

Title: Parents' awareness and perceptions of the Change4Life 100 calorie snack campaign, and perceived impact on snack consumption by children under 11 years.

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1 **Abstract:**

2 **Background:** Childhood obesity is a pertinent public health problem in the UK. Consumption of free
3 sugars, has been associated with the development of obesity. In 2018, the Change 4Life (C4L) 100
4 calorie snack campaign was launched with the slogan ‘100 calorie snacks, two a day max’, aiming to
5 encourage parents to choose lower sugar, fat and calorie snacks for their children. This study aimed to
6 examine how the campaign has been perceived by parents.

7 **Methods:** An online survey was developed to explore parent awareness, perceptions and understanding
8 of the C4L 100 calorie snack campaign. Respondents were recruited via Leeds City Council, posters
9 displayed at primary schools and children’s centres across Leeds and via social media. Paper surveys
10 were also shared with voluntary led playgroups.

11 **Results:** 342 respondents completed the survey. Just over half of the respondents had come across the
12 campaign, most seeing the leaflet or a television advert. Over two thirds of respondents ‘agreed’ or
13 ‘strongly agreed’ that the campaign caught their attention. A similar proportion ‘agreed’ or ‘strongly
14 agreed’ that the campaign informed them about 100 calorie snacks and just over a half thought it was
15 memorable. Most respondents used positive language to describe the campaign, but there was no clear
16 consensus of a perceived positive impact on healthier snack purchasing, nor preparing more 100 calorie
17 snacks at home. Respondents provided examples of how the campaign could be improved to positively
18 impact eating behaviours: better publicity and information delivery; healthier snack examples made
19 more visible; improved nutritional labelling and access to healthier products in supermarkets
20 (availability, promotion, display, choice).

21 **Conclusions:** The C4L 100 calorie snack campaign was perceived positively by parents and carers,
22 with many agreeing that the campaign was informative and memorable. However, there was no
23 agreement in terms of the parents reporting an impact of the campaign on behaviour change and
24 healthier snack habits. Future social marketing campaigns could be improved through more formal pilot
25 testing to assess the understanding and acceptance of the campaign amongst the target audience.

Key words: Childhood; intervention; nutrition; obesity; snacking; public health

26 **Background**

27 Childhood obesity is a pertinent public health challenge both globally [1] and in the United
28 Kingdom (UK) [2]. There is concern about the increasing prevalence of childhood obesity [3],
29 as it tracks into adolescence and adulthood [4, 5], and can lead to adverse health outcomes,
30 such as high blood pressure and type 2 diabetes [6-8]. Latest data from the National Child
31 Measurement Programme (NCMP) in England in 2019/20[9], indicates that in Reception class
32 (aged 4-5 years), almost a quarter of children (23%) are living with overweight or obesity, with
33 an increase of obesity prevalence to 10%. By the end of primary school (age 10-11 years),
34 over a third of children (35%) are living with overweight or obesity, with obesity prevalence
35 increasing to 21%. With childhood obesity prevalence increasing, the need for action to identify
36 targets for prevention and treatment remains high [10].

37 It is understood that the causes of obesity are multifactorial and complex [11], but diet is a
38 particularly well-established modifiable risk factor [12]. Excessive consumption of calories,
39 and in particular free sugars [13, 14], has been associated with the development of obesity [15].
40 Moreover, research indicates that overconsumption of calories is one of the most significant
41 contributing factors in becoming overweight, with many adults in the UK consuming 200-300
42 extra calories a day above recommended daily guidelines, whilst children living with
43 overweight or obesity are consuming up to 500 more calories than recommended each day [16].
44 Many of these excess calories can come from snacking occasions throughout the day. Many
45 snack foods consumed by children of all ages are highly processed, energy dense, high in sugar
46 and of low nutritional quality [17, 18]. Though data on snacking and obesity in children are
47 limited and equivocal, there is evidence that children who snack on such products frequently,
48 consume greater energy [19], have poorer quality diets, and exhibit other risk factors for
49 excessive weight gain [18]. Furthermore, a secondary analysis of data from the UK National
50 Diet and Nutrition Survey (NDNS) (Years 5 and 6 combined) by Public Health England (PHE)

51 [20], indicates that children (aged 4-18 years) are getting half their sugar intake (51.2%),
52 currently around 7 sugar cubes (approximately 21 grams) a day, from energy dense snack foods
53 (such as biscuits and cakes) and sweetened soft drinks, leading to obesity and dental decay.
54 Moreover, children were consuming at least 3 energy dense, sugary snacks and sugary drinks
55 a day, with around a third consuming 4 or more, resulting in consumption of around three times
56 more sugar than is recommended [20]. Given that snacking habits are established during
57 childhood and often persist into adulthood [21], snacking on foods and drinks of low nutritional
58 quality should be discouraged at an early age. Moreover, research has shown that targeting
59 snack occasions may be specifically beneficial in children [10].

60 Action is required to improve dietary intake, with childhood an important opportunity to
61 improve long term intake and reduce the long-term risk of obesity and other non-communicable
62 diseases (NCDs) [22]. Such action needs upstream approaches such as reformulation, and
63 downstream approaches that aim to inform the public, change opinion and build support for
64 change [23]. ‘Change4Life’ (C4L) is an example of a downstream social marketing campaign
65 that was launched in 2009 by PHE, as part of the UK government’s strategy to reduce obesity
66 [24]. The C4L campaign ran across television, print and poster advertising, to encourage target
67 groups to reduce calorie intake and develop healthier eating habits (reductions in foods high in
68 added sugar and fat (HFHS), a more regular meal pattern, less snacking, and increased fruit
69 and vegetable intake), be aware of the health risk of excess body fat, and participate in regular
70 physical activity and reduce sedentary time [25]. In January 2018, an extension to the initial
71 C4L campaign was launched; the ‘C4L 100 calorie snack campaign’ ran with the slogan ‘100
72 calorie snacks, two a day max’ [26]. A national advertisement campaign (written information,
73 website and television advert), was delivered for two months. The webpage offered advice to
74 parents around packaged snacks to look for “100 calories, two a day max” and to make quick
75 decisions on packaged snacks, by providing recommended examples of snacks to prepare at

76 home and while away from home. It also provided information on calories (including where to
77 locate calories labelling), sugar content and basic instructions on how to use traffic light
78 labelling. Alongside the campaign and website, a food scanner app was launched to show the
79 calorie, salt, sugar and fat content of foods, with the aim of making healthier choices easier
80 [20].

81 To the best of our knowledge, no previous work has explored the C4L 100 calorie snack
82 campaign, or how it has been perceived by parents. Previous research has evaluated the impact
83 of other branches of the C4L campaign, such as ‘Sugar Smart’ [23] on dietary behaviours, and
84 has indicated an increased awareness of the campaign, but little impact on attitudes or
85 behaviour [27], or that improved behaviour such as sugar reduction could not be sustained [23].
86 It is important to evaluate social marketing campaigns to both inform the development of future
87 public health focussed initiatives and to assess the value for money of existing campaigns due
88 to their use of public funds [28]. As a result, the current study aimed to assess parent awareness,
89 perceptions and understanding of the C4L 100 calorie snack campaign, and how children’s
90 eating behaviours may have changed as a result of adjusted food practices due to the campaign.

91 **Methods**

92 *The survey*

93 An online survey was developed to explore two elements: 1) parent perceptions of their child’s
94 snacking and mealtime behaviours in and outside of the home, and 2) parent awareness,
95 perceptions and understanding of the C4L 100 calorie snack campaign launched in 2018 in the
96 UK. The findings of element 1) are discussed elsewhere [29]. This paper describes the findings
97 related to element 2), the C4L 100 calorie campaign. The survey was developed and shared
98 with parents or carers of children aged up to 11 years old, who were living in the UK and over
99 18 years of age. Respondents were asked to answer survey questions about their youngest child,
100 if they had more than one child.

101 The survey was constructed using Qualtrics software 2020 (Qualtrics, Provo, UT), an online
102 platform that facilitates the collection and analysis of data. The survey is included as a
103 supplementary file (Additional file 1). The survey was developed and piloted for completion
104 online (only one survey to be completed per family), with appropriate format and layout
105 incorporated into the design. For the first part of the survey, bar two questions which explored
106 how the public want to be supported to provide healthier snacks for their children, the survey
107 was designed by the research team, informed by response categories from a survey
108 commissioned by PHE in 2018; ‘Public Perceptions and Awareness of Public Health England’s
109 reduction Programmes’ [30]. The second part of the survey, the findings of which are discussed
110 in this paper, explored perceptions of the C4L 100 calorie snack campaign relating to awareness
111 of advertising, promotional materials and webpages relating to the C4L 100 calorie snack
112 campaign; understanding of 100 calorie snack campaign information; the impact of the
113 campaign on child’s snack behaviours; and recommendations for healthy snack information
114 for parents. The final section of the survey obtained demographic, socioeconomic information
115 and postcode data (so that the Index of Multiple Deprivation could be assigned). A paper-based
116 version of the survey was piloted with a group of parents (n=10) attending a community
117 playgroup in Leeds and subsequently piloted online with a further sample of parents (n=5).
118 Minor changes were made to layout and wording for clarification before the survey was
119 launched online.

120 **Ethics**

121 Ethical approval was provided by Leeds Beckett University School of Clinical and Applied
122 Sciences ethics review committee (reference number 54329). **All methods were performed in**
123 **accordance with the relevant guidelines and regulations.** An information sheet at the start of
124 the survey made respondents aware of how the data would be used. All respondents provided
125 consent before answering any survey questions. To encourage participation a free prize draw

126 of a £50 high street shopping voucher was offered. Respondents wishing to be entered into the
127 prize draw were asked to provide a contact email address at the end of the survey.

128 **Data analysis**

129 A summary report of findings was exported from Qualtrics (1) into Microsoft Excel. The data
130 was assessed to calculate descriptives such as counts, means and percentages. Percentages are
131 presented to one decimal place or as whole numbers when $N < 100$ participants. Microsoft Excel
132 (2) was also used to create graphs and tables. The open text responses from respondents were
133 analysed by firstly reading all responses to the question, then coding and grouping them into
134 meaningful categories and themes, using Microsoft Excel (2020).

135 **Results**

136 The link to the online survey was advertised (via QR code on a poster) to primary schools
137 across Leeds, via a contact at Leeds City Council. The link was also advertised via posters
138 displayed at children's centres across Leeds and on social media such as Netmums, Mumsnet,
139 Facebook, Twitter, and on the Leeds National Childbirth Trust Facebook page. The survey was
140 accessible from July 7th 2019 to October 24th 2019. To increase the diversity of the sample,
141 paper surveys were also shared with three voluntary led playgroups in Leeds. Surveys were
142 completed by carers or parents of a child aged up to 11 years, respondents were asked to think
143 about their youngest child when completing the survey. To maximize participation and
144 completion of the survey, most questions were not compulsory. Therefore, response numbers
145 to each question vary. In total 342 respondents completed the sections on the C4L campaign.

146 ***Respondent characteristics***

147 Table 1 presents the demographic and socioeconomic characteristics of the survey respondents.
148 Most respondents were mothers ($n=288$, 91.9%), with a mean age of 38 years (SD , 6.1, range
149 22-57 years). A large proportion of the sample had at least two children ($n=219$, 70.1%). The

150 mean age of the respondents' youngest child was 5.1 years old (SD 3.0, range 0-11 years). The
 151 majority of respondents were born in the United Kingdom (n=272, 90%), and around three
 152 quarters of the sample were living in Leeds (n=223, 77.2%). The majority were from White
 153 British backgrounds (n=283, 93.7%); this is higher than the the White-British population in
 154 Leeds (73.9%) [31] and the national average (86.0%) [32]. Over 70% of the sample had at least
 155 a level 4 qualification (degree, higher degree or professional qualification). This is much higher
 156 than the Leeds average (40.1%) and the national average (40.0%)[33]. Over a quarter of the
 157 sample were from the 20% most deprived areas (IMD quintile 1) in the UK (28%), similar to
 158 the average of 31% of the population for the Leeds area and 20% nationally [31].

159 **Table 1** Characteristics of survey respondents
 160

Demographic variables		
Relationship to child (n %*)		
Mother	283	91.9%
Father	20	6.5%
Grandparent	1	0.3%
Carer	2	0.6%
Other (stepmother)	2	0.6%
Total	308	100%
Gender (n %)		
Male	21	6.8%
Female	288	93.2%
Total	309	100%
Number of children in household (n %)		
1	301	100%
2	211	70.1%
3	62	20.6%
4	31	10.3%
5	11	3.7%
Highest education qualification (n %)		
Less than 5 GCSEs or equivalent (e.g. O levels)	15	4.9%
5+ GCSEs (grades A* - C) or equivalent (e.g. NVQ level 2)	23	7.5%
2+ A levels or equivalent (e.g. NVQ level 3)	44	14.4%
Degree (e.g. BSc)	85	27.9%
Higher degree or equivalent (e.g. PhD, PGCE)	79	25.9%
Professional qualifications (e.g. teaching, nursing)	51	16.7%
No qualifications	7	2.3%
Other (graduate higher diploma)	1	0.3%
Total	305	100%
Country of birth (n %)		

UK (England, Wales, Scotland or Northern Ireland)	272	90.0%
Other country	30	10.0%
Total	302	100%
Region (n %)		
Leeds	223	77.2%
Outside of Leeds	66	22.8%
Total	289	100%
Ethnic background (n %)		
White	283	93.7%
Mixed/Multiple ethnic background	6	2.0%
Asian/Asian British	7	2.3%
Black/African/Caribbean/Black British	3	1.0%
Other (Japanese, Vietnamese)	3	1.0%
Total	302	100%
IMD** (n %)		
1 st	85	28.2%
2 nd	59	19.6%
3 rd	30	10.0%
4 th	38	12.6%
5 th	46	15.3%
Unknown/Unclassified	43	14.3%
Total	301	100%

161 *Percentages may not add up to 100% due to rounding

162 **IMD –deprivation quintiles score neighbourhoods from 1st (most deprived 20%) to 5th
163 (least deprived 20%))

164

165 *Awareness of Change4Life 100 calorie snack campaign*

166 Just over half of the respondents (54.7%, n= 187, N=342) stated that they had come across the
167 C4L “100 calorie snacks, two a day max” campaign. When asked where they had seen or heard
168 the phrase ‘look for 100 calorie snacks, two a day max’, the most common responses were a
169 C4L leaflet (n=85, 27.4%, N=310) or a television advert (n=61, 19.7%). Other responses
170 included via social media advert (n=48, 15.5%), C4Lwebsite (n=45, 14.5%), radio advert
171 (n=24, 7.7%), in the supermarket (n=23, 7.4%) and ‘other’ (n=23, 7.4%), of which children’s
172 centres and school were most commonly reported. Most of the 183 respondents who reported
173 seeing the campaign, saw it 2-3 times (n=76, 41.5%). Some reported seeing the campaign 6 or
174 more times (n=36, 19.6%), whilst 9.8% (n=18) reported that they had never seen the campaign.
175 Over half of the 184 respondents to the question, reported seeing a leaflet about the campaign

176 (n=109, 59.2%), 137 of these also reported where they had seen it. Most reported at primary
177 school (n=86, 62.8%), other responses included: GP surgery/health centre (n=13, 9.5%), health
178 professional (n=10, 7.3%), library (n=7, 5.1%), children's centre (n=6, 4.4%) and leisure centre
179 (n=6, 4.4%).

180 ***Perceptions of 100kcal snack campaign***

181 The respondents were asked about their perceptions of the campaign through their agreement
182 with a series of statements (summarised in Figure 1). Over two thirds of respondents 'agreed'
183 or 'strongly agreed' that the campaign caught their attention (n=126, 69.6%, N=191). A similar
184 proportion 'agreed' or 'strongly agreed' that the campaign informed them about 100 calorie
185 snacks (n=117, 66.0%, N=177), and just over a half thought it was memorable (n=102, 54.4%,
186 N=180). Of the 179 respondents who completed the following questions, just under a third
187 'agreed' or 'disagreed' that the campaign was appealing (looked good) (n=114, 63.7%). A
188 small majority 'agreed' or 'strongly agreed' that it was convincing (n=104, 58.5%). Over half
189 of the respondents 'agreed' or 'strongly agreed' that the campaign made them think about
190 limiting high sugar and high fat snack foods for their child (n=106, 59.2%), and just under a
191 half of respondents 'agreed' or 'strongly agreed' that it made them think about dental decay in
192 their child (n=87, 48.6%).

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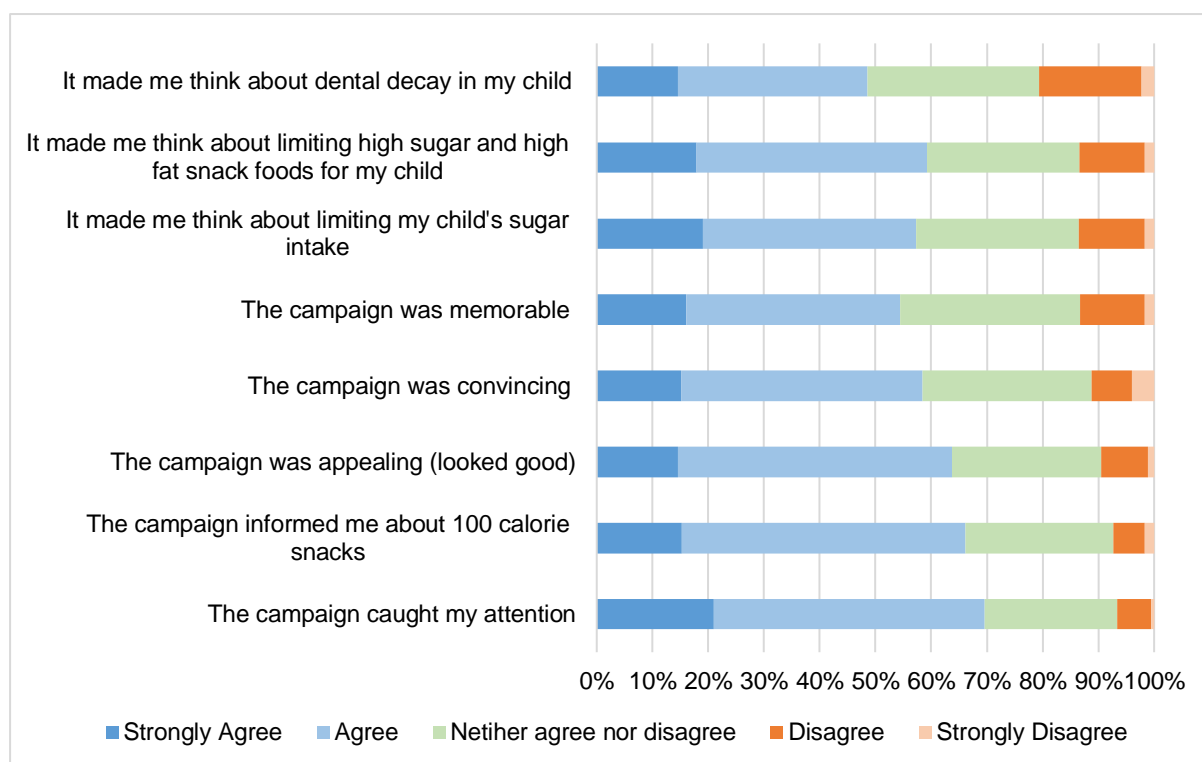
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199 **Figure 1:** Respondents' agreement with a series of statements about the campaign



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202 When the respondents were asked, ‘please tell us what you thought about the C4L 100 calorie
 203 snack campaign overall? 132 respondents provided a written response. Figure 2 highlights
 204 these perceptions. Just over half of these respondents used positive language to describe the
 205 campaign; describing it as good, very good, effective, useful, helpful or informative/interesting
 206 (n=77, 58.3%). For example: *“It was a brilliant help with snack ideas to give my children. It
 207 gave me a different variety of snack ideas which were very healthy for them”*; *“This campaign
 208 is a very good idea. It can help parents to care more about what their children eat.”*

209 A few respondents believed it was eye-catching, memorable and easy to remember. For
 210 example: *“The brightly coloured leaflet and posters draws people’s attention to it, so people
 211 are more willing to learn about the campaign and read the information”*. Others stated that
 212 they would like to have seen more examples of actual recommended snacks.

213 Furthermore, a few respondents reported a positive impact of the campaign, with improved
214 awareness of healthier nutrition and making healthier snack choices. For example: *"made me*
215 *really think about what I can give as snacks and trying new things"*. Some also reported that
216 their children were receptive to the campaign. For instance: *"It was appealing to my daughter*
217 *as she was able to make healthy choices in the supermarket"*. Conversely, some respondents
218 indicated their disagreement with the campaign messages focussing predominantly on calorific
219 content of snack foods, as well as perceiving poor suitability of snack examples. This is
220 illustrated by the following examples:

221 *"It is short sighted and unhelpful to suggest that low calorie snacks are the best snacks,*
222 *or that processed snack foods full of sweeteners are a good alternative to proper full*
223 *foods"*

224 *"I do not agree with the campaign. I give my child nutritious snacks. The calorific value*
225 *is not important. I do not want to teach my children to count calories, but to eat*
226 *intuitively"*

227 Some respondents also suggested recommendations for improvements to the campaign, for
228 example, increased promotion and more information on healthy snack choices, or for an
229 alternative focus. This is illustrated with the following quotations from respondents:

230 *"More information needs to be available on snack types and portion sizes"*

231 *"We should be promoting only fruit and veg as snacks"*

232 *"A low sugar campaign would be more apt as this is what causes obesity"*

233 ***About the 100 calorie snack information website***

234 The survey asked, 'did the campaign encourage you to search for 100 calorie snack information
235 on the website?', to which 78.3% (n=141, of N=180) reported that it did not. The majority of

236 respondents had not seen the 100 calorie snack information on the Change4Life website
237 (76.4%, n=136, N=178), indicating a clear lack of awareness of the 100 calorie information on
238 the website. The survey also asked ‘what did you think about the 100 calorie snack information
239 on the website?’ Twenty seven people commented, with a majority describing the website as
240 good, informative or just okay (as highlighted in Figure 2). Moreover, a few parents indicated
241 that the information on the website was helpful:

242 *“Good ideas for healthy snacks”*

243 *“Really like recipe ideas for lunchboxes”*

244 Respondents were asked for their agreement with a series of statements about the information
245 available on the C4L 100 calorie snack website. Of the respondents who completed these
246 statements (N=37 to 40), three quarters ‘agreed’ or ‘strongly agreed’ that the website informed
247 them about 100 calorie snacks (n=30, 77%). The majority agreed that the examples of snacks
248 were useful (n=34, 87%), but less than half agreed that the examples of snacks were easy to
249 make at home (n=18, 47%). Just over half agreed that the snacks were affordable (n=19, 51%),
250 and that their children liked the examples of snacks (n=19, 51%). Most ‘agreed’ or ‘strongly
251 agreed’ that the 100 calorie snack information was easy to understand (n=34, 85%) and nearly
252 three quarters ‘agreed’ or ‘strongly agreed’ that it helped them to understand what a healthy
253 snack looked like (n=28, 74%). Around two thirds reported agreeing or strongly agreeing that
254 the information helped them to find calorie information on packaging (n=25, 64%).

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262 *Perceived impact of the 100 calorie snack campaign on snacking behaviours*

263 There was no clear consensus of a perceived positive impact on healthier snack purchasing nor
264 preparing more 100 calorie snacks at home. However, there were some respondents who
265 reported making positive changes:

266 *“It made a huge difference to my family’s eating habits”*

267 Of the 40 respondents to complete the question, a similar number of respondents ‘agreed’
268 (n=10, 25%), ‘disagreed’ (n=11, 28%) or ‘neither agreed nor disagreed’ (n=13, 33%) that they
269 now buy more 100 calorie snacks when shopping. Of the 39 respondents who responded to the
270 question about whether they now prepare more 100 calorie snacks at home, a similar number
271 of respondents ‘agreed’ (n=11, 28%), ‘disagreed’ (n=9, 23%) or ‘neither agreed nor disagreed’
272 (n=14, 36%). Respondents did, however, report looking at the nutritional information on
273 packaging more frequently due to the campaign, for around a half (n=24, 52%) ‘agreed’ or
274 ‘strongly agreed’ that they now look for calorie information on packaging and just under two
275 thirds (n=24, 63%) ‘agreed’ or ‘strongly agreed’ that they now look at traffic labelling on
276 packaging.

277 When asked how many times in one day respondents give their child a snack (not including
278 fruit and vegetables), of the 318 respondents to the question, 1.7 (SD, 1.0) snacks were given.
279 When asked if the number of times they give their child fruit and/or vegetable based snack had
280 changed since seeing the campaign, the mean reported number of times they gave their child
281 fruit or vegetables as a snack in one day was higher at 2.0 (SD, 1.2). The survey also asked
282 about changes to snack consumption since the campaign. A much lower number of respondents
283 completed this question (N=65), as many had not seen the campaign. Nearly two thirds reported
284 no change (n=41, 63%), with only 11% (n=7) reporting it had decreased. Most of the 65
285 respondents to the question ‘has the number of times you give your child fruit or vegetables as

286 a snack changed since the campaign?’ reported that it had stayed the same (62%, n=40), with
287 only 15% reporting an increase in fruit and vegetable consumption (n=10).

288 *Improvements and recommendations to the campaign*

289 When asked about their perceptions around improvements to the 100 calorie snack information
290 (for example type of information, how it looks, where you find it), 89 respondents provided a
291 written response. Around half of the comments related to better advertising and publicity
292 around the campaign. Some examples were provided, and included mainly delivering through
293 educational settings (school, nurseries), social media, television/radio and at supermarkets.
294 Figure 2 highlights these perceptions.

295 Around a quarter of respondents suggested improvements to snack products. Some comments
296 related to improved healthiness of snack food ideas, with a handful of respondents disliking
297 artificial sweeteners in low sugar and low fat examples, with a preference for real whole foods.
298 For example:

299 *“Sugar free items that are sweet are full of other chemicals which I prefer not to give*
300 *my child. It would be better to suggest snacks that are made from non 'snack foods'*
301 *already in the house, like a small peanut butter sandwich on wholemeal bread, which I*
302 *suppose might be more than 100 calories depending on how its made, so advice on this*
303 *type of snack would be useful”*

304 Several wanted more specific ideas for healthier snacks, with examples being more visible in
305 the campaign. A few comments related to improved labelling of products, to make it clearer
306 which products meet the 100 calorie guidelines, for example:

307 *“It might be helpful...if there was something indicating snacks that are under 100*
308 *calories on the shelves. It would possibly lead to people making more informed choices*
309 *for snacks and lunchbox fillers”*

310 Several respondents disliked the target message of calories, occasionally perceiving calorie
311 counting to be ill-advised for children, preferring an alternative focus on overall healthiness of
312 diet, for example:

313 *“Don't focus on calories - it's not health ...would it not be better to have categories...we*
314 *have allergy children (dairy and egg so focus on healthy snacks for calcium, iron,*
315 *iodine, zinc, etc). We need to step away from quantifying the item and look at the*
316 *quality”*

317 Some thought focussing on sugar content or portion sizes could be more suitable. A few
318 comments also related to making the campaign more appealing to children, through use of
319 apps, games, posters with tick boxes for when a snack is eaten, for example:

320 *“Top trump cards for children to play with categories such as 'sugar content, calories,*
321 *dental health' values”*

322 ***Supporting parents to provide healthier snacks for their children***

323 Respondents were asked how they would like to be supported to provide healthier snacks for
324 their children. One hundred and twenty four respondents commented. Around a quarter of
325 comments related to strategies for improved access to healthier snacks in supermarkets/shops.
326 These included more availability and choice of healthier snack products (low sugar, low salt,
327 low fat) and improved display of healthier products (less visibility of high sugar high fat
328 options), for example:

329 *“Create isle ends - dedicated areas for healthier snacks in supermarkets”*
330 *“Supermarket to make a specially selected snack items corner with free tasting*
331 *samples”*

332 Respondents desired better promotion of and more information on low sugar, low fat, low salt
333 options in supermarkets and shops, as well as increased availability of healthier options at other
334 venues such as cafes, leisure centres, vending machines, cinemas, theme parks etc. Others
335 desired increased availability of cheaper, low sugar and low fat snack options and fruits and
336 vegetables and money-off vouchers for healthy foods made available. For example:

337 *"I can easily find whole isles of chocolate and crisps, but healthy crackers for example*
338 *are hard to find and expensive"*

339 *"Should be more fresh fruit and healthy snacks on offer at cinemas, theme parks, child*
340 *friendly outings"*

341 Some wanted clearer nutritional information labelling on packaging, particularly calories and
342 sugar, portion sizes and allergen information. Others discussed the need for tighter restrictions
343 on marketing of high sugar high fat items to children, with television characters used for
344 promoting healthier snack items, for example:

345 *"Child friendly packaging and more obvious sugar warning signs"*

346 *"Ban food manufacturers from promotions with toy/tv/film characters/companies*
347 *unless it's a healthy snack"*

348 Some respondents perceived that schools or nurseries would be useful environments for
349 targeting children, by improving packed lunches (for example with prizes for best lunchbox),
350 providing healthier meals, and restricting sales and provision of high sugar, high fat items on
351 site and creating more opportunities for children to try new healthier foods. For example:

352 *"Schools should take on board the information as my child is given high calorie snacks*
353 *in the form of cupcakes/sweets provided as a reward for good behaviour or*
354 *volunteering"*

355 *“Schools to follow their healthy campaigns through by looking at the sugar/fat content*
356 *of their school dinners better. Nurseries to have better training/guidelines on healthy*
357 *options for children”*

358 Around a quarter of respondents wanted improved guidance and information on healthier snack
359 provision for their children. Many of which related to more information on healthy snack
360 choices (low sugar mainly), for example healthy carbohydrate based snacks, suitable easy ideas
361 and recipes for children, such as sugar free treat recipes, and also ideas that can be prepared
362 and stored in advance. Providing information (for example a list of healthy snacks ideas) by
363 emails, leaflets, Apps, or on a snack chart was recommended. A few wanted reminders around
364 eating healthily as well. Several wanted ideas on how to encourage fussy eaters to eat more
365 healthily with filling low sugar tasty options. For example:

366 *"sometimes it is hard as a parent to encourage your child to eat healthier - my youngest*
367 *would choose a sugary treat over something healthier although does try"*

368 *“Hints and tips on how to encourage children to try healthy foods”*

369 *" A campaign that shows me the products so it is quick and easy to identify when*
370 *shopping or ordering online”*

371 The survey then asked how they would like information about healthy snacking to be provided.
372 Ninety three respondents provided a written response. Many comments related to preferred
373 methods for delivery of information, with ‘through school’ being the most popular. Other
374 suggestions included via TV advertising (or radio for older generations), emails and websites,
375 social media, applications on mobile phones, in supermarkets or stores and leaflets. Some also
376 commented on the need for clearer nutritional labelling on product packaging, regarding the
377 healthiness of products, for example clear labelling at the front of the package showing

378 important nutritional information that can be easily and quickly interpreted, e.g. through traffic
379 light labelling.

380 *"Make it statutory for price labelling as well as packaging to be given the same green*
381 *light logo to make it stand out more".*

382 *"Traffic lights easy to view at a glance to make quick decision. Not much reading done*
383 *by colour"*

384 There was also a suggestion for traffic light labelling to extend to take-away packaging and for
385 artificial sweeteners to be clearly labelled on packaging. A few expressed the difficulty with
386 knowing what healthy snacks to give to children and thus wanted ideas for healthy snacks, easy
387 to follow and easily accessible recipes (e.g via App), that children can also follow as well.

388 **Acceptable initiatives to support parents to choose healthier snacks for their children**

389 The survey presented a list of strategies for providing more 100 calorie snacks for children and
390 respondents were asked to select which ones were most acceptable to them (see the full survey
391 in the supplementary materials). Respondents were able to select as many strategies as they
392 wished. Of the 550 statements selected, the most popular strategy was a sticker or logo that
393 states the following product meets the 100 calorie guidelines (n=192, 34.9%), followed by
394 more products in 100-calorie portions (n=164, 29.8%) and easier labelling on which products
395 are 100 calories (n=161, 29.2%). A few comments related to focussing less on calorie content
396 of pre-packaged snacks, but rather providing ideas for healthier snacks made from ‘real whole
397 foods’ (as opposed to processed items), appropriate portion sizes, and other alternative ideas to
398 just fruit and vegetables for snacks. For example:

399 *“I have seen snacks advertising that they have less than 100 calories but they aren’t*
400 *necessarily healthy e.g. crisps or iced gems... But I wish there were more easy, low*
401 *sugar, healthy options”.*

402 *“Ideas above seem to be focussed on pre-packaged / processed foods which I would*
403 *prefer to avoid, so more ideas about home-prepared snacks or portion sizes eg of*
404 *crackers, breadsticks, hummus etc.*

405 Respondents could also select from lists of initiatives to help parents provide healthier choices
406 for their children, which would be most acceptable to them (they could select as many options
407 as they wished, 822 statements were selected). The most popular strategies were ‘healthy snack
408 ideas that are easy to prepare (n=241, 29.3%) and ‘making healthier products cheaper than less
409 healthy ones’ (n=231, 28.1%); followed by ‘providing fruit and vegetables that are more
410 affordable’ (n=190, 23.1%) and ‘all packaged products using traffic light labelling’ (n=146,
411 17.8%). Of a list of further strategies presented (300 statements selected), the most popular
412 strategy was ‘replacing unhealthy products near the checkouts with healthier ones’ (n=87,
413 29.0%). Similar lower proportions of respondents preferred the following strategies: ‘changing
414 ingredients in food gradually so people don’t notice a change in taste’ (n=53, 17.7%), ‘changing
415 ingredients in food to reduce the calories or amount of sugar, though this may change the taste
416 of the product’ (n=52, 17.3%), ‘reducing the size of the unhealthy products and keeping the
417 same price’ (n=48, 16.0%) and ‘reducing the size of unhealthy products and reducing the price’
418 (n=47,15.7%).

419 Other recommendations (n=27) included the following: cheaper, healthier, age appropriate
420 options for children; greater availability of healthier snacks; snacks that stay in date for longer;
421 more affordable fruit and vegetables in good condition; make foods more natural and less
422 sweet; sugar free snacks not full of additives or sweeteners; make healthier products taste good

423 for children, including more “kid friendly” vegetable foods; “grab and go” ideas that do not
424 need preparation; suggestions for filling meals to prevent snacking; fruit and vegetable snacks
425 beside tills; Change4Life tuck shop in schools; more recyclable packaging. Ideas for other more
426 top-down approaches included: limit snack calorie sizes by legislation; regulate advertising of
427 HFSS foods aimed at children and advertising aimed at grandparents about healthy
428 eating/snacking.

429 **Discussion**

430 To the authors knowledge, this is the first study to explore parents’ perceptions of the C4L 100
431 calorie snack campaign, and to explore its perceived impact on snack intake in families.
432 Previous evaluations of social marketing interventions targeted at adults[34, 35] and
433 children[36], suggest that they are a good approach to share information. Our findings indicate
434 a moderate awareness of the C4L 100 calorie snack campaign, (just over half of respondents),
435 with many of those stating that they had seen the C4L leaflet or a television advert at least once.
436 There was a greater awareness of the campaign in our sample than indicated in an earlier online
437 panel survey, commissioned by PHE in January 2018 [30], where only a third of their sample
438 reported being aware of the phrase ‘look for 100 calorie snacks, two a day max’ (n=47
439 respondents aged 16-75 years). Awareness of the broader C4L campaign has been reported to
440 be greater in a previous cluster-based randomised controlled trial examining its impact on
441 parents’ attitudes and behaviours about their childrens’ eating and activity (75% at
442 baseline)[27]. The lower level of awareness of the 100-calorie snack campaign overall in our
443 sample may be attributed to the small timeframe for mass media campaign promotion (only 2
444 months). Most respondents agreed that the campaign caught their attention, had informed them
445 about 100 calorie snacks and that they thought it was memorable. Such findings are positive
446 since well-performing campaigns and adverts are attention-grabbing and stand out against a
447 crowd of other information[37]. Many respondents agreed that the campaign made them think

448 about limiting high sugar and high fat snack foods for their child, and just under a half agreed
449 that it made them think about dental decay in their child. Such findings are in line with other
450 studies of social marketing campaigns that have found positive effects on attitudes towards
451 target behaviours [38], including an evaluation of the C4L smart-swaps campaign [39]. By
452 encouraging parents and carers to think about the foods they are giving their children, the
453 C4L100 calorie snack campaign may also help to strengthen intentions to alter behaviour and
454 increase the likelihood of achieving new, healthier snack behaviours [40].

455 Although some respondents stated that the C4L website had improved their awareness of
456 healthier snacks, most respondents indicated that they were not aware of the campaign website
457 and were not aware of the 100 calorie information available on the site. As levels of behaviour
458 change have been correlated with campaign exposure [36], this finding may suggest that more
459 emphasis on campaign dissemination and/or promotion is needed. The increased promotion
460 was also supported by respondents in their comments about improving the campaign.
461 Furthermore, the 40 respondents that reported their perceptions of the 100 calorie website
462 information, mainly agreed that the website information was easy to understand and it helped
463 them to understand what a healthy snack looked like, and the examples of snacks provided
464 were useful, indicating that increased publicity and signposting to the website information and
465 specifically the snack examples, would be beneficial. As only around half thought that the
466 snacks were easy to prepare at home or affordable, perhaps some modifications to the snack
467 examples need to be made to provide a larger range of affordable and easily prepared examples.
468 In terms of the perceived impact of the campaign information on family snack habits, there was
469 no clear consensus of a perceived positive impact on healthier snack purchasing nor preparing
470 more 100 calorie snacks at home. This supports previous research indicating that the C4L mass
471 media campaign had little impact on attitudes or behaviours towards healthy eating [27]. Whilst
472 some respondents stated that they had increased the frequency with which fruit and/or

473 vegetables were given to children as a snack since seeing the campaign, many reported no
474 change. Whilst the characteristics of the respondents in each group were not explored, previous
475 research indicates that short term behavioural changes to health campaigns occur mainly in
476 highly motivated individuals [41]. Respondents did however report looking at nutritional
477 information on packaging more frequently due to the campaign which could result in positive
478 changes to intake in the longer term.

479 The qualitative findings from the survey indicate that most parents and carers were positive
480 about the campaign. However, some indicated concern about the focus on calories over health,
481 the lack of consideration of the variable nutrition needs across children, and the poor suitability
482 of snack examples. Other comments relating to improvements to the campaign included more
483 specific ideas for healthier snacks and consideration of appropriate portion sizes for children.
484 Some respondents stated that additional strategies should be considered such as improved
485 access to and marketing of healthier snacks in supermarkets and shops and clearer nutritional
486 labelling. Research has shown in-store strategies such as modifying product availability,
487 placement and promotion are effective in reducing sales of unhealthy discretionary foods (3–
488 5).

489 Findings from this study point to the following recommendations to policymakers, food
490 manufacturers and intervention developers. The recommendations are based on the aspects of
491 the C4L campaign that parents found most useful and also those aspects that they found were
492 lacking. Some of the recommendations provided were explicitly stated by parents, others were
493 developed by the research team based on the analysis of the overall survey data set and through
494 reflection of this data with previous research.

- 495 1. Inclusion of specific ideas for healthy options on marketing material (leaflets, advert,
496 websites) which should be well distributed and publicised

- 497 2. Make the campaign more appealing to children through the use of child-friendly
498 materials, recommended examples include apps, games, posters and healthy snack
499 charts.
- 500 3. Improved marketing of healthier (low sugar, low fat, low salt) foods and drinks
501 targeting children, with use of popular television characters to promote healthier
502 options.
- 503 4. More information on healthy snacking made available to parents through a range of
504 media, delivered through school/educational settings, online (emails, Apps, websites),
505 TV/radio advertising, social media, supermarkets (posters, leaflets) and leaflets.
- 506 5. Include easily accessible, child-friendly recipes, that are easy and quick to prepare, as
507 well as low sugar recipes and recipes using whole foods rather than processed foods.
- 508 6. Clear nutritional labelling on the front of packaging, (including calories and portion
509 size). Easy and quickly interpretable indicators of healthiness (sugar, fat, salt) of the
510 product, for example through universal traffic light labelling on all packaging. Traffic
511 light labelling should be extended to fast food/take-away outlets. Additionally labelling
512 on which products meet the 100 calorie snack guidelines would be beneficial.
- 513 7. Provide a larger range of more healthful products in 100 calorie portions.
- 514 8. Increased availability of more affordable low sugar, low fat, low salt options, including
515 more fruit and vegetables in food outlets. Money-off vouchers for healthier options
516 could be useful. Increased availability of healthier (low sugar, low fat, low salt)
517 products at venues such as cafes/restaurants and recreational venues etc.
- 518 9. Support parents to make healthier choices for their children by improving visibility and
519 promotion of healthier snacks with improved displays, for example place healthier
520 snacks and fruits and vegetables at the checkouts, end of isles, in designated sections,

521 clearly labelled as healthier options. Less visibility of high sugar, high fat, high salt
522 options.

523 **Strengths and limitations**

524 Whilst the study provides important and unique insights of the perceptions, awareness, and
525 potential impact of the C4L 100 calorie snack campaign, which are of interest to policy makers
526 and researchers, it is not without limitations. First, whilst efforts were made to recruit a diverse
527 population of parents and carers from across the UK, the sample was predominately from the
528 north of the UK, most were white females and of a high educational level. The proportion of
529 respondents from the 20% most deprived areas was however similar to the national average.
530 As such the findings may not be wholly representative of the perceptions of the whole UK
531 population, and lack representation from fathers and communities of lower socio-economic
532 status and varying ethnic backgrounds. Establishing key contacts working in diverse
533 communities to support promotion of the survey (for example a council public health team)
534 could help overcome this in future research. Respondents were asked to self-report dietary
535 intake and changes to dietary intake, which can be compromised by self-report bias [42].
536 Moreover, as behaviour change is typically a slow process, it is important to assess the impact
537 of the C4L 100 calorie snack campaign, and related initiatives over a longer follow-up period.

538 **Conclusion**

539 This study indicates that although around half of the sample had some awareness of the C4L
540 100 calorie snack campaign, many respondents indicated that the campaign materials had little
541 impact on attitudes or behaviours related to their children's snacking. Some suggestions for
542 improvements to extensions of the C4L 100 calorie snack campaign were provided to create
543 long term behaviour change. For instance, some families welcomed additional development of
544 children's nutrition interventions based on the C4L 100 calorie snack campaign including clearer

545 advertising towards health snacks and labelling and promotion of healthy snack ideas for
546 children. Such insights could help to increase the long term impact of this campaign and
547 improve the success of future children's nutrition interventions. Future social marketing
548 campaigns could be improved through the use of more formal pilot testing to assess the
549 understanding and acceptance of the campaign amongst the target audience. Further research
550 is needed to explore the perceptions of the C4L 100 calorie snack campaign amongst a broader
551 spread of the population, including children.

List of Abbreviations

UK: United Kingdom; NCMP; National Child Measurement Programme; NDNS: National Diet and Nutrition Survey; C4L; Change4Life; PHE: Public Health England; NCDs: Non-communicable diseases; IMD: Index of Multiple Deprivation; App: Application on a mobile device.

Declarations

Ethics approval and consent to participate

Ethical approval was provided by Leeds Beckett University School of Clinical and Applied Sciences ethics review committee (reference number 54329). All respondents were asked to read an information sheet and sign a consent form prior to taking part in the survey.

Consent for publication

Although no identifiable data is presented in the manuscript, as part of the information sheet and consent form, survey respondents were asked to provide consent for the use of their data in the publication. **Informed consent was obtained from all subjects.**

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

RED and MC conceived and managed the project. RED, GB, MSC, KA and HE developed the research proposal and survey. RD and GB analysed the survey data and drafted the manuscript. All authors (RED, MC, GB, KA and HE) read and approved the final manuscript.

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