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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)

Characteristic	n	Percentage (%)
<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 2³
 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 β_{ni} are the individual random coefficients for the conjoint factors and ε_{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 model¹.

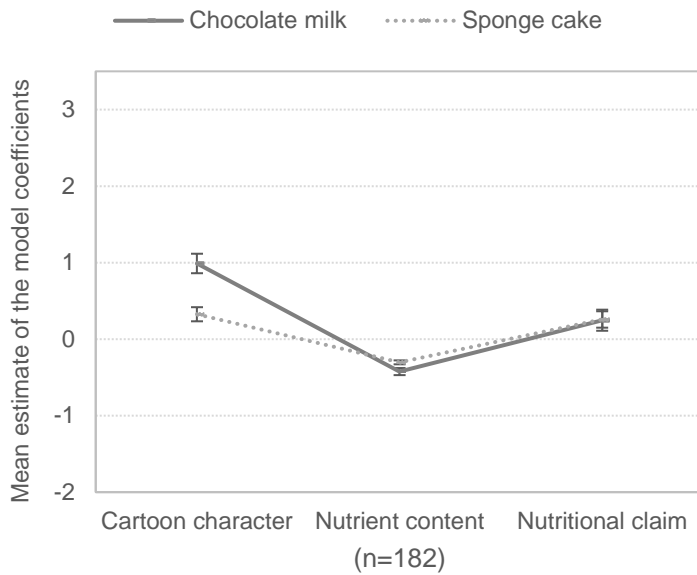
320

321

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

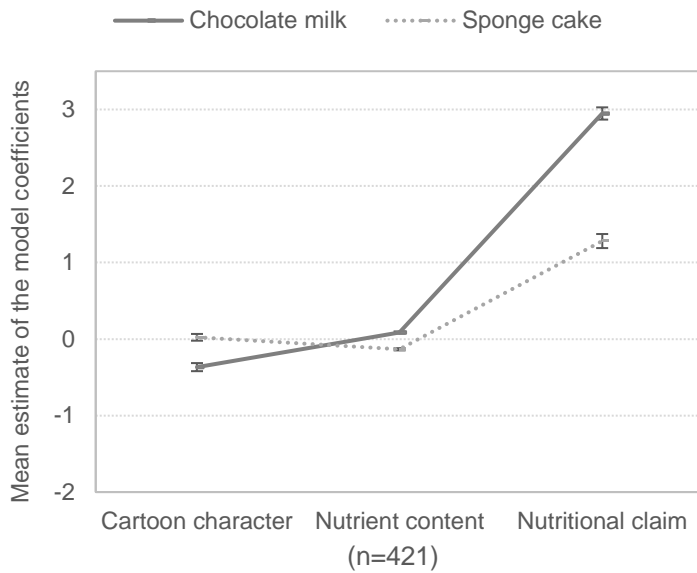
322

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

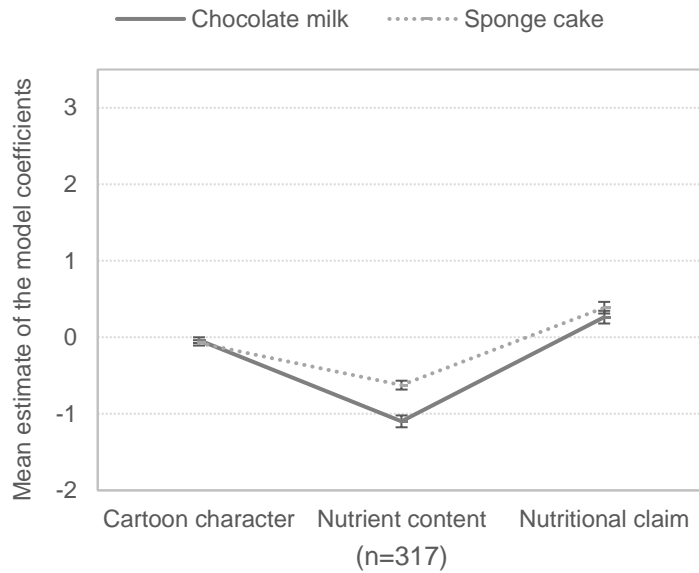
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356 3.2.1 Individual differences in the effect of label information on mothers' healthiness

357 perception of snacks

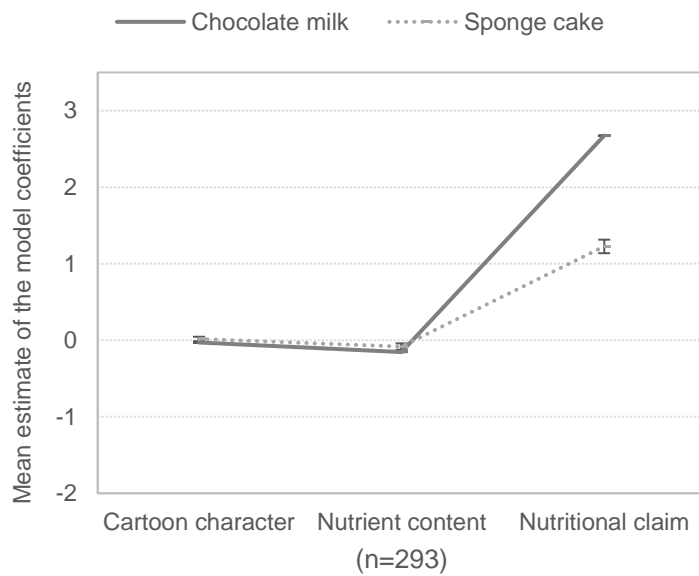
358 Hierarchical cluster analysis was used to explore individual differences on mothers'
359 healthiness perception. Two groups of mothers who gave different relative importance to the
360 variables of the experimental design when assessing the healthiness of the sponge cake
361 and the chocolate milk 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 model²). 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

² 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.

Choice Set	Alternative*	Cartoon character	Nutrient content	Nutritional claim
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

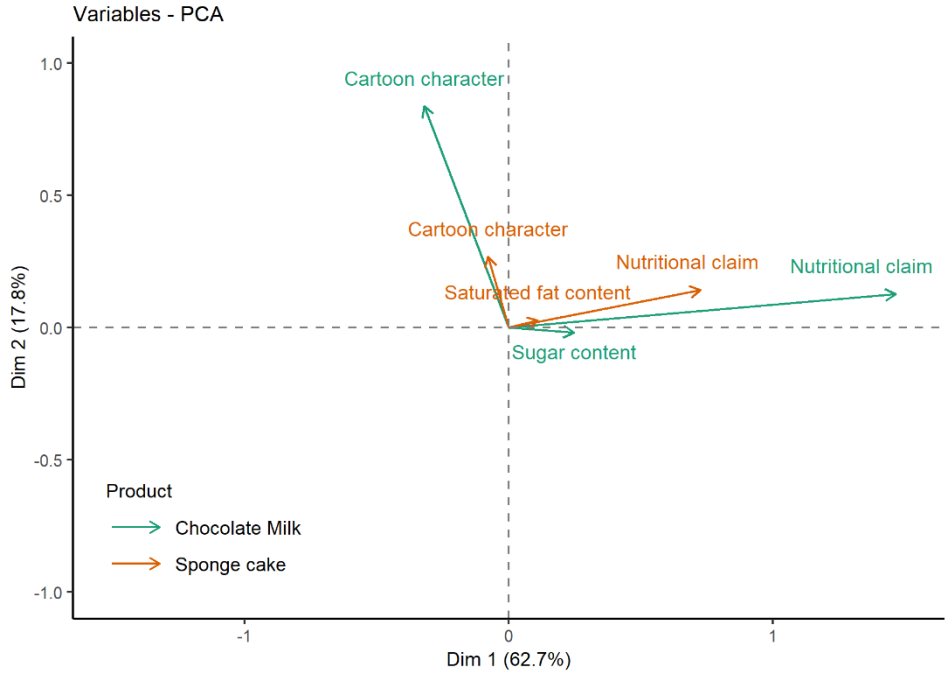
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759 Note: Details of the variables and the levels are shown in Table 2.

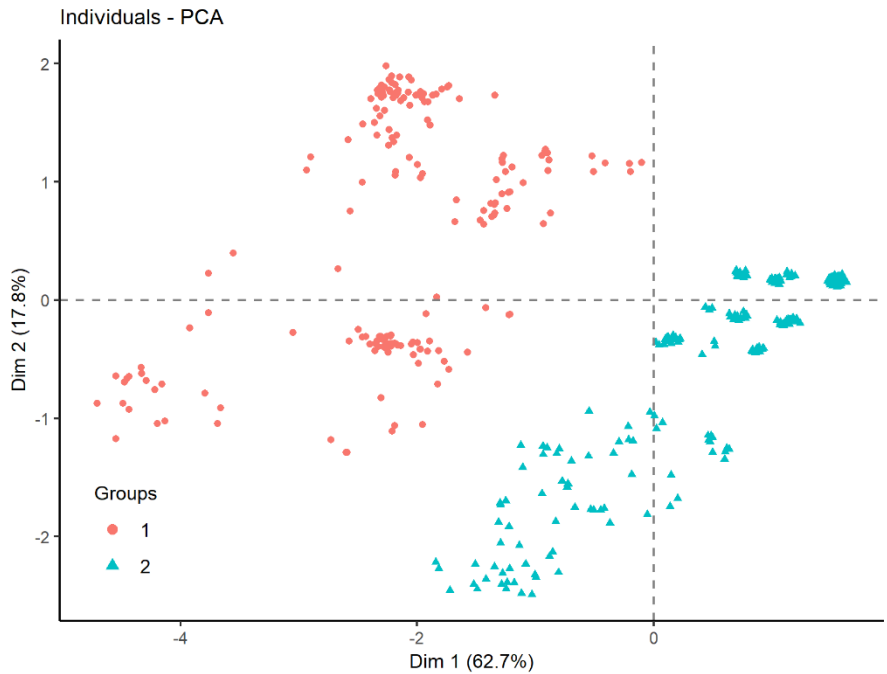
760 * CC: presence of the cartoon character; LN: low nutrient content; HN: high nutrient content; CL:

761 presence of nutritional claim.

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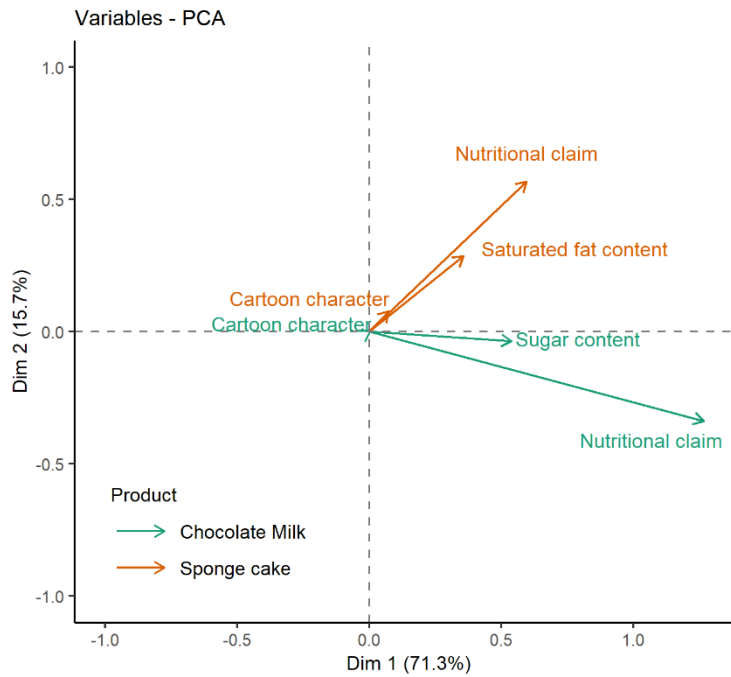
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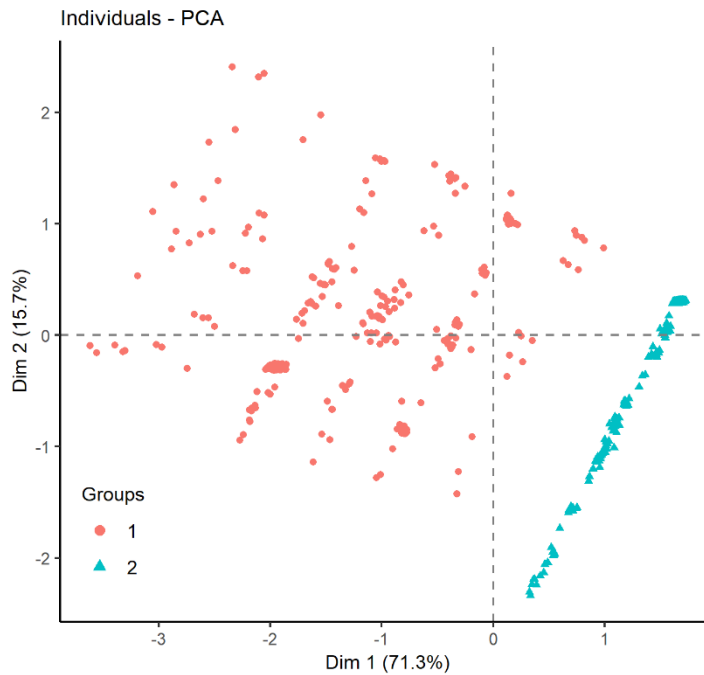
767 **Figure A1.** Representation of the coefficients and the individuals in the first two dimensions
 768 of the Principal Component Analysis performed on the individual coefficients extracted from
 769 the mixed logit model used for estimating the effect of label information on mothers' choice
 770 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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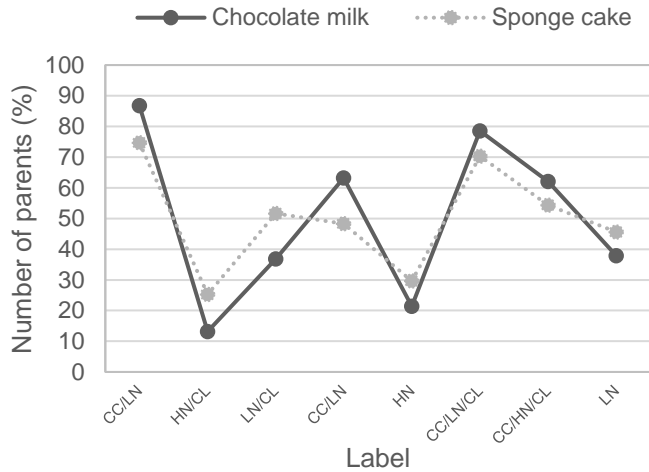
777 **Figure A2.** Representation of the coefficients and the individuals in the first two dimensions
778 of the Principal Component Analysis performed on the individual coefficients extracted from
779 the mixed logit model used for estimating the effect of label information on mothers'
780 healthiness 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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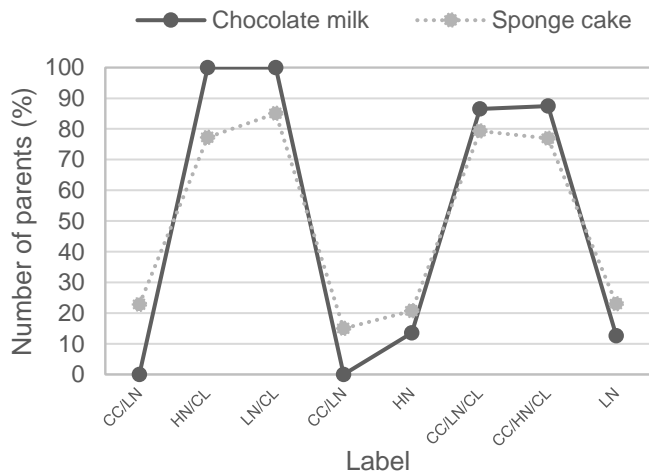
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787 a)



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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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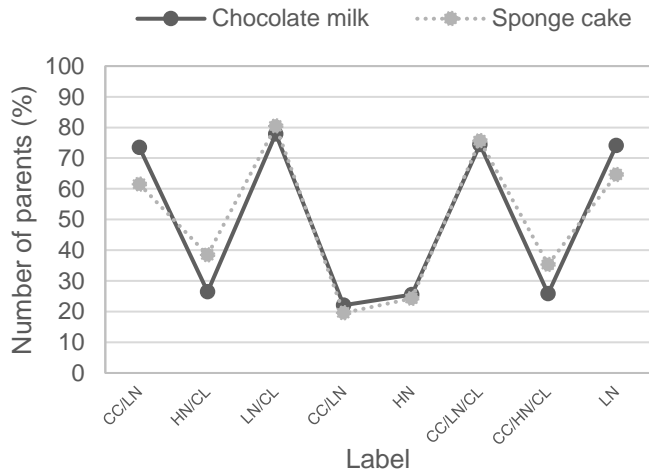
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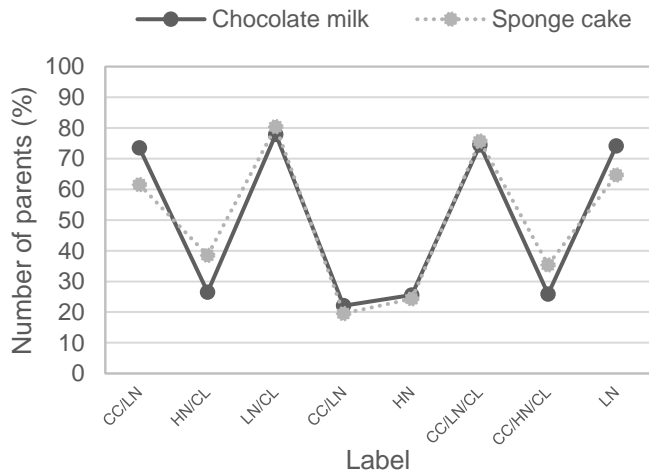
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801 a)



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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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