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8 **The influence of label information on the snacks parents choose for their children:**

9 **Individual differences in a choice based conjoint test.**

10

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27 **Abstract**

28           Labels have been reported to influence children's perception and choice of foods.  
29       However, the influence of label information on parents' food choices for their children has  
30       not received as much attention in the literature yet. In this context, the objectives of the  
31       present study were: i) to evaluate the impact of label information on parents' healthiness  
32       perception and choice of two popular snack products, and ii) to explore individual differences  
33       in how label design influences parents' healthiness perception and their choice of snack  
34       products for their children. A total of 1213 Uruguayan mothers participated in an online  
35       survey. A choice-based conjoint test was performed to study the influence of cartoon  
36       characters, nutritional claims and nutrient content information on the choice and healthiness  
37       perception of chocolate milk and sponge cake labels. Half of the parents were asked to  
38       indicate which of the products they would choose as a snack for their children and the other  
39       half were asked which of the products was healthier. Data was analyzed by means of a  
40       Mixed Logit Model followed by multivariate approaches to explore individual differences  
41       (Hierarchical Cluster Analysis and Principal Component Analysis). Results showed that,  
42       regardless of the product, nutrient claim had the strongest effect, increasing healthiness  
43       perception and encouraging mothers' choice. For both choice and healthiness perception,  
44       two groups of mothers who differed in the relative importance attached to cartoon characters  
45       and nutrient content were identified, highlighting the need to investigate individual  
46       differences. Results stress the need to regulate the use of nutritional claims, cartoon  
47       characters, and other persuasive elements in products of poor nutritional quality targeted at  
48       children.

49

50 **Keywords:** Choice experiments; label design; food policy; snacking.

51

## 52 **1. Introduction**

53           The increased availability and affordability of products with high energy density and  
54 excessive content of sugar, fat and sodium has been identified as one of the main  
55 contributors to unhealthy diets and the global childhood obesity pandemic (Lakshman, Elks,  
56 & Ong, 2012; Popkin, 2017; Swinburn et al., 2019). These products are frequently marketed  
57 as adequate for children using several persuasive and misleading marketing strategies  
58 (Giménez et al., 2017; Lapierre et al., 2017; Lavriša & Pravst, 2019; Mehta et al., 2012).

59           Product packaging is one of the most relevant components of the marketing mix, as  
60 well as an important source of information for consumers at the point of purchase (Gil-Pérez,  
61 Rebollar, & Lidón, 2020; Simmonds & Spence, 2017). Previous research has shown that the  
62 packages of products targeted at children include a wide range of cues to attract children  
63 and convey the idea that they are appropriate for them (Mehta et al., 2012). Most of the  
64 packages of these products are coloured and frequently include cartoon characters,  
65 merchandising tie-ins, photos of celebrities, and references to fun, play or sports (Chacon  
66 et al., 2013; Hebden et al., 2011). In addition, nutritional claims or references to health are  
67 usually included to create positive health-related associations, even if products are high in  
68 sugar, fat and/or sodium. These marketing strategies have been shown to encourage  
69 children to perceive products as healthy, fun, and appropriate for them, and influence their  
70 liking, persuasion power and willingness to consume (Arrúa et al., 2017b; Letona et al.,  
71 2014; McGale et al., 2016; Roberto et al., 2010; Cairns et al., 2013; Sadeghirad et al., 2016).  
72 However, the information included on food packages is also expected to influence parents'  
73 perception and choice.

74           Parents are usually the final purchase decision makers and exert a highly relevant  
75 role in the formation of their children's food preferences (DeCosta et al., 2017; Scaglioni et  
76 al., 2011). Although parents regard healthiness as one of the most important factors when

77 they select products for their children (Russell et al., 2015), research has shown that they  
78 frequently invest little time and cognitive effort when making their food choices (Maubach et  
79 al., 2009; Machín et al., 2020b). Instead, they largely rely on heuristics, i.e. simplified  
80 decision-making strategies. Parents tend to rely on health claims, brands, or realistic visuals  
81 to identify products that may be appropriate for their children (Abrams et al., 2015). In  
82 addition, Machín et al. (2020a) has recently reported that people judge the healthiness of  
83 ultra-processed products based on simple cues, such as the presence of nutritional claims,  
84 references to natural foods, and even price, brand or packaging material. These simple cues  
85 may lead parents to unintentionally make unhealthy choices for their children. Moreover,  
86 some cues (i.e. cartoon characters or colorful packages) encourage parents to select  
87 products for their children when they look for a product to please or reward their children,  
88 even if they may be unhealthy (Abrams et al., 2015).

89         The present research intends to contribute to filling a research gap by studying the  
90 influence of labelling on parents' healthiness perception and choice of snack products for  
91 their children. Focus on snacks is justified by the increased contribution of snacking to the  
92 daily energy intake of children (Fayet-Moore, Peters, McConell, Petocz, & Eldridge, 2017;  
93 Piernas & Popkin, 2010). In this sense, previous studies have reported that children  
94 frequently consume products with excessive content of sugars, fat and sodium as a snack,  
95 which contributes to their total energy, added sugars, total fat and sodium intake (Loth et al.,  
96 2020a; Shriver et al., 2017; Taillie, Afeiche, Eldridge, & Popkin, 2015).

97         Most of the previous studies on the influence of packaging on choice have explored  
98 parents' behavior as a homogenous population, which is unlikely to represent the reality.  
99 Consumer behavior is highly influenced by individual differences that derivates from factors  
100 such as personality traits, demographics, lifestyle, and attitudes (Næs et al., 2018). The  
101 literature shows that parents' snack choices for their children are largely influenced by their

102 own eating practices, time-constraints, as well as their education and socio-economic status  
103 (Blaine, Kachurack, Davison, Klabunde, & Fisher, 2017; Curtis, James, & Ellis, 2010;  
104 Damen, Luning, Fogliano, & Steenbekkers, 2019; Nepper & Chai, 2016; Gibson et al., 2020;  
105 Rafferty et al., 2018). For example, Li, Lopetcharat, and Drake (2014) studied the influence  
106 of extrinsic attributes on parent's purchase decisions of chocolate milk. They found three  
107 segments of parents with distinctive purchase behaviors who differed in terms of income,  
108 ethnic origin, and number of children. For example, health-conscious parents were  
109 characterized by a higher income.

110 In this context, the objectives of the present work were: i) to evaluate the impact of  
111 label information on parents' healthiness perception and choice of two popular snack  
112 products targeted at children in Uruguay (chocolate milk and sponge cake), and ii) to explore  
113 individual differences in how label design influences parents' healthiness perception and  
114 their choice of snack products for their children.

115

## 116 **2. Materials and Methods**

117 An online study was conducted to investigate the effect of labelling information on  
118 parents' healthiness perception and choice of snacks for their school-aged children. A  
119 choice-conjoint analysis was designed. Participants were presented with a series of choice  
120 sets and were asked to make a choice (Almli & Næs, 2018). This methodological decision  
121 was made considering that choice experiments may represent better the situation  
122 consumers face when purchasing a product ( Asioli, Næs, Øvrum, & Almli, 2016). Ethical  
123 approval was obtained from the Ethics Committee of the School of Chemistry of Universidad  
124 de la República (Uruguay).

125

126 2.1. *Participants*

127 Participants were recruited using social media given its widespread penetration  
128 among the Uruguayan population (Instituto Nacional de Estadística, 2019). Recruitment  
129 followed the recommendations provided by Tuten (2010) for conducting online surveys. A  
130 Facebook and Instagram advertisement targeted at Uruguayan adults aged between 21 and  
131 50 years old was launched in November 2019. The advertisement included the text "*If you  
132 have school-aged children, answer some questions and enter a raffle for a voucher worth  
133 \$1000 (Uruguayan pesos). Help us understand how you select snacks*", accompanied by a  
134 picture of a child at school. As an incentive, participants who completed the study were given  
135 the chance of entering a raffle for a supermarket voucher worth 30 US dollars.

136 The advertisement was delivered to 48,864 users, shown as an ad to participants  
137 selected by Facebook software. A total of 2,209 participants clicked on the advertisement  
138 and 1,990 agreed to participate after reading the study description and the informed consent  
139 form. After excluding participants who did not complete the whole questionnaire (n=755) and  
140 some male participants, because of being too few to be analyzed as a separate group (n=22),  
141 a sample of 1213 Uruguayan mothers was obtained. The underrepresentation of fathers in  
142 the study fits expectations given that mothers are the main responsible of selecting and  
143 preparing food for children in the country (Cabella et al., 2014). Table 1 shows the  
144 sociodemographic characteristics of the mothers who completed the study. Mothers whose  
145 children attend both public (free of cost and funded by the State) and private schools (paid  
146 by parents) were included (Table 1).

147

148

149

150

151 **Table 1.** Sociodemographic characteristics of the mothers who completed the study  
 152 (n=1213)

<b>Characteristic</b>	<b>n</b>	<b>Percentage (%)</b>
<i>Age</i>		
21-35	743	61
36-50	470	39
<i>Socioeconomic level</i>		
Low	518	43
Middle/High	695	57
<i>Occupation</i>		
Employed	742	61
Housewife	471	39
<i>Number of children</i>		
1	347	29
2	723	60
≥ 3	143	12
<i>Type of school children attend</i>		
Public	1015	84
Private	198	16

153

154

155 *2.2 Experimental Design*

156 Two popular snack products targeted at children in Uruguayan market were used:  
 157 chocolate milk and sponge cake. For each product, eight labels were designed using a 2<sup>3</sup>  
 158 full factorial design with the following variables: cartoon character, nutrient content and

159 nutritional claim. Cartoon characters and nutritional claim were selected given their high  
160 prevalence on the food packages of products targeted at children available in the Uruguayan  
161 marketplace (Giménez et al., 2017). A licensed cartoon character was used in the chocolate  
162 milk labels (lion), whereas a non-licensed cartoon character was used in the sponge cake  
163 labels (skater boy). The selection of the characters was based on the characteristics of  
164 products available in the Uruguayan market. Nutrient content was selected as an objective  
165 cue for product healthiness. This variable was operationalized by modifying front-of-package  
166 information about the content of a key nutrient associated with non-communicable diseases  
167 (sugar for chocolate milk and saturated fat for sponge cake) in two levels, high and low  
168 according to Uruguayan regulations (Ministerio de Salud Pública, 2018). Nutrient content  
169 was presented on the labels using the guideline daily amount (GDA) front-of-package  
170 nutrition labeling scheme. Table 2 shows the variables and levels for each of the products.  
171 Labels were designed by a professional graphic designer. In order to avoid the influence of  
172 participants' previous experiences, labels corresponded to fictitious products.

173           Using the labels, four choice sets were created for each product category following  
174 a rotation design using the package `support.CEs` (v0.4.1; Aizaki, 2012) in R version  
175 3.6.2 (R Core Team, 2019). Two alternatives per choice set and one block were specified  
176 to build the choice set design. The characteristics of the choice sets are shown in the  
177 Appendix (Table A1). Figure 1 shows an example of the labels presented in the choice set.

178

179 **Table 2.** Variables and levels of the experimental design for the two product categories.

Variable	Chocolate milk	Sponge cake
Cartoon character	Present (1)	Present (1)
	Absent (-1)	Absent (-1)



Nutrient content	High sugar content: 28 g / 200 ml (1)	High saturated fat content: 6.2 g / 60 g (1)
	Low sugar content: 22 g / 200 ml (-1)	Low saturated fat content: 2 g / 60 g (-1)
Nutritional claim	"Source of calcium and vitamin D" (1)	"With all the fiber of cereals" (1)
	Absent (-1)	Absent (-1)

180

181 a)



182

183 b)



184

185 **Figure 1.** Example of how choice sets of labels were presented to participants for the two

186 products: a) chocolate milk, b) sponge cake. For the two products, the choice set displayed

187 alternative 2 (cartoon character= absent, nutrient content= high, nutritional claim= present)  
188 versus alternative 1 (cartoon character= present, nutrient content= low, nutritional claim=  
189 absent).

190

### 191 *2.3 Experimental procedure*

192 The study was implemented using Compusense-Cloud (Compusense Inc., Guelph,  
193 Canada). Written instructions were provided at the beginning of the task. First, participants  
194 provided Informed consent using an online form. Then, they were presented with the eight  
195 choice sets, corresponding to four choice sets for each of the two products. For each choice  
196 set, they were asked to look at the two labels and answer a question. Participants were  
197 randomly divided in two groups: one of the groups (n=603) was asked to select the product  
198 they would choose as a snack for their children (choice), whereas the other group (n=610)  
199 was asked to select the healthier product (healthiness perception). The two groups of  
200 participants were compared in terms of their socio-demographic characteristics by means  
201 of equivalence tests for two proportions, considering a margin of 10% and a 5% significance  
202 level (Tunes da Silva, Logan & Klein, 2008). The groups were found statistically equivalent  
203 in all socio-demographic characteristics (all p-values < 0.001). This suggests that differences  
204 between the two groups were not expected to be due to differences in their socio-  
205 demographic characteristics.

206 The 8 choice sets (4 for each product category) were presented monadically  
207 following a Williams' Latin square design. The presentation order of the labels within each  
208 choice set was randomized between participants. After completing the choice-conjoint task,  
209 participants were asked to answer a series of sociodemographic questions (age, gender,  
210 occupation, place of residence, education, number of income earners, household size,  
211 number of children, type of children's school and children's age). Socio-economic status

212 was calculated using a standard methodology in Uruguay (Centro de Investigaciones  
213 Económicas, 2018).

214

#### 215 *2.4. Data analysis*

216 All data analyses were performed using R software version 3.6.2 (R Core Team,  
217 2019). Only data from mothers who completed the whole study (n=1213) were analyzed.

218

##### 219 *2.4.1 Choice-based conjoint analysis*

220 Data from each product category and type of response (choice or healthiness  
221 perception) were analyzed separately. A mixed logit utility model was built considering the  
222 main effects of the variables of the conjoint analysis: cartoon character, nutrient content and  
223 nutrient claim (Table 1). The utility for product  $j$  for individual  $i$  and choice occasion  $t$  in the  
224 mixed logit model can be described by:

225

$$226 U_{ijt} = \beta_{1i} \text{CartoonCh}_{ijt} + \beta_{2i} \text{Nutrient}_{ijt} + \beta_{3i} \text{Claim}_{ijt} + \varepsilon_{ijt}$$

227

228 where  $\beta_{ni}$  are the individual random coefficients for the conjoint factors and  $\varepsilon_{ijt}$  is the random  
229 error. It was assumed that all random coefficients followed a normal distribution and that the  
230 random coefficients of the individuals were the same for all their choice occasions.  
231 Correlation between the coefficients was allowed in order to accommodate possible  
232 interactions between factors. The analysis was performed using the `mlogit` package in R  
233 (v1.0-2; Croissant, 2019).

234 The parameters of the mixed logit model are estimated using an iterative process,  
235 which involves the generation of pseudo-random sequences that intend to mimic draws from  
236 a uniform distribution (Henswher & Greene, 2003). In the present work, a quasi-random

237 maximum likelihood method, commonly known as Halton draws, was used in the iterative  
238 process to obtain more uniformly distributed sequences (Zheng, 2016). Considering that  
239 there is no standard number of draws to obtain stable parameters (Hensher & Greene,  
240 2003), the model was run over a range of Halton draws (50 – 3000). For all the data sets,  
241 similar estimate values were observed across the series of draws tested, especially from  
242 200 Halton draws onwards. Moreover, the signs and significance of the coefficients were  
243 consistent across the different number of draws. For this reason, 200 Halton draws was  
244 selected for further analysis in the present work.

245

#### 246 *2.4.2 Individual differences*

247 Individual differences among mothers were studied using a multi-step strategy based  
248 on *a posteriori* unsupervised clustering. The raw individual coefficients from the mixed logit  
249 models for each product and type of response were extracted. For each type of response  
250 (choice and healthiness perception) individual differences were analyzed considering the  
251 individual model coefficients for both products. Hence, the data consisted of two matrices of  
252 six variables each, three for the chocolate milk individual coefficients (Cartoon character,  
253 Sugar content and Nutrient claim) and three for the sponge cake individual coefficients  
254 (Cartoon character, Fat content and Nutrient claim). Hierarchical cluster analysis  
255 considering Euclidean distances and Ward's method was applied on each matrix of raw  
256 individual coefficients. The clusters obtained through hierarchical cluster analysis were also  
257 interpreted using Principal Component Analysis (PCA) on the raw individual coefficients of  
258 the six variables (Figure A1 and Figure A2 in the Appendix). Unstandardized coefficients  
259 were used to maintain the coefficients scale variation.

260 The average estimates of the coefficients for each of the variables were computed  
261 for each of the identified groups. To evaluate the coherence between the segmentation and

262 the raw data, the percentage of participants who selected each label for each choice set  
263 was computed for each of the groups.

264 The groups were characterized in terms of age, occupation, type of school and  
265 socioeconomic level. Chi-squared test for independence was used to explore statistical  
266 relationships between the groups of participants and each socio-demographic characteristic,  
267 considering a 5% statistical significance level.

268

### 269 **3. Results**

270

#### 271 *3.1. Effect of label information on mothers' choice of snacks for their children*

272 Table 3 shows the mean estimate and standard deviation of the coefficients of the  
273 mixed logit model used for estimating the effect of three variables on mothers' choice of  
274 chocolate milk and sponge cake for their children. For both products, the coefficient of the  
275 nutritional claim was the largest, suggesting that it was the factor with the highest relative  
276 importance. For the chocolate milk, only nutritional claim had a coefficient that statistically  
277 significantly differed from zero. As expected, the coefficient effect was positive, indicating  
278 that mothers preferred labels featuring a nutritional claim. The coefficients of cartoon  
279 character and nutrient content were small and not statistically significantly different from  
280 zero.

281 For sponge cake labels, all coefficients were statistically significantly different from  
282 zero, suggesting that mothers' choices were influenced by the three variables. The positive  
283 coefficients of the factors nutrition claim and cartoon character indicated that mothers  
284 preferred the sponge cake labels featuring these elements over those without them.  
285 Meanwhile, the negative coefficient of the factor nutrient content suggests that mothers  
286 preferred the sponge cakes with the lowest saturated fat content (Table 3).

287

288 **Table 3.** Mean value and standard deviations of the coefficients of the mixed logit model  
289 used for estimating the effect of label information on mothers' choice of snacks for their  
290 children in the choice conjoint task for the two product categories.

<i>Product</i>	<i>Variable</i>	<i>Mean</i>	<i>Standard deviation</i>	<i>95% Confidence interval</i>	<i>p-value</i>
Chocolate milk	Cartoon character	0.047	1.358	[-0.098, 0.191]	0.527
	Nutrient content	-0.073	0.578	[-0.223, 0.077]	0.341
	Nutritional claim	2.115	1.953	[1.434, 2.797]	<0.001
Sponge cake	Cartoon character	0.114	0.810	[0.021, 0.206]	0.016
	Nutrient content	-0.185	0.350	[-0.279, -0.091]	<0.001
	Nutritional claim	0.972	1.266	[0.749, 1.191]	<0.001

291

292 The results presented above correspond to the average coefficients. However, as  
293 shown in Table 3, the standard deviations of the estimates of the three variables were high  
294 for the two products. This indicates the existence of large individual differences in how the  
295 variables influenced participants' choices for both products. Therefore, the effect of all the  
296 variables is worthy of consideration. In addition, a strong positive correlation coefficient was  
297 found between the random individual coefficients of the nutrient content and nutritional  
298 claim, both in the chocolate milk ( $r=0.78$ ) and the sponge cake ( $r=0.80$ ).

299

300 *3.1.1 Individual differences in the effect of label information on mothers' choices*

301 Individual differences in mothers' choices of snacks for their children were explored  
302 using hierarchical cluster analysis on the coefficients of the mixed logit models for the  
303 variables of the experimental design for each of the two products (sponge cake and  
304 chocolate milk). Two groups of mothers with distinct behavior were identified. The mean  
305 estimates of the coefficients of the three factors included in the experimental design are  
306 shown in Figure 2 for the two groups of mothers.

307 Mothers in Group 1 (n=182) showed a positive attitude towards the labels featuring  
308 a cartoon character, whereas. mothers in Group 2 (n=421) were characterized by their  
309 strong preference for labels with nutritional claims. Although mothers behaved similarly  
310 regardless of the products, these tendencies were stronger for the chocolate milk.

311 The behavior of the groups identified by the hierarchical cluster analysis were  
312 coherent with the raw data in terms of the labels selected for each of the choice sets.  
313 Mothers in Group 1 frequently selected the labels featuring the cartoon character, while  
314 mothers in Group 2 frequently selected the labels featuring the nutritional claim (Figure A3  
315 of the Appendix).

316 The representation of the groups obtained from the hierarchical cluster analysis on  
317 the PCA score plot was coherent (Figure A1 of the Appendix). Both groups were clearly  
318 separated in the first two components, which explained 80.5% of the variability of the  
319 coefficients of the mixed logit model<sup>1</sup>.

320

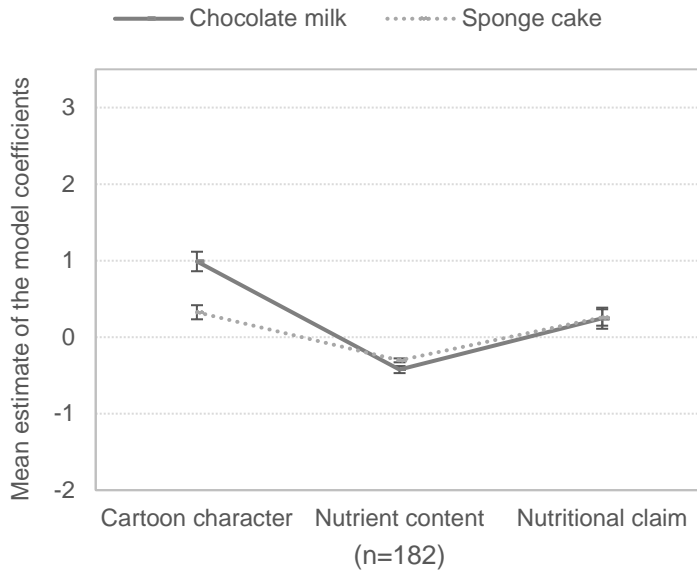
321

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<sup>1</sup> The variability refers to the coefficients of the mixed logit model and not the variability among participants according to the raw data.

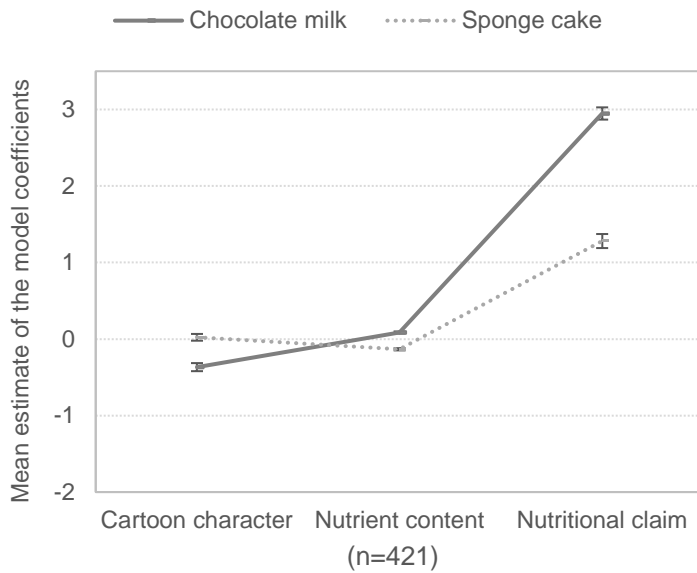
322

323 a)



324

325 b)



326

327 **Figure 2.** Mean estimates (and confidence interval) of the mixed logit model used for  
328 estimating the effect of label information on mothers' choice of snacks for their children for  
329 the two groups identified in the Hierarchical Cluster Analysis for the chocolate milk and  
330 sponge cake: (a) Group 1 and (b) Group 2.

331



332 No statistically significant differences in terms of sociodemographic variables were  
333 identified between the two groups. Group 1 and Group 2 showed similar distribution in terms  
334 age (56 and 63% of young mothers, respectively), occupation (64 and 60% of employed  
335 mothers, respectively), type of school (81 and 85% of mothers had children attending public  
336 schools) and socioeconomic level (43% of mothers from low socioeconomic level).

337

### 338 *3.2. Effect of label information on mothers' healthiness perception of snacks*

339 As shown in Table 4, the coefficients of nutrient content and nutritional claim  
340 statistically significantly differed from zero for both chocolate milk and sponge cake. This  
341 suggests that mothers' healthiness perception of both products was influenced by nutrient  
342 content and nutritional claim. Based on the positive coefficient for the nutritional claim and  
343 the negative coefficient for the nutrient content, it can be concluded that labels with  
344 nutritional claims and low nutrient content (sugar or saturated fat) were perceived as  
345 healthier than those without claims and high nutrient content. Large individual variation in  
346 the effect of the experimental variables was found, as evidenced by the high standard  
347 deviations of all the coefficients (Table 4). Moreover, a high correlation between the random  
348 individual coefficients of the nutrient content and nutritional claim was identified for both the  
349 chocolate milk ( $r=0.69$ ) and the sponge cake ( $r=0.76$ ).

350

351 **Table 4.** Mean value and standard deviations of the coefficients of the mixed logit model  
352 used for estimating the effect of label information on healthiness perception of snacks for  
353 their children in the choice conjoint task for two product categories: chocolate milk and  
354 sponge cake.

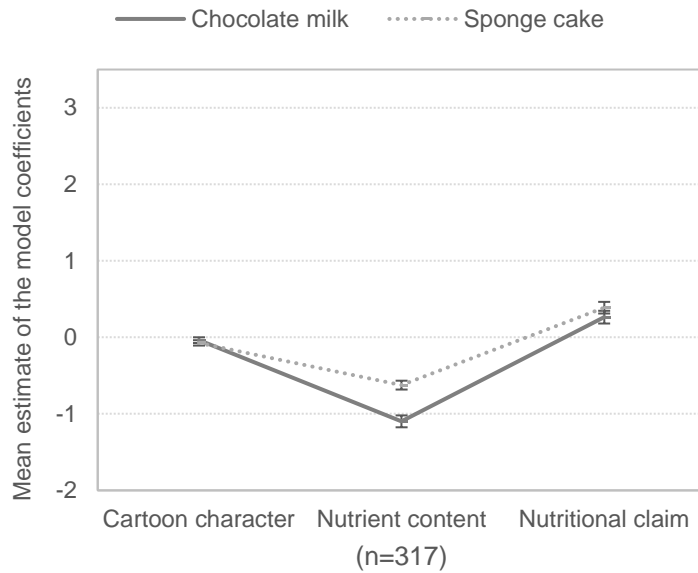
<i>Product</i>	<i>Variable</i>	<i>Mean</i>	<i>Standard deviation</i>	<i>95% Confidence interval</i>	<i>p-value</i>
Chocolate milk	Cartoon character	-0.035	0.535	[-0.148, 0.078]	0.544
	Nutrient content	-0.641	1.005	[-0.830, -0.453]	<0.001
	Nutritional claim	1.425	1.644	[1.008, 1.841]	<0.001
Sponge cake	Cartoon character	-0.030	0.529	[-0.118, 0.058]	0.498
	Nutrient content	-0.364	0.752	[-0.467, -0.262]	<0.001
	Nutritional claim	0.786	1.066	[0.593, 0.979]	<0.001

355

356 *3.2.1 Individual differences in the effect of label information on mothers' healthiness*  
357 *perception of snacks*

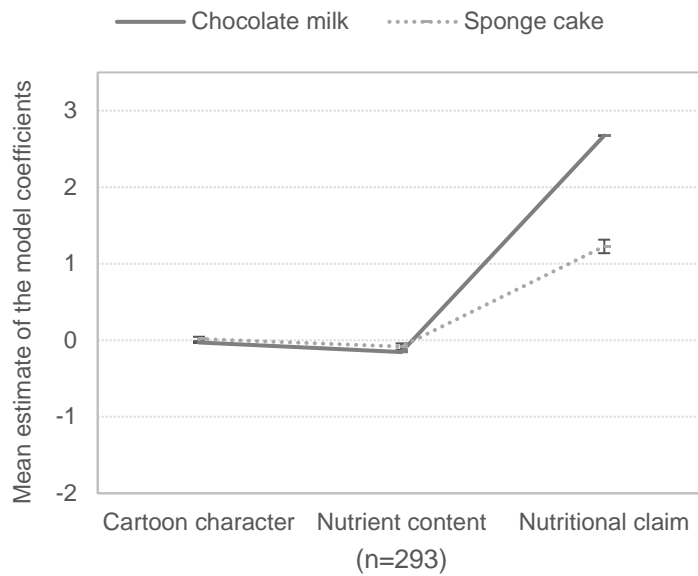
358 Hierarchical cluster analysis was used to explore individual differences on mothers'  
359 healthiness perception. Two groups of mothers who gave different relative importance to the  
360 variables of the experimental design when assessing the healthiness of the sponge cake  
361 and the chocolate milk were identified. The mean estimates for the three factors studied for  
362 each group are shown in Figure 3. Regardless of the product, mothers in Group 1 (n=317)  
363 were mainly influenced by the nutrient content and perceived labels with high  
364 sugar/saturated fat content as less healthy than the rest (Figure 3). Meanwhile, mothers in  
365 Group 2 (n=293) mainly based their healthiness perception on the nutritional claim: they  
366 regarded the products with nutritional claims as healthier than the products without claims.  
367 This effect was stronger for the chocolate milk than the sponge cake. These results were  
368 coherent with the raw data, i.e. the labels selected by mothers in the choice conjoint task.  
369 Mothers in Group 1 highly selected the labels featuring a low nutrient content, whereas  
370 Group 2 highly selected the labels with the nutritional claims (Figure A4 of the Appendix).

371 a)



372

373 b)



374

375 **Figure 3.** Mean estimates (and confidence interval) of the mixed logit model used for  
376 estimating the effect of label information on mothers' healthiness perception of snacks for  
377 the two groups identified in the Hierarchical cluster analysis for the chocolate milk and  
378 sponge cake: (a) Group 1 and (b) Group 2.

379 Mothers were not widely distributed along the first two components of the PCA (which  
380 explained 87% of the variability of the coefficients of the mixed logit model<sup>2</sup>). Instead, they  
381 were represented along a series of transverse lines (Figure A2 of the Appendix), which may  
382 be related to the lack of existence of marked differences in the relative importance attached  
383 to the experimental variables when assessing the healthiness of sponge cake and chocolate  
384 milk labels. However, the position of the groups identified in the Hierarchical Cluster Analysis  
385 in the first two components was in agreement with the average coefficients of the two groups.

386 Regarding differences between the groups in terms of socioeconomic variables,  
387 there was a slightly lower proportion of mothers whose children attend public schools in  
388 Group 1 (79%) compared to Group 2 (88%) ( $p=0.003$ ). No statistically significant differences  
389 were observed in age, occupation, and socioeconomic level.

390

## 391 **4. Discussion**

392

### 393 *4.1 Influence of label design on the parents' preference and healthiness perception*

394 Results from the present work suggested that, regardless of the product category,  
395 the nutritional claim had a strong impact on mothers' healthiness perception and choice of  
396 snacks for their children. This is in line with previous research showing that parents perceive  
397 claims as healthiness cues and regard them as one of the most relevant attributes when  
398 selecting a product for their children (Abrams et al., 2015; Machín et al., 2016; Maubach et  
399 al., 2009). Previous studies with Uruguayan school-aged children have shown similar  
400 results. Nutritional claims have been identified as one of the most relevant attributes for

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<sup>2</sup> The variability refers to the coefficients of the mixed logit model and not the variability among participants according to the raw data.

401 children's choice of snack products in choice-based conjoint tasks (Ares et al., 2016; Arrúa  
402 et al., 2017a).

403 Results of the present work showed that nutritional claims had a higher relative  
404 importance than sugar and fat content in shaping mothers' healthiness perception and snack  
405 choice. This suggests that nutritional claims may override the effect of objective information  
406 about the content of nutrients with potential negative effects on health, i.e. sugar, fat and  
407 sodium. This is in agreement with the fact that nutrient declarations are regarded as difficult  
408 to find and understand by Uruguayan mothers (Machín et al. 2016). According to Harris et  
409 al. (2011), mothers are likely to misinterpret and overgeneralize claims which may lead them  
410 to select poor nutrient quality products.

411 Although in the present work the influence of the nutrient content on mothers' choices  
412 and healthiness perception was small, the tendency fitted expectations. In line with the  
413 present results, Li, Lopetcharat and Drake (2014) reported that parents found more  
414 attractive a chocolate milk when it is low in fat and sugar. In the present work, the  
415 significance of nutrient content differed between products. For the chocolate milk, the effect  
416 of sugar content was only significant when the parents selected the healthiest label.  
417 Meanwhile, for the sponge cake fat content was relevant for both healthiness perception  
418 and choice. It is likely that parents considered the chocolate milk as a relatively healthy  
419 product and therefore they paid more attention to the nutrient information content only when  
420 they had a health motivation (Van Herpen and Van Trijp 2011). The sponge cake, however  
421 may have been perceived as an indulgent option, with different reasons underlying choice.  
422 The larger effect of fat content on sponge cake labels compared to the sugar content in  
423 chocolate milk could also be attributed to the absolute difference between the two levels of  
424 the nutrient content variable. The difference in sugar content between the two levels was  
425 only 27% (22g vs. 28g), whereas for fat content it was 310% (2.0g vs. 6.2g). Mothers could

426 have perceived the difference in fat content as more relevant than the difference in sugar  
427 content.

428         The low importance attached to objective nutritional information suggests the need  
429 to implement simplified front-of-package nutrition labelling schemes, such as nutritional  
430 warnings, to facilitate the identification of products with excessive content of sugar, fat and  
431 sodium. In this sense, recent research has shown that the implementation of this scheme in  
432 Uruguay improved consumer ability to interpret nutritional information (Ares et al., 2021).  
433 These simplified cues may be accessible for parents in all age ranges and socioeconomic  
434 levels and could help them making healthy snack choices for their children.

435         The cartoon character had the lowest impact on mother's choice and healthiness  
436 perception for both product categories. Similar results were reported by Russell et al. (2017)  
437 who found that the presence of a cartoon character was one of the least important factors  
438 driving parent's choices of breakfast cereals in a discrete choice experiment. Although the  
439 presence of cartoon characters positively influences children food choices (Ares et al., 2016;  
440 Arrúa et al., 2017b; Hémar-Nicolas et al., 2021; Letona et al., 2014; McGale et al., 2016),  
441 nutritional quality seems to be a more relevant driver of parent's food choices for their  
442 children (Oellingrath et al., 2013; Russell et al., 2015). Therefore, it is likely that parents  
443 prioritize the cues closely related to healthiness during their selection (e.g. claims). Another  
444 feasible explanation is that mothers may have provided socially desirable responses during  
445 the choice task, as parents are expected to provide healthy foods for their children.

446

#### 447 *4.2 Individual differences in mothers' healthiness perception and choice*

448         Results from the present work showed that the effect of nutritional claims, nutrient  
449 content information and cartoon characters on mothers' choice and healthiness perception

450 cannot be generalized to the whole population since different groups with distinctive choice  
451 behavior were found. One segment of mothers (Group 2) was strongly influenced by the  
452 nutritional claim, both in the choice and in healthiness perception tasks. This is in line with  
453 the results observed at the aggregate model. It is worth highlighting that this behavior was  
454 more salient for the chocolate milk, which may be related to the understanding and familiarity  
455 of this claim due to its frequent use in the product category.

456         Nutritional claims had less weight for Group 1, who gave more importance to the  
457 presence of a cartoon character when choosing a snack product for their children. This group  
458 of mothers tended to select products with cartoon characters for their children. Although a  
459 previous study reported that cartoon characters had a low influence on parents' choices  
460 (Russell et al. ,2017), other studies have reported that parents perceive products with  
461 cartoon characters as more appealing for children (Abrams et al., 2015). In the present  
462 study, the effect of cartoon character was larger for the chocolate milk than for the sponge  
463 cake. The difference may be related to the fact that the character included in the chocolate  
464 milk labels was licensed and familiar to parents, compared to the non-licensed character  
465 included in the sponge cake labels (c.f. Figure 1). Nuances in the effect of different types of  
466 cartoon characters on children's perception and choice have been reported (Ogle et al.,  
467 2017; De Droog et al., 2011; Arrúa et al., 2017a), which can be attributed to the associations  
468 raised by the characters.

469         The sociodemographic characteristics explored in this study were not able to  
470 differentiate the groups of mothers. Considering that parents usually select products that are  
471 less healthy but visually attractive to deliberately entertain or reward their children, future  
472 studies should investigate the influence of parental practices on the relative importance  
473 attached to labelling information when making snack choices.

474           Regarding healthiness perception, one segment of mothers (Group 1) selected the  
475 healthiest product based on the objective nutritional information in the label (i.e. sugar or fat  
476 content). This group was composed by a larger percentage of mothers with children in  
477 private schools. In line with these results, Lima, Ares, and Deliza (2018) showed that parents  
478 whose children attended to private schools were more health conscious of the products  
479 targeted at children. These parents gave lower healthiness rating to snacks targeted at  
480 children compared to parents whose children attended schools. Although parents  
481 sometimes disregard nutritional information, consumers with higher socioeconomic  
482 status/income are more likely to read the label information (Blitstein, Guthrie, & Rains, 2020;  
483 Hough, & Sosa, 2015; Machín et al., 2016; Ollberding, Wolf, & Contento, 2010; Satia,  
484 Galanko, & Neuhouser, 2005).

485

#### 486 *4.3 Limitations of the study*

487           The present work is one of the few studies that explores individual differences in how  
488 labelling information influences parents' healthiness perception and choice of snacks for  
489 their children using a choice-based conjoint task. Although results were coherent with  
490 previous studies that applied other qualitative and quantitative methods, some  
491 methodological considerations are worthy to highlight. In this study, a limited number of  
492 choice sets were presented to the parents, which only allowed to study the main effects of  
493 the conjoint factors. Although interactions were considered by allowing correlation between  
494 the coefficients in the model, future studies should consider a larger number of choice sets  
495 to obtain more robust data to explore these interactions.

496           Although clear clusters of parents were found, differences in the socio-demographic  
497 characteristics of the groups were small. This limitation was also mentioned by Asioli et al.



498 (2016), who applied a multi-step strategy to investigate the individual differences among  
499 consumers in a choice-based experiment for iced coffee. These authors observed that  
500 despite the clearly distinct patterns in consumer behavior, differences in consumer attributes  
501 such gender or age were difficult to quantify. Considering that behavioral and attitudinal  
502 characteristics have been reported to have more explicative power on consumers' food  
503 purchase decisions than demographics (Hollywood et al., 2007), it is advisable that future  
504 studies consider additional parents' characteristics.

505

## 506 **5. Conclusions**

507 Results from the present work showed that nutritional claims have a strong effect on  
508 mothers' healthiness perception and choice of snacks for their children, overriding the effect  
509 of the content of sugar and saturated fat. However, relevant individual differences on the  
510 effect of label elements on mothers' choice and healthiness perception were identified. In  
511 this sense, the choices of one group of mothers was influenced by the presence of cartoon  
512 characters on the labels. These results stress the need to regulate the use of claims, cartoon  
513 characters and other persuasive elements on the food labels of products of poor nutritional  
514 targeted at children.

515

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526

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755 **Appendix**

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757 **Table A1.** Characteristics of choice sets used in the study.

<b>Choice Set</b>	<b>Alternative*</b>	<b>Cartoon character</b>	<b>Nutrient content</b>	<b>Nutritional claim</b>
1	1 CC/LN	Present	Low	Absent
	2 HN/CL	Absent	High	Present
2	3 LN/CL	Absent	Low	Present
	4 CC/LN	Present	High	Absent
3	5 HN	Absent	High	Absent
	6 CC/LN/CL	Present	Low	Present
4	7 CC/HN/CL	Present	High	Present
	8 LN	Absent	Low	Absent

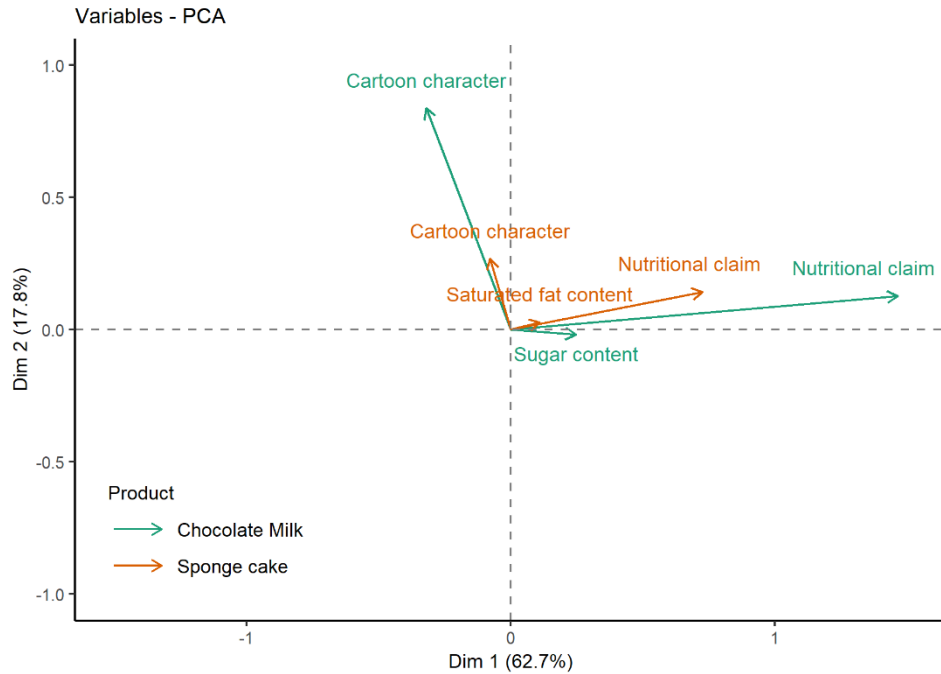
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759 Note: Details of the variables and the levels are shown in Table 2.

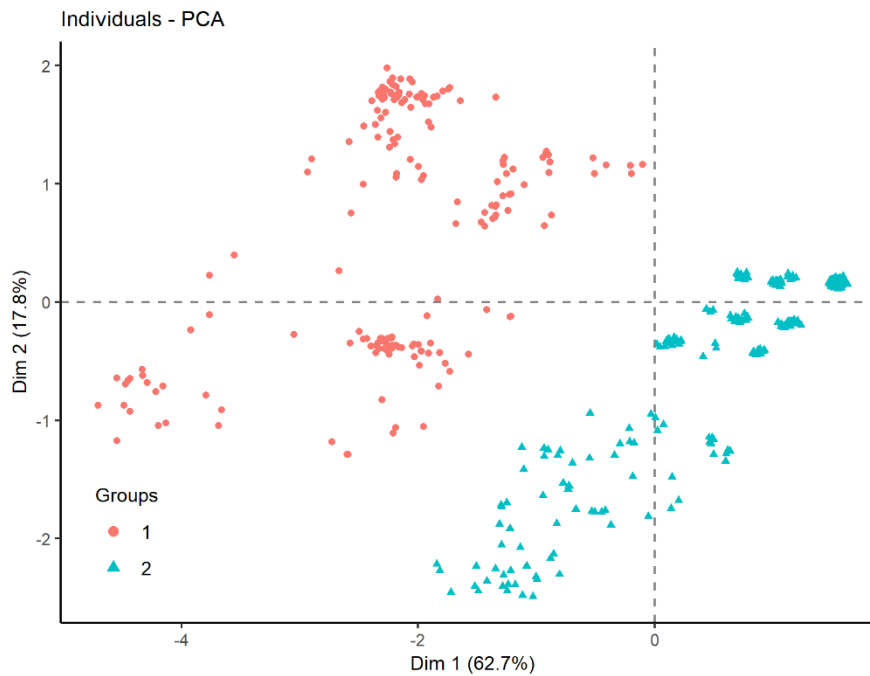
760 \* CC: presence of the cartoon character; LN: low nutrient content; HN: high nutrient content; CL:

761 presence of nutritional claim.

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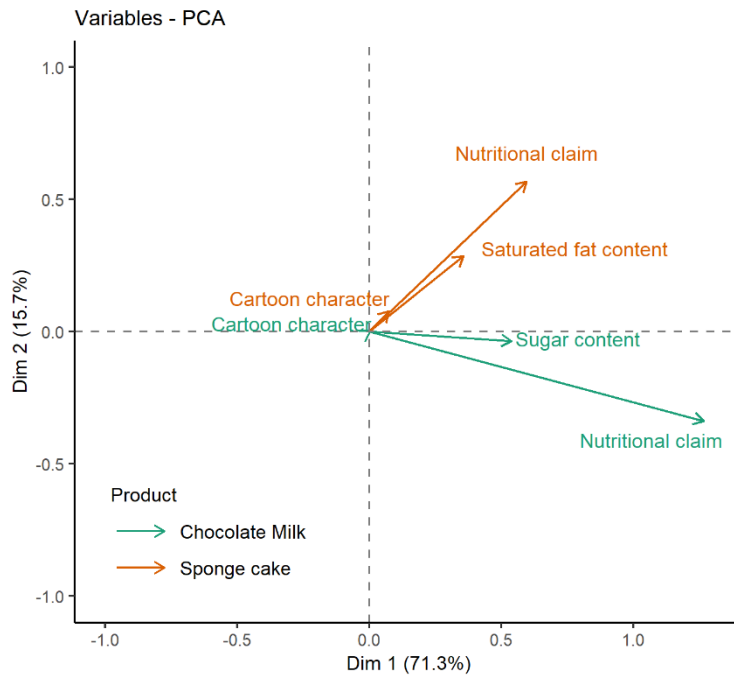
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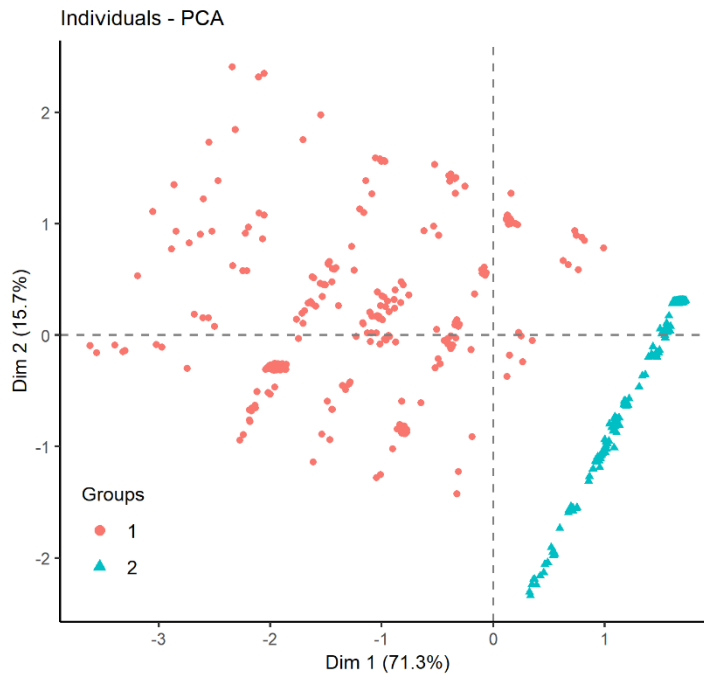
767 **Figure A1.** Representation of the coefficients and the individuals in the first two dimensions  
 768 of the Principal Component Analysis performed on the individual coefficients extracted from  
 769 the mixed logit model used for estimating the effect of label information on mothers' choice  
 770 of snacks for their children. Variables corresponding to coefficients of the two products  
 771 (chocolate milk and sponge cake) are shown with different colors in the variables plot. The

772 two groups of mothers identified by hierarchical cluster analysis are shown in the score plot  
773 of the individuals with different markers and colors.

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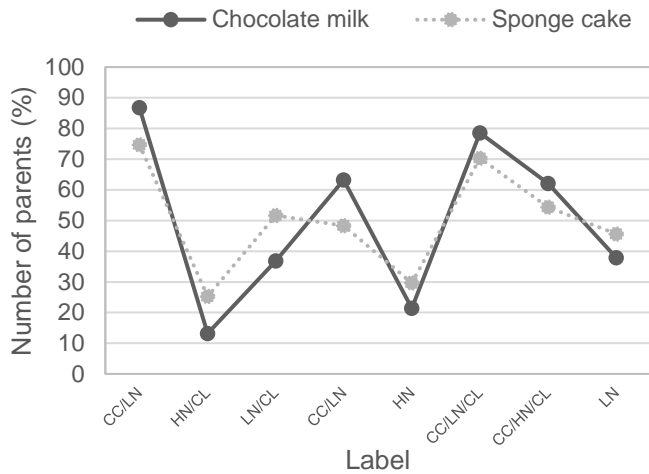
777 **Figure A2.** Representation of the coefficients and the individuals in the first two dimensions  
778 of the Principal Component Analysis performed on the individual coefficients extracted from  
779 the mixed logit model used for estimating the effect of label information on mothers'  
780 healthiness perception of snacks. Variables corresponding to coefficients of the two  
781 products (chocolate milk and sponge cake) are shown with different colors in the variables  
782 plot. The two groups of mothers identified by hierarchical cluster analysis are shown in the  
783 score plot of the individuals with different markers and colors.

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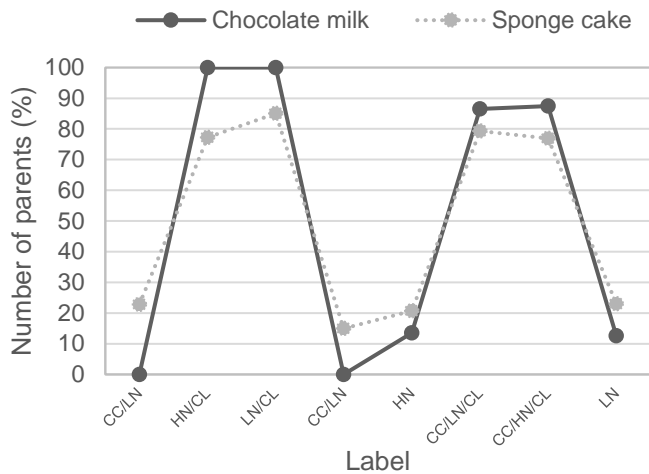
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787 a)



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789 b)



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791 **Figure A3.** Frequency of selection of labels in the choice conjoint task on mothers' choice  
 792 of snacks for their children for the groups identified in the Hierarchical cluster analysis: a)  
 793 Group 1, b) Group 2. Abbreviations in the name of the labels indicate presence of the cartoon  
 794 character (CC), low nutrient content (LN), high nutrient content (HN) and presence of  
 795 nutritional claim (CL).

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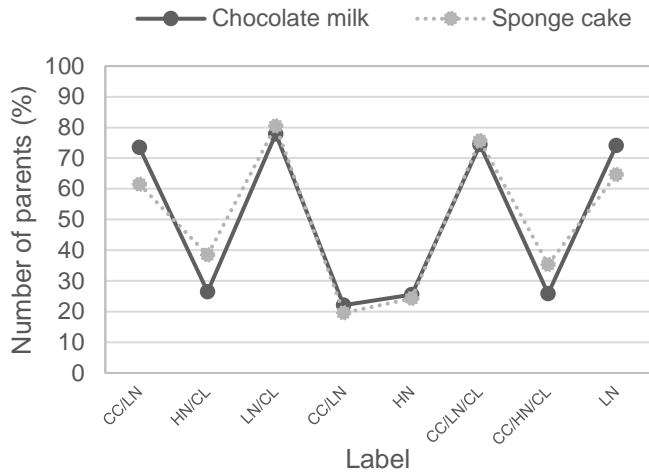
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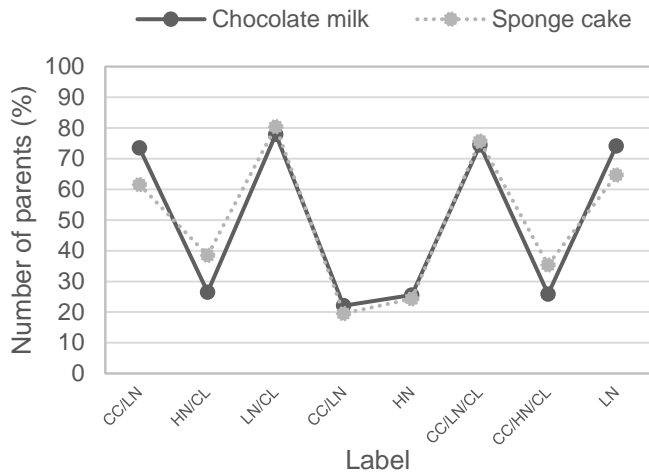
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801 a)



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803 b)



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805 **Figure A4.** Frequency of selection of labels in the choice conjoint task mothers' healthiness  
806 perception of snacks for the groups identified by the hierarchical cluster analysis: a) Group  
807 1, b) Group 2. Abbreviations in the name of the labels indicate presence of the cartoon  
808 character (CC), low nutrient content (LN), high nutrient content (HN) and presence of  
809 nutritional claim (CL).

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