared on mock products across all levels of healthfulness, although in
121 reality some of the claims would not be permitted on these products, depending on national
122 food labelling regulations.

123

124

FIGURE 1 ABOUT HERE

125

126 **Procedure**

127 The survey comprised one practice choice task using a non-related food product (muesli bars)
128 and eight experimental choice tasks. Respondents were randomized to one of the three FoPL
129 conditions and thus only saw one type of FoPL across all eight choice sets. Figure 2 shows the

130 number of people who commenced the study and the number who made it through to the end
131 minus those who were excluded based on screening criteria or dropped out before finishing
132 the survey. Reflecting the current marketplace reality in Australia of a voluntary FoPL
133 system, the allocated FoPL was present on half the packs within each choice set, with the
134 other two packs bearing no FoPL. All other attributes were presented according to the
135 efficient design script created by NGene. Each choice set comprised four mock packs of foods
136 from the same product category and respondents indicated which of the four products they
137 would prefer to purchase (or they could select “none of the above”). Across the eight choice
138 sets, each food type was randomly presented twice, but never consecutively.

139

140

FIGURE 2 ABOUT HERE

141

142 In line with recommendations from the choice task literature, the tasks in the present study
143 were designed to incorporate elements of a real world shopping context (41–43). Respondents
144 could zoom in on the mock packs to see them in more detail and the NFP could be accessed
145 by clicking a link below the mock pack image. Additionally, a 30 second time limit (based on
146 previous studies (44–46) and pilot testing) was imposed for each choice, after which time the
147 survey progressed to the next choice set.

148

149 **Analysis**

150 Only choice sets for which the respondent did not select “none of the above” and indicated
151 that they consumed/purchased that food more often than never were included in analyses.
152 This constituted 11244 out of a possible 16551 choice sets (68%) across 1 953 respondents.
153 The outcome variables (choice probabilities for the interaction between no FoPL, the DIG,
154 MTL and HSR FoPLs and the no claim, nutrient, general and higher level claim conditions)

155 were calculated in STATA and plotted according to level of product healthfulness.
156 Meaningful differences between conditions were inferred when the 95% confidence intervals
157 (CIs) around each coefficient did not overlap (47).

158

159

Results

160 Across all the choice sets presented to respondents, 18% ($n = 3027$) of individual choice sets
161 were not completed due to respondents opting out of making a choice, and 5% ($n = 900$) were
162 not completed due to the time limit being exceeded for making that particular choice.

163 Respondents were significantly less likely to opt out of individual choices in the MTL
164 condition (17%) than the DIG (19%, $z = 4.43$, $p < 0.001$) and HSR conditions (19%, $z = 3.63$,
165 $p < 0.001$). There was no significant difference in the frequency with which respondents
166 timed out across conditions.

167

168 **Figure 3** provides an overview of the results relating to the ‘claims x FoPL x healthfulness’
169 interaction. Non-overlapping error bars indicate a statistically significant difference between
170 points on the graph that represent different forms of nutrition information. Choice frequency
171 was relatively low across all levels of product healthiness for mock packs with no claim and
172 no FoPL. Although 50% of the products within each choice set featured no FoPL, choice
173 frequency for mock packs with no FoPL was low (ranging from 10 – 13% across the different
174 FoPL conditions). This is most likely explained by the fact that the healthiness of no FoPL
175 products could only be interpreted through the NFP (which, in this study, was only viewed on
176 6% of all mock packs) and the view rate was not higher for packs without a FoPL.

177 Furthermore, research suggests that consumers value the provision of useful nutrition
178 information on packs (14), and therefore they are highly likely to exhibit a preference for

179 products that feature more useful nutrition information. Thus, some level of FoPL positivity
180 bias was to be expected.

181

182 The 'HSR, no claim' condition resulted in the choice trajectory that was most closely aligned
183 with objective product healthfulness (i.e., fewer respondents chose the less healthy products
184 and more chose the healthier products). In the case of less healthy products with a FoPL, the
185 presence of claims resulted in a positivity bias where there was a higher probability of choice
186 in the 'claim present' conditions relative to the 'no claim' conditions. The same positivity bias
187 produced by health claims was observed among moderately healthy/healthier products with
188 no FoPL. However, when FoPLs were present on the moderately healthy/healthier products
189 there was no significant difference in choice according to whether a claim was present versus
190 absent. Finally, there were no significant differences between males and females or age
191 groups (10-17, 18-46, 46+ year olds) in their choice of mock packs based on healthiness x
192 FoPL x health claim combinations.

193

194 **FIGURE 3 ABOUT HERE**

195

196 Given that, when a FoPL was present, the presence of a claim consistently increased choice of
197 less healthy foods (for which increased choice is most concerning), this interaction was
198 explored in more detail to determine whether certain claims had a stronger impact on choice.
199 Figure 4 shows the results for each claim type. Across products with a FoPL, choice
200 probability was lowest in the 'no claim' condition and was significantly lower for the HSR
201 than the DIG and MTL, suggesting that the HSR was the most effective at signalling less
202 healthy foods. The positivity bias highlighted in Figure 4 was evident across all three types of
203 claims within each FoPL condition. The combination of a DIG and any claim resulted in the

204 highest choice probability for less healthy foods. General and higher level health claims
205 boosted choice to a greater extent than nutrient claims among packs with the MTL.

206

207 FIGURE 4 ABOUT HERE

208

209

Discussion

210 When FoPLs appeared on-pack without any claims, product choice more closely
211 corresponded with product healthfulness than when FoPLs appeared on products with claims.

212 This was most evident among products bearing the HSR. When any claim was present in
213 combination with a FoPL on less healthy products, a strong positivity bias was observed such

214 that respondents were more likely to choose less healthy products bearing a claim. These

215 results suggest that claims can counteract the potential for FoPLs to alert consumers to less

216 healthy products. This finding is supported by other choice studies showing that consumers

217 are more likely to choose a less healthy product if it contains a claim, regardless of whether a

218 FoPL is present (3,5,48). Among healthier and moderately healthy products, claims did not

219 significantly affect choice over and above FoPLs. This may be explained by the fact that

220 respondents are already more likely to select these products because the FoPLs communicated

221 a positive message about them.

222

223 Choice probability was not consistently higher for any particular type of claim across the

224 entire sample. However, among less healthy products specifically, the combination of certain

225 claims and FoPLs had a greater impact on choice. Choice probability increased when any

226 claim appeared with the DIG, but decreased when general level health claims appeared with

227 the MTL or HSR. These findings suggest that, of all the FoPLs tested, the DIG is least likely

228 to discourage the choice of less healthy foods when claims are present.

229

230 The finding that both nutrient and health claims boosted choice of less healthy products has
231 important policy implications as countries currently regulate these types of claims differently
232 (49,50). In Australia, the overall healthiness of a food is assessed against nutrient profiling
233 criteria before the product can be deemed eligible to carry health claims, but this does not
234 apply to nutrient claims, which only have to meet nutrient specific criteria (51). The results of
235 the present study suggest that the same restrictions should apply to nutrient claims.

236

237 In previous research relying on self-reported food choice behaviors, respondents reported
238 being sceptical of nutrient and health claims and preferring to use FoPLs when they are
239 available (37,52). The results of the present study indicate that even when FoPLs are present
240 on less healthy products, nutrient and health claims can, perhaps subconsciously, increase
241 choice of those products. This was evident from the greatest alignment between product
242 healthfulness and choice occurring when packs included a FoPL with no accompanying
243 claim. The finding that particular FoPLs (i.e., the HSR) were more effective in helping
244 consumers select healthier foods while others increased choice across all food regardless of
245 healthfulness (i.e., the DIG) supports regulations to mandate effective FoPLs rather than
246 leaving the decision to manufacturers.

247

248 It is important to acknowledge the use of an online, simulated food choice task as a potential
249 limitation of the study. However, this approach afforded greater control over the variables of
250 interest and design techniques were used to maximize ecological validity (e.g., including
251 different types of foods, creating time pressure, allowing respondents to opt out of making
252 choices, using realistic mock packs, and providing an NFP). Although respondents were not
253 specifically instructed to select the healthiest product from the choice set, nutrition

254 information was the main source of variance between the mock packs. This could have led to
255 overestimation of the influence of this information on food choice. Future research using real
256 purchase situations would be valuable in assessing the validity of the present findings.

257 Although much past research has suggested that nutrient and health claims positively bias
258 consumers' food choices, these results illustrate the magnitude of their impact when paired
259 with specific FoPLs. Overall, these results serve to highlight the role of FoPLs in facilitating
260 healthier choices and the negative consequences of allowing claims to appear on less healthy
261 products.

262

263 **Acknowledgements:** SP, BK, HD, BN, CM, ZT designed the research; ZT and SP conducted
264 research; RN and ZT analysed the data; ZT and SP took primary responsibility for preparing
265 the paper, and all authors reviewed and approved the final manuscript. The authors declare no
266 conflict of interest.

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Table 1. Sample profile ($n = 2069$)

Males ($n = 1015$)			Females ($n = 1054$)		
Age (years)	Socio Economic Status		Age (years)	Socio Economic Status	
	Low ¹	Medium-High		Low ¹	Medium-High
	($n = 494$)	($n = 521$)		($n = 518$)	($n = 536$)
10-14	69	73	10-14	73	76
15-18	65	68	15-18	69	78
19-25	42	58	19-25	51	53
26-35	64	64	26-35	65	67
36-45	63	64	36-45	65	66
46-55	63	65	46-55	64	65
56-65	64	66	56-65	66	66
65+	64	63	65+	65	65

¹Low Socio Economic Status category comprised those in deciles 1 to 4 of the Australian Bureau of Statistics' Socio-Economic Indexes for Areas (SEIFA) (32)









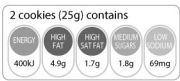



Figure 1. Levels of attributes displayed on mock packs relevant to the current study. Note: NPSC scores decrease from the less healthy to the more healthy product within each food category.

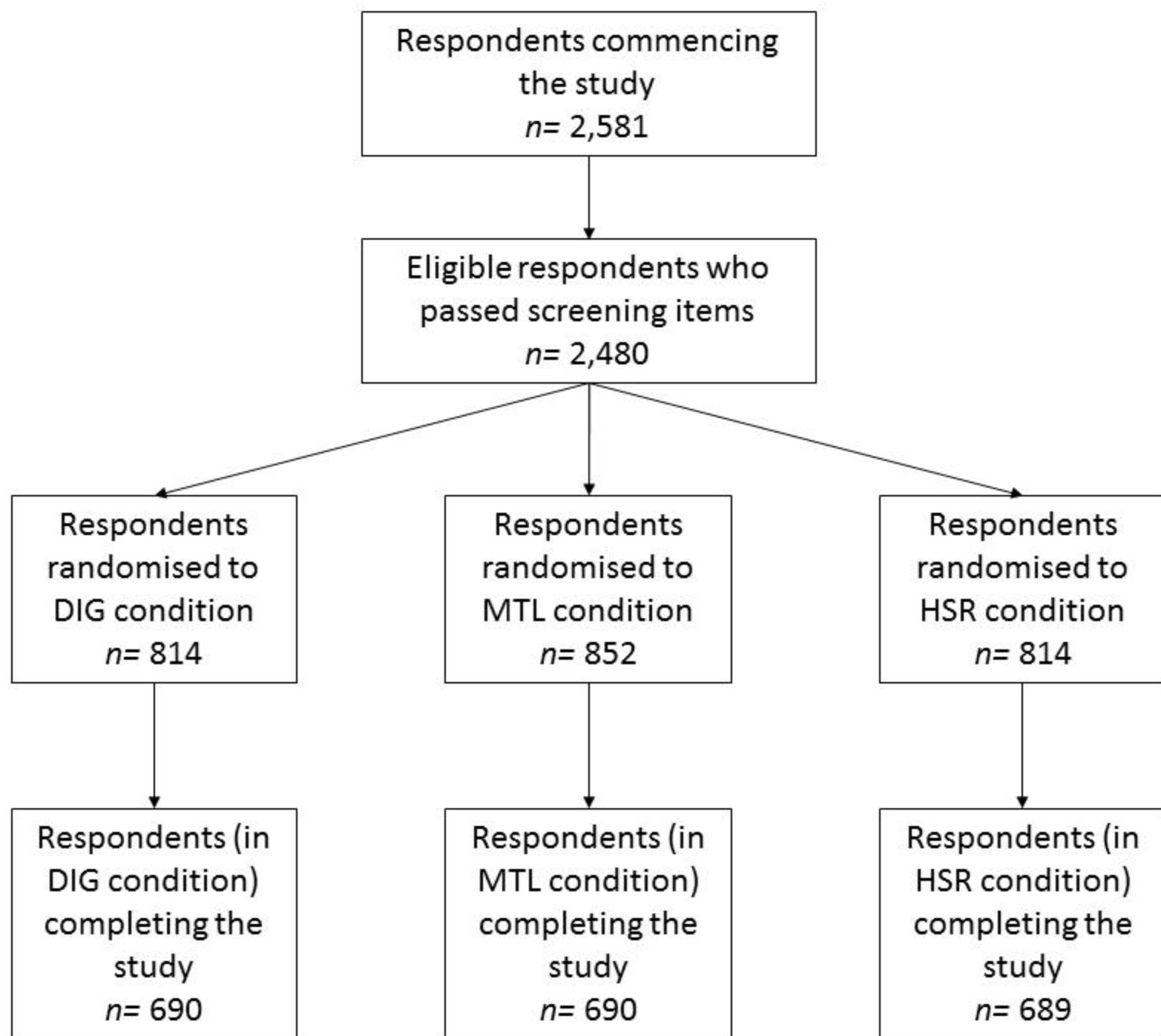
Figure 2. Participant flowchart

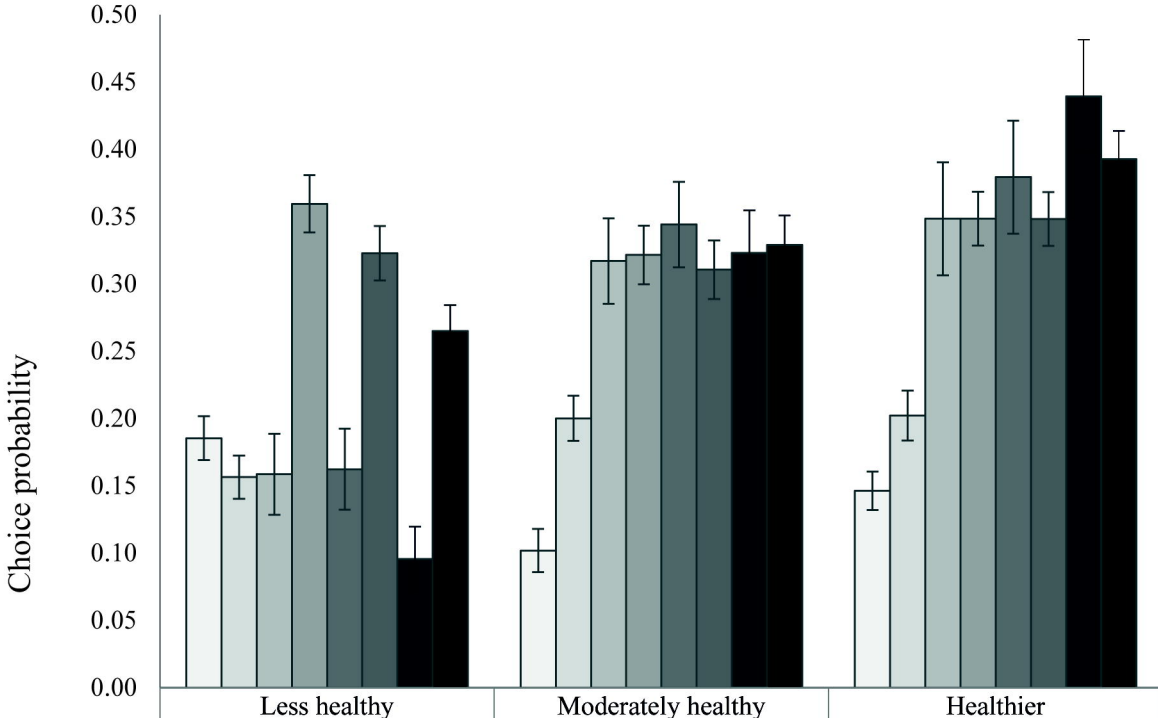
Figure 3. Probability of choice according to product healthfulness, FoPL type (DIG, MTL, HSR), and claims (present/absent), $n = 1953$. Choice probabilities were calculated in STATA.

Figure 4. Choice probability for less healthy products according to FoPL type (DIG, MTL, HSR), and claim condition (no claim, nutrition claim, general level health claim, higher level health claim), $n = 1953$. Choice probabilities were calculated in STATA. ^{a,b,c} Different superscript letters indicate a significant difference between means.

Sample mock pack					

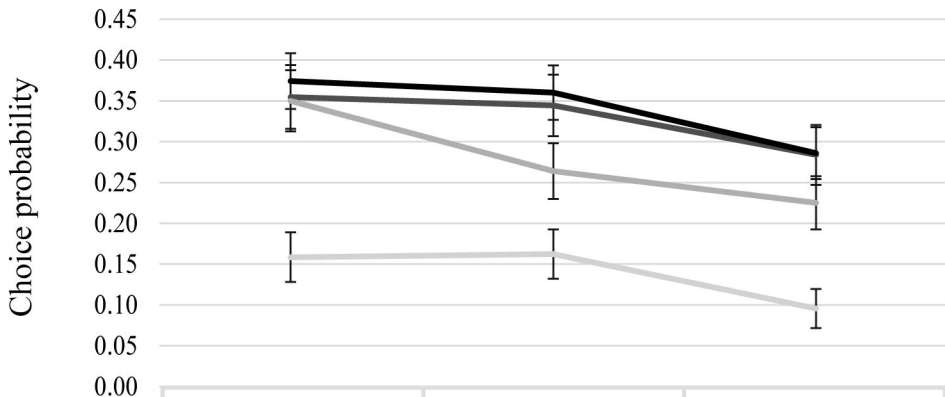
Attribute	Level	Cookies	Corn flakes	Pizza	Yoghurt
Claims	No claim				
	Nutrition claim	Reduced saturated fat	High in fiber	Reduced salt	High in calcium
	General level health claim	Reduced saturated fat to help reduce total blood cholesterol	High in fiber to help improve digestive function	Reduced salt to help maintain healthy blood pressure	High in calcium for strong bones
	Higher level health claim	Reduced saturated fat. A diet low in saturated fat helps reduce the risk of coronary heart disease.	High in fiber. A diet high in fibre helps reduce the risk of bowel cancer.	Reduced salt. A diet low in salt helps reduce the risk of hypertension.	High in calcium. A diet high in calcium helps reduce the risk of osteoporosis.
Healthfulness	Less healthy	   			
	Moderately healthy	   			
	Healthier	   			
FoPL	No FoPL				
	Daily Intake Guide				
	Multiple Traffic Light				
	Health Star Rating				





	Less healthy	Moderately healthy	Healthier
□ No FoPL, no claim	0.19 (0.17, 0.20)	0.10 (0.09, 0.12)	0.15 (0.13, 0.16)
□ No FoPL, all claims	0.16 (0.14, 0.17)	0.20 (0.18, 0.22)	0.20 (0.18, 0.22)
▒ DIG, no claim	0.16 (0.13, 0.19)	0.32 (0.29, 0.35)	0.35 (0.31, 0.39)
▒ DIG, all claims	0.36 (0.34, 0.38)	0.32 (0.3, 0.34)	0.35 (0.33, 0.37)
■ MTL, no claim	0.16 (0.13, 0.19)	0.34 (0.31, 0.38)	0.38 (0.34, 0.42)
■ MTL, all claims	0.32 (0.3, 0.34)	0.31 (0.29, 0.33)	0.35 (0.33, 0.37)
■ HSR, no claim	0.10 (0.07, 0.12)	0.32 (0.29, 0.35)	0.44 (0.4, 0.48)
■ HSR, all claims	0.26 (0.25, 0.28)	0.33 (0.31, 0.35)	0.39 (0.37, 0.41)

Less healthy products



	DIG	MTL	HSR
	Mean (95% CIs)		
■ No claim	0.16 (0.13, 0.19) ^a	0.16 (0.13, 0.19) ^a	0.1 (0.07, 0.12) ^a
■ Nutrition	0.35 (0.32, 0.39) ^b	0.34 (0.31, 0.38) ^b	0.28 (0.25, 0.32) ^b
■ General level	0.35 (0.31, 0.39) ^b	0.26 (0.23, 0.3) ^c	0.23 (0.19, 0.26) ^b
■ Higher level	0.37 (0.34, 0.41) ^b	0.36 (0.33, 0.39) ^c	0.29 (0.25, 0.32) ^b