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What features of a nutrition resource are important to adolescents of a low socioeconomic status?

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1 **What features of a nutrition resource are important to adolescents with a low socioeconomic**
2 **status?**

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22 None.

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24 HS made substantial contributions to the background research, development of interview questions,
25 project design, obtaining ethical approval, recruitment, data collection, data analysis and
26 preparation of this article. CC initiated this project and supported with the development of the
27 interview questions and review of this paper. LCAC made substantial contributions to the
28 background research, development of interview questions, project design, obtaining ethical
29 approval, data analysis and review of the article.

30 **Ethical Standards Disclosure:**

31 This study was conducted according to the guidelines laid down in the Declaration of Helsinki and
32 all procedures involving human subjects were approved by the University of Aberdeen Rowett
33 Ethics Review Panel. Written informed consent was obtained for all subjects.

1 **Abstract:**

2 *Objective:* To identify the key features of a nutrition resource that are important to adolescents with
3 a low socioeconomic status.

4 *Design:* Structured interviews were conducted to explore participants' preferences relating to
5 features of a nutrition resource. Thematic framework analysis approach was used to determine key
6 themes, subthemes and concepts from the data.

7 *Setting:* Streetsport activity sessions, North East of Scotland.

8 *Subjects:* 18 adolescents aged 12-17 years, from a low socioeconomic background.

9 *Results:* The overarching themes identified were barriers and facilitators to engagement with a
10 nutrition resource. Adolescents expressed a preference for an app and this was mainly attributed to
11 convenience and low cost. There was also an emphasis on the integral role social media has in their
12 lives. Aesthetics was a facilitator for both male and female participants, with a particular focus on
13 weight loss. Behaviour change support including reminders, access to simple recipes and adopting a
14 'small change approach' were identified as possible facilitators whereas cost, environmental
15 influences and existing eating habits were identified as possible barriers to engaging with a nutrition
16 resource.

17 *Conclusions:* A number of subthemes, including aesthetics, cost and convenience, which have
18 previously been reported in adolescents with a higher socioeconomic status, were prominent in our
19 research. The present study contributes to insights relating to behaviour change tools which should
20 be considered when developing a nutrition resource targeting disadvantaged adolescents. Further
21 research focusing on how mobile phone technology and social media can be utilised to support
22 dietary behaviour change in low SES adolescents is recommended.

23

24 **Keywords:** Adolescents, low socioeconomic status, nutrition, healthy eating, resource, app

25 **Introduction:**

26 During adolescence independence is established, and this is often accompanied by changes in eating
27 practices⁽¹⁾. With this, just 8% of UK adolescents are achieving the recommended 5 portions of fruit
28 and vegetables per day⁽²⁾, and the most commonly purchased foods in this age group include
29 confectionary and sugar sweetened beverages⁽³⁾. This is of particular concern because dietary habits
30 established during adolescence often continue into adulthood⁽⁴⁾ and poor diet is strongly related to
31 chronic diseases including diabetes, cancer and cardiovascular disease⁽⁵⁾.

32
33 It is well documented that those with a lower socioeconomic status (SES) have a higher risk of poor
34 nutrition than their wealthier peers⁽⁶⁾. Those with a low SES typically consume more discretionary
35 foods and less fruit and vegetables⁽⁷⁾. These poor food choices parallel health inequalities, which are
36 highlighted by the existence of significant socioeconomic differences in the rates of obesity and
37 chronic diseases⁽⁸⁾. In Scotland, children and adolescents in the most deprived areas have a greater
38 risk of obesity in comparison to their age matched peers in the least deprived areas⁽⁹⁾, and this
39 translates to 22% and 13% respectively. Additionally the NHS have reported that 26% of 15 year
40 olds from the most deprived areas have extensive tooth decay compared to 12% of 15 year olds who
41 are not eligible for free school meals⁽¹⁰⁾. Consequently there is a 3 fold increased risk in adult
42 periodontal disease and caries in low versus high childhood SES groups⁽¹¹⁾.

43
44 There have been multiple policies introduced to address poor nutrition in children and adolescents
45 in Scotland. Schools are now legally bound to meet minimum nutrition standards⁽¹²⁾, whilst health
46 education and promotion is regarded as mandatory⁽¹³⁾. Nonetheless 33% of Scottish adolescents
47 aged 12-15 years remain at risk of overweight and obesity⁽¹⁴⁾. This figure has fluctuated since 1998,
48 but there has not been significant reductions in the proportion of children and adolescents who are
49 at risk of overweight (including obesity), and socioeconomic discrepancies relating to diet
50 continue⁽¹⁵⁾. Published literature supports the theory that increased knowledge is not sufficient to
51 change behaviour⁽¹⁶⁾, as demonstrated in a Scottish study which found that an education
52 intervention increased knowledge but failed to elicit dietary behaviour change in school-aged
53 children⁽¹⁷⁾.

54
55 The use of technology based health promotion is increasing amongst adolescents, and this has been
56 referred to as a 'new channel' to illicit health related behaviour change⁽¹⁸⁾. Given the increased
57 reliance on the internet in the adolescent population, there is a need to determine how healthy eating
58 behaviour can be promoted using online tools⁽¹⁹⁾. Research conducted in America has demonstrated

59 effective behaviour change for both diet and physical activity in adolescents following on from
60 interventions with an online resource^(20,21). Nonetheless, there is limited research in this area in the
61 UK. The current study sought to investigate key features of a nutrition resource that are important to
62 adolescents with a low SES, and also aimed to determine if electronic media is an acceptable format
63 for delivering nutrition information to this group.

64 **Methods:**

65 The present study partnered with the Denis Law Legacy Trust, a not for profit charity operating in
66 Aberdeen City, North-East Scotland⁽²²⁾, providing a range of free sport (e.g. football, basketball,
67 tennis, netball, dance, street games, based on demand) and creative activity sessions to children and
68 adolescents in deprived areas as part of the Streetsport initiative. These work on a pop-up basis,
69 with Streetsport bringing equipment to different sites across the City. Young people participate in a
70 drop-in fashion based on word of mouth, advertising via social media, posters, leaflets, website,
71 local community groups, or referral via school or social workers. The research was conducted
72 across 3 Streetsport sites in Aberdeen City; Northfield, Torry and George Street. These locations are
73 classified within the top 20% most deprived areas in Scotland in accordance with the Scottish Index
74 of Multiple Deprivation (SIMD)⁽²³⁾, the Scottish Government's tool for identifying areas of
75 deprivation based on postcode.

76
77 A review of literature and a series of discussions between the research team and stakeholders with
78 relevant experience including public health, education and academic professionals as well as
79 Streetsport staff, informed the development of structured interview questions. The researcher also
80 volunteered at Streetsport for 8 weeks prior to data collection, enabling them to gain familiarity
81 with the adolescents and vice versa, establishing a rapport and trust, which is considered a suitable
82 approach for hard-to-reach groups⁽²⁴⁾.

83
84 Recruitment took place at Streetsport sessions. One week prior to data collection potential
85 participants were approached by the researcher (HS) who explained the study and provided them
86 with an information sheet. Those under the age of 16 were also provided with an information pack
87 for their parents.

88
89 In order to participate in the study, those aged 12-15 years were required to return a signed parental
90 consent form. Prior to data collection they were asked to complete an assent form. In line with age
91 of ethical consent in Scotland, those aged 16-17 years were asked to give signed consent themselves
92 before taking part.

93
94 Data collection took place in May 2017 and June 2017. Structured face to face interviews were
95 conducted by HS at Streetsport sessions. This was seen as the most appropriate location and method
96 of data collection because low response rates are a particular challenge in this group⁽²⁵⁾, and
97 reducing participant burden was prioritised. The interviews encompassed 5 main topics outlined in
98 table 1. Questions were typically open ended with visual prompts to support (Supplementary data).

99 This method was chosen to elicit in depth views from the adolescents. However, due to the setting
100 audio recording was not possible and therefore all answers were written down by the researcher.
101 SES was determined by postcode using SIMD 2016⁽²³⁾.

102

103

104 Data was analysed using a 'Framework' approach, as described by Spencer *et al.* (2010)⁽²⁶⁾,
105 allowing for comparison in responses across subgroups. The responses were read by two
106 researchers (HS, a MSc Human Nutrition student with an interest in health and fitness and LCAC, a
107 researcher with a background in Health Sciences and Public Health Nutrition) who identified
108 themes and subthemes reflecting all the responses, and met to discuss their independent analysis of
109 the data. The participant responses were coded against the subthemes using Microsoft Excel.

110 **Results:**

111 A total of 55 participants were given information sheets during the recruitment phase; 22 aged 16-
112 17 years and 23 under the age of 16. Eighteen adolescents participated in this study (33%); 10 males
113 and 8 females, the majority of whom (n=16) were aged 16-17 years and most of them (n=14) lived
114 in the most deprived SIMD areas 1 and 2 (see table 2 for detailed demographics). Five participants
115 were volunteers at Streetsport, but had previously been participants and wanted to continue to
116 attend the activity sessions.

117
118 The overarching themes identified were barriers and facilitators to engaging with a healthy eating
119 resource. Emergent subthemes were identified along with key concepts, illustrated in figure 1. Cost
120 and convenience were both prominent emerging subthemes considered as both barrier and
121 facilitator. Barriers identified included existing unhealthy eating habits and environmental
122 influences, whereas facilitators included aesthetics, health and fitness, communication with peers,
123 behaviour change, developing knowledge of healthy eating, and additional engaging features. These
124 emerged from the researchers' interpretation of the data in the context of the aims of the study and
125 were partly driven by the questions asked.

126
127 **Cost**

128 Cost was identified as a prominent emerging subtheme linked to both barriers and facilitators.
129 Providing a resource that is free was important to participants, whilst paying to access a nutrition
130 tool was not considered a priority:

131 *'There are other resources that are free so why spend money when you don't have to.'* (P02, female,
132 17 years)

133 Participants perceived healthy foods as expensive whereas less nutritious foods were considered
134 cheap. There was reference to the cost of food being a barrier to engaging with a nutrition tool
135 because this factor alone strongly influences their current food choices:

136 *'The cost of healthy food is expensive. Salad vs burger in McDonalds. I always go for the cheaper*
137 *option'.* (P08, female, 16 years)

138 Additionally, participants felt that the cost of healthy food prevented them from relating to famous
139 role models because they are wealthier and can afford healthier foods:

140 *'They (celebrities) have money to eat better and to have personal trainers and I don't. Healthy*
141 *food is expensive'.* (P05, female, 17 years)

142 On the other hand, participants discussed what they liked most about the apps they are currently
143 using. Free access was an important feature, and therefore cost was also identified as a facilitator to
144 engaging this group with a nutrition resource:

145 *'They (apps) are a free way to speak to folk.'* (P15, male, 16 years)

146

147 **Convenience**

148 One of the most prominent subthemes to emerge was convenience, with time, accessibility and ease
149 identified as important concepts. When asked if there was anything that would prevent participants
150 from using a healthy eating resource, there was an emphasis that time is a barrier, with other things
151 taking priority:

152 *'I go to work early and come back late. I don't have time to read stuff on healthy eating.'* (P15,
153 male, 16 years)

154 Although, this was not just the case for the older participants, indeed, one of the participants, who
155 was under the age of 16, said 'I don't have a lot of free time' and for this reason she reported that
156 she would not engage with a healthy eating app but instead she would prefer an interactive learning
157 session. However, this was not the reported preference for the other participant under the age of 16.
158 Additionally, when discussing the content of a nutrition tool it was common for participants to
159 mention that time was a limiting factor and that they would not want anything that 'takes too long'.

160 On the other hand, time was also identified as a facilitator, and this was apparent when participants
161 described an app as their preferred format for a nutrition tool:

162 *'Apps are quick and you can use them at any time.'* (P03, male, 16 years)

163 The accessibility of apps and the ability to use them anywhere at any time was also a significant
164 feature that participants made reference to, and was identified as both a barrier and facilitator to
165 engaging participants with a nutrition tool. This response was typical:

166 *'An app would be good because you have your phone on you all the time and can use it whenever or
167 wherever.'* (P04, female, 16 years)

168 On the other hand, the majority of those who did not choose an app as a preferred method made
169 reference to having limited data storage on their phones, which would make an app less accessible.
170 These participants had a preference to using either a website or television as a source of nutrition
171 information and again ease of access was a facilitator:

172 *'Websites are easy to access, apps take up storage.'* (P03, male, 16 years)

173 *'I watch TV every night. It doesn't need effort.'* (P15, male, 16 years)

174 When asked what participants liked about the apps they are currently using they described them as
175 'easy to use' and 'easy to look at', and it was apparent that using their phones was effortless:

176 *'My phone is always with me. It's easier, I can use 4G wherever I am.'* (P08, female, 16 years)

177 Features such as taking photographs of foods eaten were also viewed as an easy option and were
178 considered an appealing feature to some participants:

179 *'Taking photos would be easier. My phone is always on me and I can take photos wherever.'* (P10,
180 female, 16 years)

181 However, there were mixed views on this and those who did not want to take photographs of their
182 food also spoke about ease, with one participant saying 'it's easier to write'.

183

184 **Existing unhealthy eating habits**

185 Existing unhealthy eating habits were mentioned throughout the interviews and there was a general
186 consensus that there are 'lots of unhealthy options' available, which could prevent participants from
187 engaging with a nutrition tool. Meal skipping, in particular breakfast, was discussed:

188 *'It's the only time I eat during the day (lunch). I don't eat breakfast.'* (P02, female, 17 years)

189 Moreover, it was common for participants to make reference to their poor food choices during their
190 lunch break. Consequently, there was an interest in learning more about how to make healthier food
191 choices at lunch time. This example was typical:

192 *'I normally eat bad at lunch, there are lots of unhealthy options and I never think to have healthy
193 food.'* (P09, female, 16 years)

194

195 **Environmental influences**

196 Participants acknowledged that the environment encourages the purchase of unhealthy foods and
197 this was seen as a barrier that may prevent them from engaging with a healthy eating resource. One
198 participant felt that 'the food around you stops you focusing on being healthy'. In agreement with
199 this, advertisements were also considered a barrier:

200 *'You see a new food and immediately want to try it even when it's unhealthy. Even if you don't want
201 to eat bad seeing the advert will make you want to try it.'* (P03, male, 16 years)

202

203 **Aesthetics**

204 Aesthetics was a prominent subtheme and was considered a strong motivator for participants when
205 discussing engagement with a nutrition tool. Weight and body image were frequently referenced,
206 and this was common in both male and female responses:

207 *'I feel better when I lose weight, I have more friends when I am thinner.'* (P10, female, 16 years)

208 This focus on body image was also apparent when participants were asked about their thoughts
209 relating to the use of celebrities as a role model for healthy eating:

210 *'If a celebrity had a nice body this would motivate me. I want a nice body, I would focus on weight.'*
211 (P04, female, 16 years)

212 In addition to body image, participants made reference to how their teeth look. It was viewed as
213 important to not have 'rotten teeth' and making healthier choices, such as choosing sugar free
214 drinks, was mentioned. Participants reported that they would want to learn more about how food
215 affects your teeth:

216 *'It looks good to have healthy teeth and a nice smile.'* (P08, female, 16 years)

217

218 **Health and fitness**

219 Throughout the interviews health and fitness was commonly discussed, with sport, feeling good and
220 having a healthy diet identified as the main concepts. Improving fitness was important and was a
221 prominent subtheme that emerged during interviews with male participants, and was occasionally
222 referenced in the responses of female participants:

223 *'Healthy eating would help to run well for football.'* (P08, female, 16 years)

224 *'I would want to learn more to get better at rugby and football.'* (P17, male, 17 years)

225 Additionally, it was common for participants to make reference to the relationship between a
226 healthy diet and feeling good, and this was viewed as a motivator to improving food choices:

227 *'If you feel good from eating better you would stick to it, otherwise you wouldn't.'* (P15, male, 16
228 years)

229 In general, there was a positive attitude towards having a healthy diet amongst participants, and all
230 but 4 participants reported that they would be interested in learning more about nutrition. Those
231 who did not want to learn more either attributed this to time and cost or they felt they already had
232 adequate knowledge of what foods are good for you with one participant saying 'I already know
233 what to do, eat well to move well'. When discussing food swaps to enable a healthier diet, there
234 were some participants who reported they would choose the healthiest option imminently:

235 *'I would chose fruit because it's the healthiest option so may as well go for that one.'* (P12, male,
236 16 years)

237 Additionally, some participants reported that they are currently trying to improve their diet:

238 *'I would set healthy eating targets. I did it today. I wanted to have the healthier option today. When*
239 *I was offered fizzy juice I asked for water.'* (P06, female, 13 years)

240 However, others preferred to make smaller changes and this is discussed later under 'behaviour
241 change'.

242

243 **Communication with peers**

244 All but one participant reported using some form of social media, which was described as being a
245 'good way to stay connected'. The participant who did not report currently using social media was
246 under the age of 16 and reported that her phone was broken. There was a strong emphasis on the
247 importance of communicating with friends, and this was an attractive feature of their current apps:

248 *'Apps keep you connected with friends, you can talk to them all the time and see what they are*
249 *doing.'* (P04, female, 16 years)

250

251 **Behaviour change**

252 Throughout the discussions, participants inferred that behaviour change support was an important
253 feature of a nutrition resource. This was reported across the age groups and in both males and
254 females. It was apparent that setting nutrition related targets was viewed as an effective approach:

255 *'That would help (setting healthy eating targets) because if you set targets it will help you with*
256 *eating healthy in everyday life.'* (P18, male, 16 years)

257 Additionally, reminders related to healthy eating targets were viewed as an important feature of a
258 nutrition resource since it was common for participants to reference healthy eating as something
259 that is 'easy to forget':

260 *'I would like this because it would stop me forgetting. It's easy to forget to eat well.'* (P06, female,
261 13 years)

262 When asked for their own views on what features of a nutrition tool are important, there was
263 reference made to recipes and shopping lists to support behaviour change. Participants felt that
264 recipes that are easy to prepare would support them in improving their diet:

265 *'There is a lack of simple recipes. Something with few ingredients that is easy to make. Pictures*
266 *would be best.'* (P02, female, 17 years)

267 Additionally, an example shopping list was also seen as a good tool to support dietary behaviour
268 change:

269 *'A list of what to eat, like a shopping list of healthy foods to buy for a week, to be organised and not*
270 *just buy whatever.'* (P16, female, 16 years)

271 Finally adopting a small change approach was identified as a potential facilitator to engaging
272 participants with a nutrition tool. Providing options for snack swaps was discussed, with options
273 ranging from reduced portion sizes to healthier choices. There was a mixed response in what
274 participants would prefer but it was apparent that still having the option to 'eat what you want' or to
275 'cut down slowly' was important:

276 *'You don't have to give up what you like, I'd rather cut down.'* (P18, male, 16 years)

277

278 **Developing knowledge of healthy eating:**

279 There was a positive attitude to expanding knowledge of nutrition related topics amongst the group,
280 with access to an education resource being viewed as 'interesting' and 'helpful'. Participants
281 reported that they wanted to learn more about the composition of foods:

282 *'I want to learn what is in different foods and what is good and bad.'* (P02, female, 17 years)

283 Conversations were also led to which topics would be of interest to participants, and increasing
284 knowledge was desirable.

285 *'I would like to know about this (energy balance and weight) to know what to eat.'* (P14, female, 13
286 years)

287 Although the most commonly reported topic of interest was energy balance and weight, other topics
288 including how food affects your teeth, making healthy choices at lunch time and increasing fruit and
289 vegetable consumption were also areas participants wanted to learn more about.

290 When discussing the inclusion of a quiz as a learning tool for a nutrition resource, participants
291 generally felt this was an acceptable approach that could support them with their learning:

292 *'You would get feedback which helps with learning and learning from mistakes.'* (P02, female, 17
293 years)

294 Additionally, expert advice that you can 'trust' was a concept that was important:

295 *'It's experts who are giving advice, they have personal experience and you can trust their advice.'*
296 (P11, male, 17 years)

297

298 **Additional features to support engagement with a nutrition tool:**

299 The appearance of a nutrition resource was important to participants. One participant reported that
300 taking photographs of food is engaging because it would make the resource ‘colourful’.

301 Additionally, it was seen that this is a good approach to draw attention to the resource:

302 *‘It should be bright coloured to attract people. It needs to be enjoyable. Otherwise you just get*
303 *bored.’* (P11, male, 17 years)

304 A further concept that was commonly discussed during the interviews was the general dislike of
305 reading, which was perceived as boring and would potentially discourage participants from
306 engaging with a nutrition tool. For this reason, something with an interactive element was
307 considered a facilitator to engaging this group:

308 *‘Quizzes would be alright because it’s different and better than reading.’* (P12, male, 16 years)

309

310

311 **Discussion:**

312 This study points to a range of key barriers and facilitators to engaging adolescents from a low
313 socioeconomic background with a nutrition resource and the majority of participants identified both
314 barriers and facilitators. The study found that there is an interest in learning more about nutrition
315 within this group, and this was emphasised throughout the interviews, despite the fact that many
316 appeared to already have some knowledge of healthy eating. There was a general preference for a
317 nutrition tool to be in an app format, and this was attributed to convenience and low cost, which was
318 possibly unsurprising given the research was conducted amongst low SES adolescents. Indeed
319 mobile phone health related resources have previously been shown to increase the potential for
320 reaching hard-to-reach groups⁽²⁷⁾. Nonetheless, one participant, who was under the age of 16 years,
321 reported that she did not have time for her phone. Since this age group was poorly represented in
322 our sample we are unable to draw conclusions relating to discrepancies between preferences of
323 younger and older adolescents. However Ofcom have reported that 71% of adolescents aged 12-15
324 years have a social media site and 70% of those aged 13 have a smartphone⁽²⁸⁾. They also
325 highlighted that no particular socioeconomic group is more or less likely to own a smartphone.
326 Therefore, an app is possibly an acceptable format for a nutrition resource in this group, but further
327 research is required to confirm this amongst younger adolescents.

328

329 It was also of note that our participants valued apps for social interaction, and the only apps
330 participants spoke about were social media. With the knowledge that social norms amongst peers
331 influences adolescent food choices, and are often unsupportive of healthy eating⁽²⁹⁾, there is an
332 opportunity for social media to be utilised as a tool to support behaviour change. Indeed a recent
333 qualitative study reported that Australian adolescents from disadvantaged areas favoured electronic
334 media as a method for accessing nutrition information, with frequent reference to Facebook⁽³⁰⁾.
335 With this, there is a demand for research to focus on how the use of social media can be adapted to
336 promote diet related behaviour change across the adolescent population.

337

338 The importance of convenience was related to both the nutrition tool and the preparation of food
339 and it was clear that other factors in their life took priority. Indeed previous research in adolescents
340 has reported that time and accessibility were key themes relating to the use of online sexual health
341 education resources⁽³¹⁾. Additionally research focusing on older adolescents and young adults with a
342 low SES found that participants liked foods that were fast and easy⁽³²⁾, which is aligned with the
343 reference made to 'simple' recipes 'with few ingredients' during our interviews. Previous
344 qualitative research has reported that parents of adolescents with a low SES typically do not

345 influence food choices and family meals are not part of their normal routine, which conflicts with
346 what is reported from those with a higher SES⁽³³⁾. Therefore, recipes provided should be suitable for
347 adolescents, as it is likely they will be preparing their own meals, and therefore simplicity is
348 important. There were mixed preferences for use of photographs versus written information,
349 however use of images could overcome possible literacy issues which may be more common in low
350 SES groups.

351 Convenience was also linked to the preference for a ‘small change approach’ amongst some of the
352 participants in our group. Although many of our participants said that they would make healthy
353 changes imminently, and indeed some already were, others reported they would rather reduce
354 portion sizes and make smaller changes towards healthy eating. It is important to recognise that
355 those from lower SES may not have access to the healthy food options at home, and it has been
356 reported that those of lower SES purchase significantly lower percentages of energy from fruits and
357 vegetables⁽³⁴⁾. Therefore, the consumption of the healthiest option may not be an easy option for
358 adolescents in this group and providing options which include reducing portion size could be more
359 realistic. This approach has been shown to enhance self-efficacy through achieving small lifestyle
360 changes, which has previously been demonstrated as an effective method for eliciting behaviour
361 change in adolescents⁽³⁵⁾.

362
363 Cost was also a prominent subtheme that was identified as both a barrier and facilitator, and it was
364 perceived that healthy diets were expensive. The price of food is one of the main factors that
365 influences food choices in lower SES groups⁽³⁶⁾ and adolescents typically look for cheap foods⁽³⁷⁾.
366 Previous studies have demonstrated that subsidising healthy foods increases consumption in the
367 adolescent population⁽³⁸⁾. Consequently it has been recommended that budgeting and demonstrating
368 cost effective options should be covered in nutrition education in lower SES groups⁽³⁹⁾, and this is
369 an important consideration for the development of a nutrition resource targeting adolescents with a
370 low SES. Additionally the cost of a nutrition tool could be a facilitator or barrier to engaging
371 adolescents, and this is in agreement with the previous research that has reported that low SES
372 adolescents feel that nutrition information should be free⁽³¹⁾.

373

374 Qualitative research has previously demonstrated that aesthetics is a priority to adolescents⁽⁴⁰⁾, and
375 this was a prominent subtheme in our study. Weight loss was frequently mentioned, and this was
376 observed across the age groups and in both males and females. Indeed adolescents have previously
377 reported that a thin body holds power in both friendships and social groups at school⁽⁴¹⁾. Since
378 dieting behaviours for weight loss are a risk factor for the development of unhealthy eating

379 behaviours in adolescents⁽⁴²⁾, an integrated approach that provides information on energy balance
380 and weight, and the dangers of excessive dieting could have advantages in terms of relevance and
381 safety⁽⁴³⁾. Another aesthetical motivator was having healthy teeth. Zotti *et al.* (2016) found that
382 using an app to enhance standard oral hygiene motivation amongst an adolescent population was
383 effective in improving oral health status⁽⁴⁴⁾. This intervention included the use of photographs and
384 text messages to motivate and remind participants to adhere to the instructions, highlighting the
385 acceptability of an interactive tool to elicit health behaviour change in adolescents.

386
387 The association between nutrition and fitness was well recognised amongst our participants, and
388 this may be due to their current interest in sport. Indeed published literature focusing on improving
389 nutrition in adolescents have often targeted physical activity and nutrition together^(45,46). The idea of
390 using a professional sports person as role model to improve nutrition elicited mixed responses.
391 Knowledge focusing on nutrition for professional athletes was thought to be motivating to those
392 who wanted to improve sport performance and this has previously proved effective in health
393 promotion interventions targeting children and adolescents with a low SES⁽⁴⁷⁾. However during our
394 interviews it was apparent that the perceived higher cost of healthy food meant some participants
395 felt they could not relate to famous role models who have more money available. Again this
396 highlights the need to consider cost and relevance when designing different features of a nutrition
397 tool to engage adolescents with a low SES.

398
399 Finally, the results demonstrated that health behaviour change approaches are viewed as important
400 to our participants and some were already goal setting. Interventions targeting low income groups
401 are advised to include simple techniques such as encouraging participants to set goals which help
402 them translate motivation into action⁽⁴⁸⁾, and this approach was well received across the interviews.
403 Interestingly, our participants felt healthy eating was something they often forgot about. Indeed
404 Backett-Millburn *et al.* have previously discussed that the parents of low SES adolescents consider
405 food choices to be the responsibility of their children, and therefore this group may not be prompted
406 to eat healthy foods at home⁽³³⁾. Randomised controlled trials have demonstrated improved efficacy
407 and adherence to health related interventions that have included reminders, in the form of text
408 messages, in both children and adolescents^(49,50). Nonetheless of the current health apps available to
409 adolescents, reminders are not commonly utilised to support behaviour change⁽⁵¹⁾. This
410 demonstrates the need to address the most effective behaviour change techniques in apps targeting
411 this group.

412

413 A number of study limitations should be acknowledged. The approach for obtaining consent meant
414 it was challenging to recruit participants under the age of 16, and this is highlighted by the low
415 response rate. This limits the ability to draw conclusions for younger adolescents from the results
416 available. Indeed previous research in adolescents has reported that studies that use opt out consent
417 result in higher participation and a more representative sample, particularly in low SES
418 populations⁽⁵²⁾. It is also possible that the sample was biased towards those who have an interest in
419 healthy eating. Amongst the group there were multiple participants who were engaged with sport,
420 whilst others had an interest in nutrition that was attributed to career aspirations or previous dieting.
421 Therefore the results may not be reflective of the wider low SES adolescent population. Due to the
422 drop-in style of the Streetsport sessions, the number of eligible participants was difficult to assess.
423 We did not routinely collect information on whether participants were at school or working and also
424 whether or not they were living with parents or elsewhere, which may have influenced their
425 responses and limits the ability to interpret the data. Finally, there were multiple distractions
426 including noise, disruption from peers and adverse weather conditions at the Streetsport sessions.
427 This made recruitment challenging and prevented the researcher from audio recording the
428 interviews. Also having friends nearby whilst being interviewed may have influenced the
429 adolescents' responses. Although the researcher attempted to capture the words as spoken, they may
430 have influenced the data in the way that it was written. With written notes, there is a risk of the
431 interviewer biasing the data collected, by being subjective or misinterpreting what is said. It could
432 be considered that the data had already been partly synthesised and interpreted by the interviewer
433 and was not first-order data. In addition, this approach interrupted the flow of the interview and
434 limited the depth and richness of the data collected. It also limited the second researcher analysing
435 the data from fully understanding the context of the words. Finally, the background of the
436 researchers is likely to have influenced the interpretation of the data.

437
438 On the other hand, the qualitative design allowed insight to be gained into personal, social and
439 environmental factors relating to engaging this group with a nutrition tool. It was also beneficial for
440 the researcher to volunteer at Streetsport prior to data collection, as this allowed for the most
441 appropriate methodologies to be identified and trust to be built with this 'hard-to-reach' group. The
442 perspective of disadvantaged adolescents on this topic is poorly represented and the information
443 collected provides insightful considerations for the development of a nutrition tool targeting this
444 group.

445

446 In summary the findings are aligned with current research relating to adolescents, mainly conducted
447 amongst those from higher SES, in terms of their preference to receive health information through
448 electronic media. Convenience, aesthetics and cost are key considerations, and this has previously
449 been reported elsewhere. More specifically, resources targeting this group should be interactive as
450 reading is considered 'boring' and is likely to prevent engagement. The findings provide new
451 insight relating to appropriate behaviour change support such as access to easy recipes, reminders
452 and a small change approach which were identified as facilitators to engaging adolescents with a
453 low SES with a nutrition resource. More research is required to determine if there are discrepancies
454 between younger and older adolescents, as well as to establish how social media can be utilised to
455 encourage dietary behaviour change in this group.

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602 **Tables and figures:**

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604 Table 1: Description of the topics discussed during the structured interviews.

Topic Area	Focus of questions
Background information	Understanding of the term ‘healthy eating’ Interest in learning more about ‘healthy eating’ Previous resources used to look up information on healthy eating
Format of tool	Preference in regards to the delivery of healthy eating information Reasons behind preferred choice
Content	Goal setting Food diaries Reminders Celebrity endorsement Quiz Food swaps Topics of interest
Barriers and facilitators	Any specific barriers or motivators to using a nutrition resource
Participant input	Any additional ideas that participants felt would be important for a healthy eating resource

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617 Table 2: Participant demographic information recorded at the structured interviews

ID	Age	Gender	Location of data collection	SIMD 2016 Quintile*	Role at Streetsport
P01	17	Male	Torry	3	Volunteer
P02	17	Female	Torry	2	Volunteer
P03	16	Male	Torry	2	Volunteer
P04	16	Female	George St	2	Participant
P05	17	Female	George St	2	Participant
P06	13	Female	George St	2	Participant
P07	16	Female	Northfield	3	Participant
P08	16	Female	Northfield	1	Volunteer
P09	16	Female	Northfield	1	Participant
P10	16	Female	Northfield	2	Participant
P11	17	Male	Northfield	3	Participant
P12	16	Male	Torry	1	Participant
P13	17	Male	Torry	2	Participant
P14	13	Female	Torry	1	Participant
P15	16	Male	Northfield	5	Participant
P16	16	Female	Northfield	1	Participant
P17	17	Male	Northfield	1	Volunteer
P18	16	Male	Torry	2	Participant

618 *1 most deprived, 5 least deprived

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632 Figure 1: A summary of the themes, subthemes and concepts that were identified in the thematic
633 analysis of the responses from the structured interviews. + and – signs represent facilitators and
634 barriers respectively, whereas +/- represents the subthemes that were identified as both a barrier and
635 facilitator to engaging with a nutrition resource. Bold text identifies prominent subthemes and
636 italics, emerging subthemes.

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Thank you for volunteering for my research project. It will take about 15 minutes to go through these questions, if you need me to explain anything or repeat the question then please let me know.

Section 1 – Demographics:

Name:

Age:

Postcode (if known):

Sex:

Section 2 – Background:

- 1) What do you understand by the term 'healthy eating'?
Prompt – have you heard about eating a balanced diet? Is this something you consider important? Can you explain why?

- 2) Are you interested in learning more about healthy eating?

- 3) Can you explain the reasons behind your answer to this (question 2)?

- 4) i) Have you ever used any resources to learn more about healthy eating? Yes/no
ii) If yes which resources have you used?

iii) What did you like or dislike about these resources?

Section 3 – Format:

- 1) Which of the following would you prefer as an option for learning about healthy eating?
 - i) App on your phone
 - ii) Website
 - iii) Paper based for example a leaflet or booklet (show prompt)
 - iv) Interactive sessions at Streetsport for example games
 - v) TV adverts
 - vi) Other

- 2) Can you explain why you chose (answer to question 1)

- 3) What apps are you currently using? If they need a prompt give examples including facebook, snapchat, Instagram, twitter.
- 4) What do you like about these apps?

Section 4 – Content:

- 1) How do you feel about setting healthy eating targets? If a prompt is required use examples such as swapping chocolate or crisps with fruit.
- 2) Food diaries can be used to look at what you eat. If you were to keep a food diary would you prefer a photographic food diary (show prompt) or a written food diary (show prompt).
A photographic food diary means you take photos of the meals and snacks you eat and upload them onto a diary. The written diary would involve you writing down everything you eat.
- 3) Please can you explain why you prefer (answer to question 2)?
- 4) How would you feel about having healthy eating reminders send to you?
Examples of reminders include text messages or pop ups on your phone.
- 5) Would knowing what healthy foods a celebrity sports person eats motivate you to make healthier food choices?
Prompt - For example Andy Murray or Lionel Messi (allow the participant the opportunity to name any potential role models).
- 6) How would you feel about doing healthy eating quizzes as a way of learning more about healthy food options?

- 7) Food swaps are a good way to make healthier food choices. If you were to swap a fizzy drink, for example coke or Irn Bru, which of the following would you be most likely to choose? Use prompt
- i) Half a portion of coke or Irn Bru
 - ii) Diet coke or diet Irn Bru
 - iii) Diluting juice
 - iv) Water
 - v) Other (ask what other options they might choose)
- 8) If you were to swap a chocolate bar, for example a galaxy or mars bar, which of the following would you be most likely to choose? Use prompt
- i) A smaller portion for example a snack size mars bar
 - ii) A cereal bar
 - iii) A piece of fruit
 - iv) Other (ask what other options they might choose)
- 9) Out of the following, which would you be most interested in learning more about? You can pick as many or as few as you like.
- i) Information on sugar and health
 - ii) Health benefits of fruit and vegetables
 - iii) Ways to increase fruit and vegetable consumption
 - iv) Making healthy food choices at lunch time
 - v) Energy balance and weight
 - vi) How eating effects your teeth
 - vii) How to keep a food diary
 - viii) Other

Section 5 – Barriers and facilitators:

- 1) Is there anything specific that would stop you using a healthy eating resource?

- 2) Can you explain why?

- 3) Can you describe anything that could potentially encourage or motivate you to using a healthy eating tool?
Prompt – looking good (good skin, healthy teeth), feeling good, weight loss, long term health benefits

- 4) Can you explain why?

Section 6 – Participant input:

- 1) Is there anything that we have not discussed that think is particularly important for a nutrition tool?

- 2) Why do you feel this would be important?

Thank you for taking the time to speak with me today. Your answers will remain confidential and you will not be named in the final report for this research. If you have any questions please let me know.

