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Global cities and cultural diversity: challenges and opportunities for young people's nutrition

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Title: Global cities and cultural diversity: challenges and opportunities for young people's nutrition

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1 **Abstract**

2 Childhood obesity is a common concern across global cities and threatens sustainable urban
3 development. Initiatives to improve nutrition and encourage physical exercise are promising but are
4 yet to exert significant influence on prevention. Childhood obesity in London is associated with
5 distinct ethnic and socio-economic patterns. Ethnic inequalities in health-related behaviour endure,
6 underpinned by inequalities in employment, housing, access to welfare services, and discrimination.
7 Addressing these growing concerns requires a clearer understanding of the socio-cultural,
8 environmental and economic contexts of urban living that promote obesity. We explore
9 opportunities for prevention using asset based-approaches to nutritional health and well-being, with
10 a particular focus on adolescents from diverse ethnic backgrounds living in London. We focus on
11 the important role that community engagement and multi-sectoral partnership play in improving the
12 nutritional outcomes of London's children.

13

14 London's children and adolescents grow up in the rich cultural mix of a global city where local
15 streets are characterised by diversity in ethnicities, languages, religions, foods, and customs,
16 creating complex and fluid identities. Growing up with such everyday diversity we argue can
17 enhance the quality of life for London's children, and strengthen their social capital. The
18 [Determinants of young Adult Social well-being and Health](#) longitudinal study of ~6,500 of
19 London's young people demonstrated the positive impact of cultural diversity. Born to parents from
20 over 100 countries and exposed to multi-lingual households and religious practices, they
21 demonstrated strong psychological resilience and sense of pride from cultural straddling, despite
22 material disadvantage and discrimination. Supporting the potential contribution of such socio-
23 cultural assets is in keeping with values of social justice and equitable and sustainable development.
24 Our work signals the importance of community engagement and multisectoral partnerships,
25 involving, for example, schools and faith-based organisations, to improve the nutrition of London's
26 children.

27

28

29

30 **Title:** Global cities and cultural diversity: opportunities for young people's nutrition

31

32 There is an abundance of scientific literature that links 'healthy diets' to physical and mental health.
33 Yet inequalities have endured and continue to widen. It is increasingly recognised that wide scale
34 adoption of healthy behaviours requires a shift in thinking from individuals to populations and from
35 proximal determinants to the 'causes of the causes'. The social ecological model ⁽¹⁾ provides a broad
36 perspective integrating multiple levels of influence (e.g. families, neighbourhoods and
37 communities, policies) that impact on health behaviour and ultimately health outcomes. Health
38 promotion programs that focus only on behavioural change or downstream impacts through
39 educational activities or other strategies to change behaviours at the 'within-person' level, often
40 neglect the social and environmental contexts in which adverse behaviours occur and are reinforced
41 ⁽²⁾. Improving the health of vulnerable populations necessitates interventions that target multiple
42 levels of influence, in multiple settings, and use multiple intervention strategies. Interventions that
43 engage with this complexity are challenging to design, implement and evaluate, but likely to
44 leverage substantive sustainable impacts. This has been a central consideration of our Kings and
45 Communities for Youth Health research programme which is exploring how best to promote
46 healthy nutrition among adolescents living in urban environments and at high risk of nutrition
47 related diseases.

48

49 **London's global context – an asset and a risk**

50 London is a global city characterised by a multiplicity of ethnicities, languages, cultures, food
51 choices, and religious beliefs. Data from the 2011 Census showed London to have above national
52 average proportions for most minority ethnic groups including African (7%), Indian (6.6%), and
53 Caribbean (4.2%), with the proportion of non-UK born residents increasing >10% between 2001
54 and 2011. Over 250 languages are spoken in London, with almost a quarter (22%) of the population
55 reporting a language other than English as their main language, and with 4.1% of the population
56 unable to speak English ⁽³⁾.

57

58 The perceived threat of diversity has received much media emphasis recently, fuelled by political
59 events including 'Brexit' and anti-immigration rhetoric, increased social inequalities, and terrorism
60 events. Several studies propose, however, that diversity is linked to London's social capital and
61 economic growth ^(4,5). Social capital, i.e. access to social networks and resources, has been
62 theorised to operate through 'bonding capital' *within* groups or 'bridging capital' *across* groups ⁽⁶⁾.
63 Diversity has been shown to improve perceptions of and relations between ethnic groups with
64 'bridging ties' in diverse social settings resulting in greater social cohesion and positive social

65 interactions ^(7,8). Cultural diversity and its associated social capital, the synergistic interplay of
66 community assets (e.g. trust, cooperation, shared values, social networks), also contribute to
67 London's diet and nutrition-related behaviour diversity ⁽⁹⁾. London's reputation as one of the
68 world's culinary capitals, for example, is based on the variety of ethnic food options. Local high
69 streets reflect ethnic enclaves, forming geographical and cultural niches with a plethora of food-
70 related businesses and services adapted to the needs of different ethnic groups.

71

72 London's social and ethnic inequalities are, however, deep and enduring: 22.5% of London falls
73 within the most deprived 20% of England, while the boroughs of Tower Hamlets, Haringey,
74 Hackney, Lambeth, Lewisham, Barking and Dagenham are among the top 1% of lower super output
75 areas for deprivation in England ⁽¹⁰⁾. The rate of early deaths from preventable causes is twice as
76 high in Tower Hamlets as it is in the nearby City of London ⁽¹¹⁾. Ethnic differences in deprivation
77 are stark, with Pakistanis, Bangladeshis and Black ethnic origin people more likely to live in the
78 most deprived areas ⁽¹²⁾. Pakistani households are more likely to be overcrowded compared to
79 White British ⁽¹²⁾. The social and economic aspects of deprivation (i.e. poverty, social exclusion)
80 present major challenges for public health initiatives aimed at tackling obesity in urban areas.

81

82 People of South Asian or Black African descent have respectively four- and three- fold elevated
83 risks of diabetes compared with White Europeans. Risks of hypertension and stroke are also greater
84 in these groups, but while South Asians also experience higher rates of coronary disease, people of
85 Black African origin are protected ^(13,14). There is increasing evidence that ethnic differences in risk
86 factors, such as blood pressure, emerge in childhood with greater metabolic sensitivity to adiposity
87 than in White ethnic groups ^(15,16). Our work focuses on adolescence, a key stage of the life course
88 characterised by a complex development period during which physical, psychological, social and
89 emotional capabilities are consolidated and underpin future health, social and economic trajectories.
90 On a global scale, the benefits of investment in adolescent health are increasingly recognised, and
91 failure to address health inequalities at this stage, can set young people on a path to lifelong socio-
92 economic and health adversity ⁽¹⁷⁾.

93

94 More than two million children and young people live in London, around a quarter of the London
95 population, with an 11% rise expected by 2020 ⁽¹⁸⁾. London has a high rate of child obesity
96 compared to other global cities. Young people face the challenge of negotiating 'obesogenic'
97 environments ⁽¹⁹⁾ – their physical activity shaped by the built environment, their diets by food
98 systems that bombard them with calorie-dense foods often cheaper than healthier alternatives, and
99 their well-being compromised by precarious employment and high costs of housing. Our research

100 engages with this complexity of context faced by adolescents, to address inequalities in health and
101 obesity. We first discuss key findings from the [Determinants of young Adult Social well-being and](#)
102 [Health](#) (DASH), our longitudinal study of adolescents living in London, before reporting on early
103 findings from a programme of feasibility studies in London, the Caribbean and Saudi Arabia.

104

105 **Socio-cultural influences on London's adolescent health**

106 The DASH study is the largest longitudinal study of ethnically diverse young people in the UK
107 designed to examine ethnic inequalities in health. Details of DASH are described elsewhere ⁽²⁰⁾.
108 Underpinned by the life course model ⁽²¹⁾, the study centres on adolescence, a critical stage for
109 establishing lasting health trajectories, both mental and physical, and consolidation of lifestyle
110 behaviours. The sample was recruited between 2002 and 2003 from 51 schools in 10 London
111 boroughs. A total of 6643 pupils, aged 11-13 years, took part in the baseline survey, and ~80% took
112 part in a follow-up survey at 14-16 years. A pilot follow-up was conducted with 10% of the sample
113 at 21-23 years of age, including qualitative interviews with 42 participants from diverse ethnic
114 backgrounds. About 80% of the cohort are from ethnic minorities and speak more than 40
115 languages. Two thirds of these were UK born, with about 100 countries of birth reported among
116 those born abroad. We take the position that ethnic identity is dynamic and multidimensional,
117 reflecting historic social and cultural traditions and current context ⁽²²⁾. Ethnicity in DASH was
118 measured by self-report utilising over 25 ethnic categories derived from the British Census,
119 including options for 'mixed' and 'other'. Separate questions asked about country of birth of self,
120 parents and grandparents. Self-ascribed ethnicity was compared with these responses to check for
121 inconsistencies. The sample is well characterised in relation to diversity, psychosocial and
122 biological measures.

123

124 Despite the recent polarized debate observed in the mid-Brexit climate, findings from DASH
125 support a view of diversity as a public health asset which can be protective against adverse health
126 outcomes. As reported in the qualitative interviews, growing up in contexts of cultural diversity and
127 religious values was perceived to have positive benefits (Box 1). Ethnic minority adolescents in the
128 DASH cohort exposed to London's multi-lingual/religion environments exhibited strong
129 psychological resilience and sense of pride from cultural straddling, *despite* more material
130 disadvantage and experience of racism throughout adolescence compared with their White peers
131 (Figure1).

132

133 "I feel very Nigerian because that what I was brought up round, in a Nigerian culture, the food I
 134 eat, the mannerisms, just Nigerian influences around me. And at the same time, I've also had
 135 British influences around me outside of my house, so yeah, best of both worlds I guess." DASH
 136 Participant 42, male, Black African, Christian, degree

137

138 "[Islam] teaches you so much about helping other people and just being there for other people
 139 and putting yourself in other people's shoes and seeing what they go through and the difficulties
 140 in life. So it really teaches you a lot of patience. " DASH Participant 11, male, Pakistani, Muslim,
 141 GCSE

142 *Box 1: In their own words: The Determinants of Adults Social well-being and Health*

143

144 Although frequency of attendance to a place of worship declined in their early 20s, compared to
 145 White participants, more ethnic minority participants continued to attend a place of worship into
 146 young adulthood, as well as reporting regular engagement with family activities, issues which we
 147 will return to in relation to their health benefits. In adolescence, better mental health was observed
 148 among ethnic minority youths, particularly Nigerian/Ghanaian males, compared with their White
 149 British peers^(23, 24). Measures of linguistic diversity, attendance at a place of worship, parenting
 150 styles⁽²⁵⁾, family centredness⁽²⁶⁾ and cultural integration⁽²⁷⁾, were independently associated with
 151 improved adolescent mental health, after adjustment for social adversity⁽²⁸⁾. A London based study
 152 further documented this psychological resilience (better mental health problems despite greatest
 153 socioeconomic disadvantage) among Bangladeshi adolescents compared with their White peers^{(24,}
 154 ²⁹⁾. The impact of place of worship attendance, independent of religious affiliation, suggest that
 155 health benefits may be mediated through social support, cultural identity, and resilience to
 156 adversity, particularly racism⁽³⁰⁾. Regular attendance to a place of worship may promote 'ethnic
 157 socialisation', which may have benefits for mental health, adaptation, and health behaviours^(31, 32).

158

159 ***Ethnicity and dietary habits***

160 We focus here on two key dietary habits measured in adolescence - fruit and vegetable intake and
 161 breakfast consumption. An extensive literature base has demonstrated that reduced intake of fruit
 162 and vegetables is associated with an increased risk of cardiovascular diseases and cancer^(33, 34).
 163 Breakfast skipping is associated with adolescent obesity and less favourable metabolic profiles⁽³⁵⁻
 164 ⁴⁰⁾, increased risk-taking behaviours (tobacco, alcohol abuse, increased snacking and sedentary
 165 lifestyles)⁽⁴¹⁾, and poorer academic performance⁽⁴⁰⁾. In a systematic review, Pearson and colleagues
 166 reported that family correlates of fruit and vegetable consumption included parental intake and
 167 modelling, family rules and parental encouragement⁽⁴²⁾. As with fruit and vegetable intake, the

168 family environment has a key influence on breakfast consumption and parental breakfast
169 consumption, two parent family units being positively associated, whereas socioeconomic
170 disadvantage is inversely associated^(43, 44).

171

172

173 DASH has shown that throughout adolescence, ethnicity, parental care⁽⁴⁵⁾ and family activities
174 were independently associated with fruit and vegetable consumption of <5 portions per day among
175 both men and women, after adjusting for main confounders (Table 1). Black Caribbeans, Black
176 Africans and Pakistanis/Bangladeshis were more likely to consume <5 portions of fruit and
177 vegetable/day than their White British peers. Decreasing parental care and family activities were
178 associated with a greater likelihood of lower than 5 portions/day. Among females, increasing age
179 was associated with a lower likelihood of consuming <5 portions/day. There were some ethnic
180 specific effects for females as tested by interaction terms 'ethnicity × parental care' and 'ethnicity ×
181 family activities'. In particular, Black Africans who reported low parental care, and Black
182 Caribbeans and Black Africans who reported low family activities score significantly more likely to
183 have <5portions/day. We did not find an association between socioeconomic circumstances with
184 fruit and vegetable intake, adding to the inconsistencies reported in the literature^(42, 46, 47). Another
185 important feature of the findings in Table 1 is that lower frequency of physical activity was
186 associated with <5 portions of fruit and vegetable consumption, reflecting a clustering of unhealthy
187 behaviours.

188

189 Risk taking behaviour peaks in adolescents so that clustering of risky dietary behaviour is not
190 surprising^(48, 49). DASH shows some evidence for clustering adverse dietary behaviours. Figure 2
191 shows that in early adolescence (11-13 years) fruit and vegetable consumption of <5 portions/d was
192 associated with skipping breakfast, among both genders, in White British and Other Ethnicity
193 groups, and among Black Caribbean males, Black African males and Indian girls, after adjusting for
194 confounders.

195

196 Table 2 shows that fruit and vegetable consumption was a longitudinal correlate of skipping
197 breakfast from early adolescence to early adulthood (21-23 years). Even with a smaller sample, a
198 higher likelihood of skipping breakfast was still observed among Black Caribbeans (OR 1.98, 95%
199 CI 1.10-3.58, p=0.024) and Black Africans (OR 2.62, 1.45-4.73, p=0.001). Here we also see that a
200 longitudinal measure of unemployment (parental at 11-13 years and own at 21-23 years) was
201 associated with skipping breakfast, indicating the importance of persistent economic disadvantage
202 on skipping breakfast. Understanding the drivers of multiple dietary risk factors warrants further

203 investigation particularly given the obesogenic urban environments in which young people live^{(50,}
204 ⁵¹⁾.

205

206 ***Ethnicity and overweight***

207 We recently reported on ethnic patterning of growth from early adolescence, and a prospective
208 association between adiposity measures and cardiovascular disease risk from early adolescence to
209 early adulthood^(52, 53). The greater cardiovascular risks observed in some ethnic minority groups in
210 childhood signals a continuation of the biological legacy of earlier generations. Black Caribbeans
211 and Black African girls in DASH continued to present higher rates of unhealthy BMI compared to
212 their White peers from early adolescence to early adulthood (Figure 3). About one third of the
213 sample were overweight or obese at both ages. Overweight, which was related to poor nutritional
214 habits (cited above) in early adolescence, was associated with early markers of cardiovascular
215 disease risk in adulthood, including an increase in blood pressure, arterial stiffness and glycosylated
216 haemoglobin^(52, 53). A key driver of these patterns are the neighbourhoods that ethnic minority
217 adolescents live in. They tend to be clustered in poorer areas, with fewer opportunities for physical
218 activity and increased access to fast food outlets⁽⁵⁴⁾.

219

220 Nutrition is important for the physical and mental health of young people. In high-income countries,
221 75% of adult mental health issues have an onset before the age of 18 years^(55, 56). We have been
222 exploring the influence of discordance between perception of weight and objective measures on
223 mental health of young people in the DASH population⁽⁵⁷⁾. This literature is dominated by US
224 research. For example, Duong and Roberts (2014) found that 22% of female adolescents of a
225 healthy weight were less satisfied with their weight, compared to 15% of males and that the trend
226 persisted over time. African American adolescents tend to underestimate their weight status⁽⁵⁸⁾.
227 Adolescents' social network, parental overweight, and overweight peers contribute to weight
228 discordance, particularly underestimation⁽⁵⁸⁻⁶⁰⁾. In the DASH cohort, ~40% of adolescents
229 perceived their weight status to be different to their objectively measured weight status. Perceived
230 weight status was assessed using the following question 'given your height and weight would you
231 say you are...' and responses included 1) about right 2) too heavy 3) too light or 4) not sure. Gender
232 differences in discordance were observed only at baseline where girls (46%) were more likely to be
233 discordant than boys (38%, $p < 0.05$) (data not shown). Compared to their White peers,
234 Pakistani/Bangladeshi girls were more likely to have a discordant weight perception throughout
235 adolescence, Conversely, Black African, Indian and Pakistani/Bangladeshi boys were more likely to
236 be discordant at 14-16y (Figure 4). Among those discordant, 9% at age 11-13y and 6% at age 14-
237 16y perceived themselves to be normal weight but measured overweight; the corresponding figures

238 for perceiving themselves to be underweight but measured normal were 8% and 10%. At both ages,
239 22% were unsure of their weight but measured overweight or normal weight. Regardless of
240 ethnicity, age and gender were longitudinal correlates of weight misperception throughout
241 adolescence. Alcohol consumption and reported experiences of racism at 11-13y and religious
242 prohibition of food at 14-16y (particularly among Muslims) were age specific independent
243 correlates of weight misperception. Given the impact on mental health and its common occurrence
244 across all ethnic groups, these findings underscore the importance for addressing the influences that
245 trigger discordant weight perceptions among different ethnic groups and genders.

246

247 The next section illustrates how these findings have informed our translational studies. The
248 sustainability of public health interventions has become increasingly important for researchers,
249 evaluators, community partners and funders ⁽⁶¹⁾. Our collaborations extend beyond individuals and
250 classrooms to bridge schools, communities and service providers, and focus on prevention as a
251 priority, with the hope that this approach will enhance sustainable capacity to support healthy
252 nutrition.

253

254 **Promoting healthy nutrition among London's adolescents**

255 The high attendance of ethnic minority children to places of worship in London and its protective
256 role for risk behaviours and mental health prompted us to explore places of worship as community
257 settings for culturally tailored obesity prevention. Places of worship have long been involved in
258 advocacy for social change including inequalities, and because of their broad public reach and focus
259 on both spiritual and physical needs have successfully delivered health programmes targeting a
260 wide range of health outcomes ⁽⁶²⁾. The DASH DiEt and Active Living (DASH-DEAL) study was
261 our first exploration, small scale but detailed, of the challenges and opportunities of engaging with
262 the complexity of schools and places of worship (e.g. mosques, temples and churches) in London to
263 maximise the programme impact ^(62, 63). While schools provide a better infrastructure to deliver
264 interventions, places of worship provide access to parents and other family members and potentially
265 wider community support and reach among 'hard to reach' ethnic minority populations. Engaging
266 both types of setting, working in close partnership with primary and community healthcare, could
267 provide a comprehensive approach towards reaching universal coverage for health promotion
268 interventions. A key outcome of the DASH-DEAL study was that the complexity of the different
269 religious settings necessitated specific strategies. In the next section, we discuss some key findings
270 from our current developmental studies with Black Majority Churches (BMCs) and secondary
271 schools in deprived neighbourhoods in South London with high density of Black Caribbeans and
272 Black Africans. Black Majority Churches are defined as Black-led churches with a high density

273 (~90%) of Black African and/ Black Caribbean congregational members. Working with community
274 partners is an iterative organic process and there are challenges in balancing scientific rigour with
275 the needs, interests, and values of partners. Our flexible mixed-method approach, including
276 photovoice, ethnography, focus groups and concept mapping workshops, walk along and telephone
277 interviews, enriched our understanding of feasible solutions and optimised engagement from those
278 who would have been difficult to reach using conventional approaches.

279

280 ***Community partnerships with Black Majority Churches in London for nutrition interventions***

281 A number of factors may be related to the capacity to initiate and sustain community partnerships
282 with BMCs to implement prevention programmes. We scoped the distribution of BMCs with the
283 help of key Black Church leaders to ensure adequate representation of Black Caribbean and Black
284 African churches. Most BMCs are Pentecostal, with the highest concentration in Southwark,
285 estimated to be >240 churches. With the help of senior Black pastors, responsible for clusters of
286 BMCs, we chose 2 clusters with 6 BMCs to learn about their social programmes, including youth
287 clubs, Sunday-schools, and community clubs, all of which could provide intervention focal points
288 for young people. We summarise some key barriers and facilitators that emerged from thematic
289 analysis of the qualitative data from 17 semi-structured interviews with representatives from BMCs
290 (including from youth clubs, leadership, administration, and congregation), local primary care and
291 public health, care commissioners, NHS England, and the voluntary sector.

292

293 Challenges to collaboration: The meshing of views across practitioners, commissioners and national
294 bodies indicated strong support for engaging with faith groups for prevention, but there appeared to
295 be a distinct lack of shared understandings with faith groups. Reluctance to engage with faith
296 groups attributed to perceived conflicts in attitudes, knowledge and values were acknowledged as
297 potential barriers to partnership building:

298

299 *'I think there is an anxiety sometimes ...about working with faith groups... I think it's about*
300 *values... there's a reluctance sometimes to embrace those kinds of groups with open arms.'*

301 (Participant 8, face-to-face interview, commissioner, male)

302

303 *'... NHS mentality of, you know, the clinicians are the only people whose voices matter. So there's*
304 *kind of attitude issues.'* (Participant 11, telephone interview, national body, female)

305

306 Engagement was linked to trust and membership of communities, ‘understanding where everybody
307 is coming from, the ‘need to build bridges for the right reasons’, and the recognition of complexity
308 and inequality:

309

310 *‘We’ve got such inequality...makes it a challenge because there aren’t answers, you haven’t got*
311 *easy answers... that’s a bit of a challenge.’* (Participant 7, Face-to-face interview, Commissioner,
312 Male).

313

314 Organisational cultures were often cited as a barrier to developing partnerships and aligning
315 agendas, with ‘silo working’, ‘competing priorities’ and challenges in finding the ‘right people that
316 have the levers to change’:

317

318 *“.. [we] need to understand the agendas of different silos because each one is trying to exist and*
319 *maintain its existence... if you don’t understand what’s driving that..., then you’re never going to*
320 *be able to get that work between the silos.”*

321 (Participant 9, face-to-face interview, practitioner, male).

322

323 Other potential challenges cited included no ‘*one size fits all*’, with the additional dimension of
324 planning for ‘*transient populations*’, and the risk of ‘*unrealistic timescales*’ for building
325 partnerships, the need for ‘*stable funding streams*’ rather than ‘*infighting for limited funds*’ and
326 political contexts linked to ‘*ever-changing directions*’ of policies and cuts to local public health
327 budgets.

328

329 Factors supporting partnerships: Having a clear vision, mission and shared interests are regarded as
330 key to successful partnerships⁽⁶⁴⁾. Aspects such as trust, goal alignment and positive working
331 relationships between like-minded sectors have been found to be more important determinants of
332 cross-sectoral working (including public-private partnerships) than practical resources⁽⁶⁵⁾.

333

334 Incentives, such as opportunities for training or work experience, were considered by congregants
335 to be crucial for initial involvement of communities, given the time commitment required. These
336 were linked to capacity development, and in particular to ownership of interventions and
337 sustainability:

338

339 *“Especially when you’re doing 16 plus [high school examinations], people will be looking for jobs*
340 *and things like that... if you highlight what they’re going to take away from this, if it’s skills or if it’s*
341 *something for their CV that’s through their involvement.”*

342 (Participant 2, focus group, congregant, female)

343

344 *“You have to train people. ..from this community... So they’ll be shadowing you from infancy,*
345 *watching it mature, understanding how it works. Then you want to kind of transfer your skills..”*

346 (Participant 1, focus group, congregant, female).

347

348 Maintaining a sense of ‘informality’, ‘consistency’, and ‘visibility’ were of paramount importance
349 to congregants, and generally recognised by practitioners and commissioners as facilitators for
350 collaborative partnerships. Congregants felt it was important for there to be a humorous and light-
351 hearted approach. Communication via online forums, social media and websites were positively
352 reviewed by all participants. This has implications for coordination and governance arrangements,
353 including in the healthcare sector, the extent to which partnerships are voluntary or formal, and how
354 evaluation should be conducted.

355

356 A key learning for us has been the time and patience it takes to forge trusting relationships
357 particularly as lack of trust is the most widely cited challenge for community-based research ⁽⁶⁶⁾.

358 The results presented here provide some essential domains for a conceptual framework for
359 partnership sustainability with BMCs, and have informed our readiness assessment for
360 implementation.

361

362 ***Challenges and priorities for healthy nutrition identified by adolescents***

363 We used concept-mapping, focus groups and researcher observations over two weeks to develop
364 our understanding of what adolescents felt were important issues to address in relation to their food
365 choices. Concept mapping is steeped in participatory approaches and is gaining recognition in
366 public health as a tool for improving the reliability of findings via cross-sectoral cooperation from
367 the outset ⁽⁶⁷⁾. It entails a mixed methods approach that combines qualitative group processes (e.g.,
368 brainstorming, categorizing ideas) with descriptive statistical analyses to facilitate a group
369 description of ideas and represent them graphically. Through this process, a visual representation of
370 the factors that are felt to be important and modifiable are created.

371

372 The findings are based on perspectives of 11-13 year olds (69 pupils) in two secondary schools, one
373 in a very deprived neighbourhood but both with ethnically diverse pupil populations. Thirty-seven

374 pupils took part in four focus groups, and 32 pupils took part in two sets of four concept mapping
375 workshops. Photovoice⁽⁶⁸⁾ was used whereby pupils created a picture narrative of the things that
376 influenced their diets which was then used to ‘brainstorm’ ideas about influences on healthy eating.
377 Pupils then categorised and rated their ideas for importance and modifiability for a positive change.
378 Results of our concept mapping analysis identified 5 clusters of influences: Home Life; School
379 Context; Strong Beliefs/Opinions; Food Literacy; Neighbourhood Food Outlets.

380

381 The position of the clusters relative to each other indicates the conceptual similarities between the
382 different domains; those shown closer together are more similar than those that are farther apart.
383 The size of each block denotes the perceived cohesiveness of the cluster. The statements within
384 smaller, tighter groupings (e.g. Home Life) were more conceptually cohesive than the statements
385 within more diffuse clusters (e.g. Beliefs/Opinions). Table 3 shows the number of items within
386 clusters and average ratings of the clusters for importance and modifiability. We drew from the
387 focus groups and researcher observations to help us identify the items in the clusters and highlight
388 some salient points.

389

390 Home life & neighbourhood environments: Ready availability of unhealthy foods at home and in
391 neighbourhoods appeared to frustrate adolescent motivation to manage their dietary habits to their
392 benefit. These issues appeared to be common regardless of socio-economic context, though
393 differences appear in relation to what was available in cupboards and fridges at home:

394

395 *‘I wake up with the mindset that I’m going to be extremely healthy, but as I open the fridge*
396 *and I see the Gatorade or the Snickers, and I have to!’* Participant 1.02, male, 13y

397

398 *‘You’re at home and you’re like, ‘Mum, I really want to eat healthy’ and she’s like, ‘Okay,*
399 *well we’re having macaroni and cheese for dinner.’* Participant 3.04, female, 12y

400

401 School and home neighbourhoods, and the journey from school to home derailed good
402 intentions, as pupils passed many fast food outlets and shops and were tempted in:

403

404 *‘In primary school, you just go straight home, but now every day you walk past the shops.*
405 *Like, oh, I didn’t want to go to the shops, but now that they’re there, I do.’* Participant 2.04,
406 female, 13y

407

408 This was confirmed by observations of pupils in the morning before school hours shopping
409 in grocery outlets near to their schools.

410

411 Other participants described the ready availability of cheap unhealthy foods which could be ordered
412 easily online and delivered to home:

413 *'Like a click of a button and you already have unhealthy foods, but just the thought of eating*
414 *healthy seems a lot harder because they make it seem like it isn't easy to get healthy foods'*

415 Participant 4.01, male, 11y

416

417 Some pupils showed awareness of how food producers targeted teenagers through
418 marketing:

419 *'... they [food companies] know what they're doing. They target people our age and know*
420 *how to draw us in'* Participant 2.03, female, 13y

421

422 School environments: School environments received less emphasis in pupils' responses, but
423 researcher observations illustrated the challenges in implementing healthy food policies for
424 inner city schools in deprived areas. For example, despite policies that disallow sugar
425 sweetened drinks and unhealthy snacks, pupils were observed to be hiding sweets, crisps,
426 and large bottles of sugary drinks in their school bags. Though schools conduct random
427 searches of pupils' bags upon entering school grounds, pupils appear to know how to avoid
428 being checked. One pupil even reported how other pupils sold prohibited fizzy drinks on the
429 school premises:

430

431 *'It's the school's fault. People can't bring fizzy drinks or juice to school, but they [pupils]*
432 *sell it here'* – 1.02, male, 13y

433

434 Skipping lunch at school was common, labelled by pupils as “not important” and often substituted
435 with snacks. Pupils were observed to be rushing in and out of the canteen so as to maximise their
436 break time in the playground. Pupils also mentioned avoiding long lunch lines, and choosing fast-
437 food establishments or microwaveable foods instead of school meals or packed lunches. This
438 ambivalence towards regular mealtimes is a challenge for intervention and could set up lifelong
439 patterns of unhealthy nutritional behaviour. Meal skipping, and as noted above breakfast skipping in
440 particular, is related to cardio-metabolic health and childhood obesity.

441

442 Food literacy: Food literacy levels varied. Among some adolescents the connection between body
443 physiology and food choices was often misguided, for example one participant stated ‘..[you] need
444 *sugar in your belly for energy...healthy food has less sugar, it makes you weaker*’ (Participant 3.02,
445 female, 12y). Others acknowledged that fruits have ‘*healthy sugars*’, and make for a good dessert
446 substitute. Some spoke about replacing white rice with brown rice, but the most common reasoning
447 behind this argument was that brown rice ‘*has other things in it*’. Another notable feature of pupils’
448 responses was a lack of awareness of wider issues such as how food choices are influenced by
449 wider environmental or societal contexts. These findings strongly support a multi-level multi-
450 component intervention approach that straddles family, schools and communities to promote
451 nutritional self-regulation among adolescents.

452

453 **Urban living and adolescent nutrition in globalised cities**

454 Improvements in national incomes and life expectancies globally have been accompanied by
455 striking increases in social disparities, urbanisation and globalisation of risky exposures for global
456 transitions in nutrition ⁽⁶⁹⁾. Young people are experiencing dramatic changes in opportunities and
457 constraints in low- and middle-income countries. Our global health projects span countries of
458 widely divergent cultural, socio-economic and political contexts including Guyana and Saudi
459 Arabai. Guyana, for example, is the third poorest country in the Western hemisphere, with 55% of
460 its population living below the poverty line. Non-communicable diseases are a significant public
461 health problem in the country and in the Caribbean region. Overweight and obesity (19%) and
462 underweight (8%) contribute to the burden of childhood malnutrition ⁽⁷⁰⁾. The Kingdom of Saudi
463 Arabia, on the other hand, is a high-income Islamic country in the Gulf that has experienced
464 alarming rises in childhood/adolescent obesity in the 2000s, such that about one third of
465 children/adolescents are overweight/obese by adolescence ⁽⁷¹⁾. Our feasibility studies focus on
466 exploring how to strengthen families, schools and communities, and on working with policy makers
467 and practitioners to acquire, interpret and eventually use the research evidence for the physical and
468 mental well-being of young people.

469

470 Despite different socio-political contexts, our mixed methods developmental studies reveal notable
471 commonalities across London, UK, Georgetown, Guyana and Jeddah, Saudi Arabia. As in some
472 parts of London, markets in Guyana are a focal point for weekly shopping. The pictures illustrate
473 the abundance of fruits and vegetables but affordability and availability has reduced over the years
474 ⁽⁷²⁾, with urbanisation in Guyana significantly affecting local supplies. Despite the contextual
475 differences, the results of our concept mapping workshops with secondary school children in all
476 three countries highlighted some generic issues across the different settings for nutrition

477 interventions. There has been a shift in diets with increases in eating away from home, access to fast
478 foods, low fruit and vegetable intake, and lack of physical activity opportunities in school curricula.
479 Reports of consumption of fast foods resonated with those we heard from London's adolescents, for
480 example in Jeddah adolescents reported that '*Fast food is tasty, easy to obtain*' and '*healthy food is*
481 *limited in the mall*', and in Guyana '*too much unhealthy snacks*' and '*not having enough*
482 *vegetables*'. Issues around breakfast skipping were also correspondent with reports of '*limited time*
483 *to have breakfast*' (Jeddah), '*Not having a hot cup of tea every morning because of trying to make*
484 *it to school on time in traffic*' (Guyana). The use of mobile technology was prevalent across all of
485 these settings, and mobile applications and social media were cited as important potential modes of
486 delivery for nutrition interventions. The level of health promoting activities in schools varied with
487 fewest activities in Jeddah, despite being the most affluent. Unlike London and Georgetown,
488 mosques were not considered appropriate for the delivery of nutrition interventions as usage is for
489 religious activities. Partnership working differed with strongest central government involvement,
490 i.e. the Ministry of Education, in Guyana, although this is the most economically unstable country
491 of the three. A sustainable school-based programme seemed most feasible, however, in Jeddah
492 where the prevention agendas of all partners appeared to coalesce.

493

494 **Conclusions**

495 In summary our studies informed our understanding of the contextual drivers for changes in dietary
496 habits among young people living in London in families, schools, neighbourhoods, and faith based
497 organisations. Our developmental studies also gave detailed insights of the challenges and
498 opportunities for partnerships with places of worship and other sectors for prevention, and the need
499 for advanced methodologies in this area.

500

501 We are applying the learning from our ongoing studies which use mixed methods, and pragmatic as
502 well as realist evaluation, to develop the design of follow-on studies, with programme adaptability
503 being a key consideration to suit different socio-cultural contexts. For example, the [HEAL-D](#)
504 (Health Eating & Active Lifestyles for Diabetes) study uses extensive community engagement with
505 African and Caribbean Type 2 Diabetes patients in London to continually adapt its design and
506 theory of change to optimise reach. The CONTACT ([Congregations Taking Action against NCDs](#))
507 study in South America and the Caribbean is a system intervention that is exploring how best to
508 integrate places of worship into the primary health care system to benefit those most at risk. Diverse
509 challenges and opportunities for feasibility and sustainability are being mapped and tested as the
510 intervention is implemented. The CYPHP ([Children and Young People's Health Partnership](#))

511 intervention study in South London aims to shift healthcare towards community settings, and bring
512 prevention and health promotion, including nutrition, into responsive healthcare in all settings.
513 There are significant health gains for both physical and mental health to be had from addressing
514 intersections of inequalities (e.g. deprivation, racism, food dense neighbourhoods). Our findings
515 signal opportunities for cross-sectoral engagement which could lever benefits across several
516 outcomes, including healthy nutrition, with an emphasis on translation of proven strategies to reach
517 young people from vulnerable communities.

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529

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536

537 Conflict of Interest

538 None.

539

540 Authorship

541 SH is the Principal Investigator of DASH, led on the analysis and drafted the first version of the
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543 conducts the qualitative data collection and analysis for DASH and the CONTACT study and
544 assisted in the analysis and write up of all qualitative data. MOK, SH, CE oversaw the conduct of
545 the London and Guyana developmental studies, recruitment of schools, collection and analysis of
546 data. The Kings and Communities for Youth Health study was designed by SH, MOK, AD, TG,
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550

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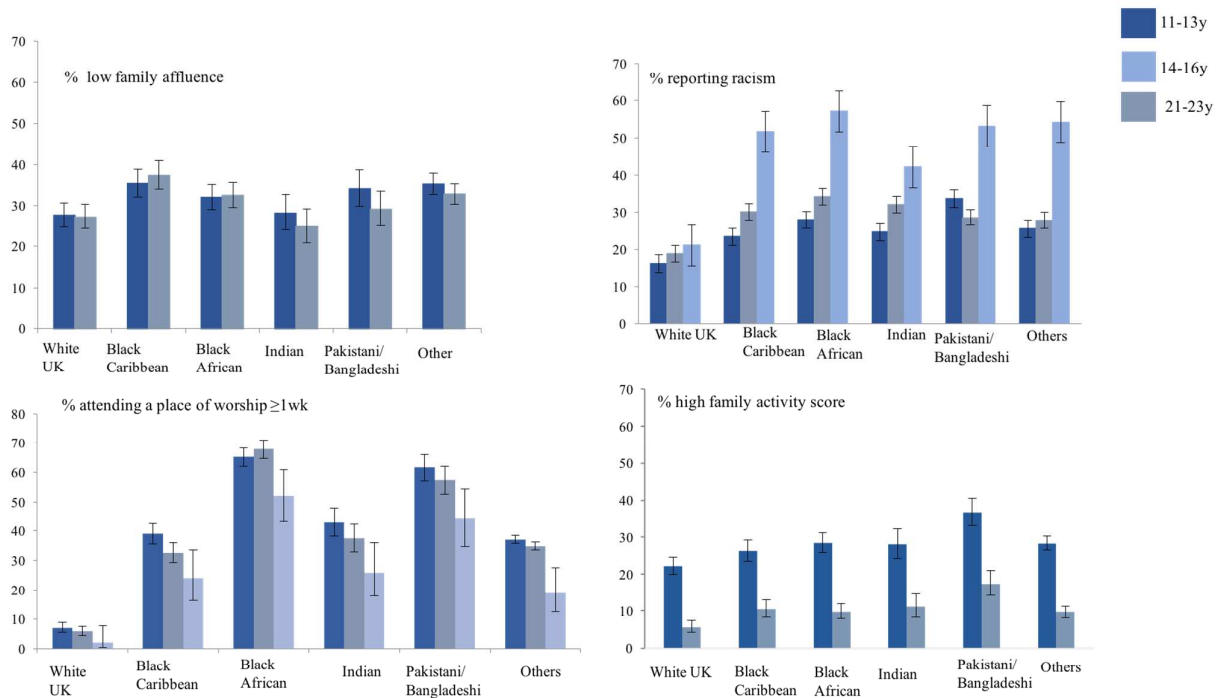
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For Peer Review

759 **Figure 1.** Cumulative exposure to disadvantage, family activities, racism, religious engagement and
 760 family engagement activities at 11-13years, 14-16years and 21-23years, by ethnicity: percentage
 761 and 95% CIs. The Determinants of young Adult Social well-being and Health (DASH) study ⁽⁷³⁾.
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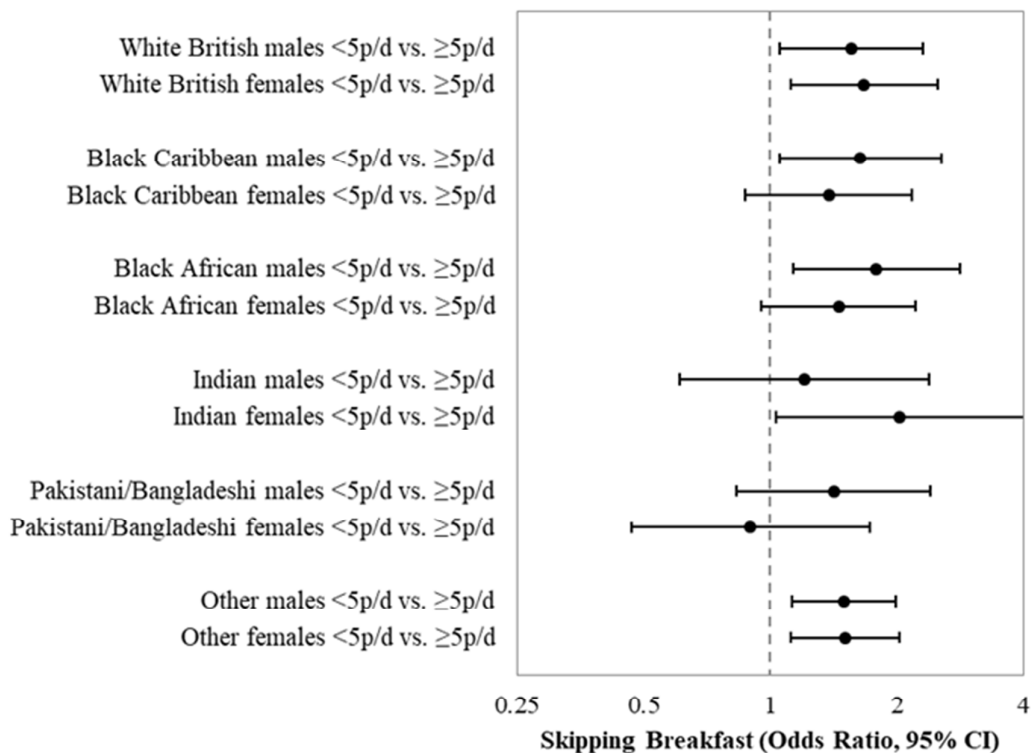
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764 Family activities ⁽²⁶⁾ included watching TV or videos, playing indoor games, eating a meal, going for a walk or playing
 765 sports, visiting friends or relatives, and going other places; a score was derived based on frequencies of all six activities,
 766 with a higher score indicating better family connectedness. The score was recoded into tertiles (based on thresholds for
 767 tertiles at 11-13 years). Only the high score tertile is shown. Family Affluence Scale ⁽⁷⁴⁾ was derived from number of
 768 cars, computers, holidays and own bedroom, coded 'high (≥ 3)', 'medium (1-2)' and 'low (0)'; high affluence only
 769 shown. Experiences of discrimination ⁽⁷⁵⁾ scale which includes questions on 'unfair treatment' on the grounds of race,
 770 skin colour place of birth and religion in various locations e.g. school, work, on the street. Sample sizes 11-16y/21-23y:
 771 White British 867/107; Black Caribbean 695/102; Black African 818/132; Indian 397/98; Pakistani Bangladeshi
 772 451/111; Others 1,459/115.

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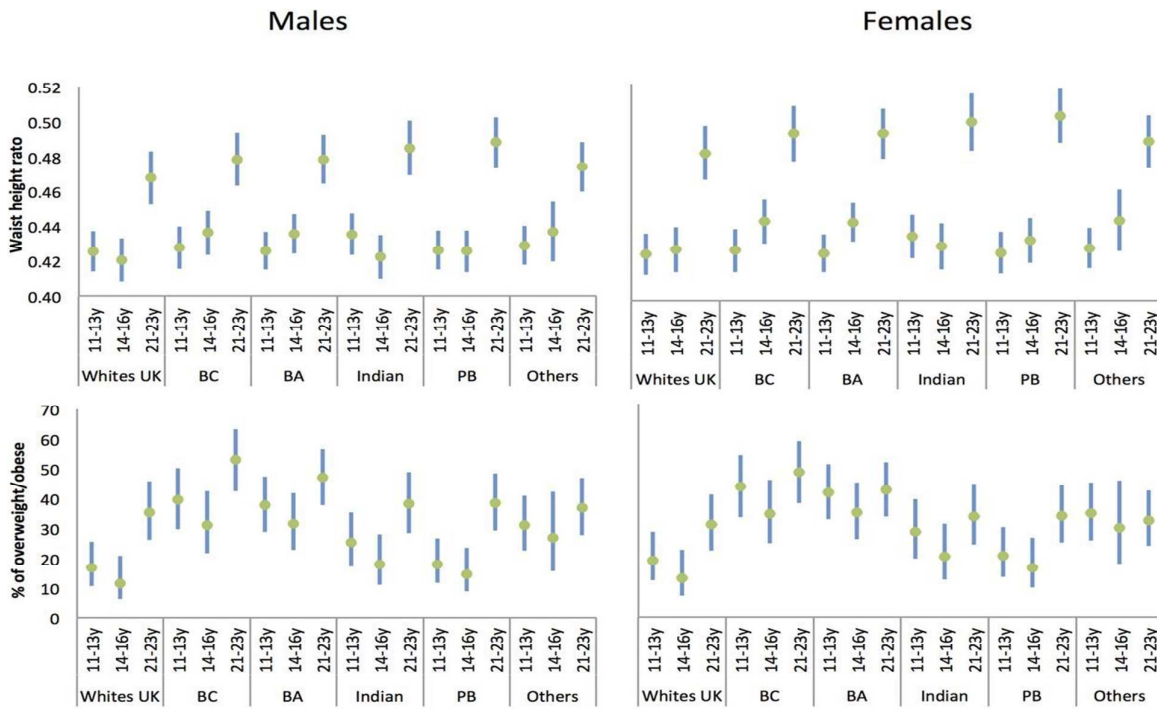
775 **Figure 2.** Breakfast skipping among 11-13-year-old adolescents with fruit and vegetable
 776 consumption <5 portions/d vs. ≥5 portions/d by gender and ethnicity, plotted on a log scale. The
 777 Determinants of young Adult Social well-being and Health (DASH) study ⁽⁷⁶⁾.
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 780 White British males: N=595; White British females: N=555; Black Caribbean males: N=413; Black Caribbean females:
 781 N=410; Black African males: N=427; Black African females: N=510; Indian males: N=255; Indian females: N=210;
 782 Pakistani/Bangladeshi males: N=373; Pakistani/Bangladeshi females: N=205; Other males: N=1,030; Other females:
 783 N=869.
 784 p/d= portions per day.
 785 Models adjusted for fruit and vegetable consumption, age, parental care, parental control, family activities and family
 786 affluence. Skipping breakfast was defined as not eating breakfast every day. Parental care and control were measured
 787 using the Parental Bonding Instrument ⁽²⁵⁾; Family Affluence Scale ⁽⁷⁴⁾ was derived from the number of cars, computers
 788 and holidays and own bedroom. Family activities included watching TV or videos, playing indoor games, eating a meal,
 789 going for a walk or playing sports, visiting friends or relatives, and going other places ⁽²⁶⁾.
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799 **Figure 3.** Waist to height ratio and per cent of overweight/obese, by age and ethnicity for males and
 800 females: means/percentage and 95% CIs, adjusted for gender and ethnicity ⁽⁵²⁾.
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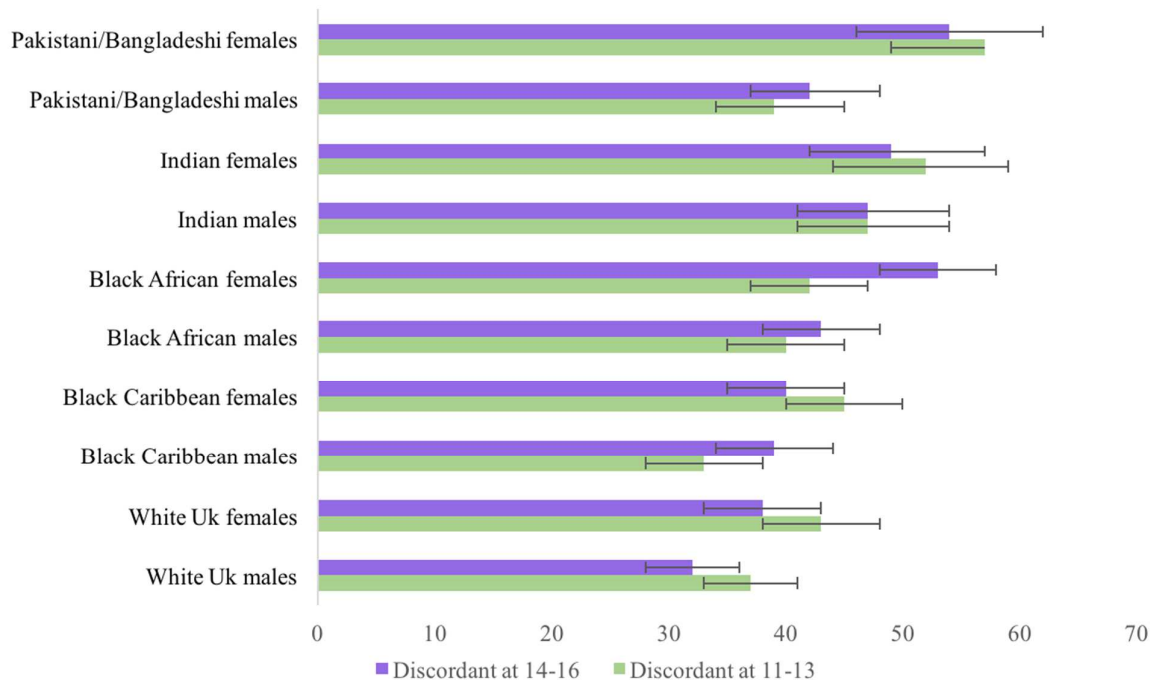
804 BA, Black African; BC, Black Caribbean; PB, Pakistani/Bangladeshi – Note. Adapted from “Longitudinal study of
 805 cardiometabolic risk from early adolescence to early adulthood in an ethnically diverse cohort”.

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808 **Figure 4.** Percentage with perception of weight status discordant to measured weight by age and
 809 ethnicity: percentage and 95% CIs, the Determinants of young Adult Social well-being and Health
 810 (DASH) study ⁽⁷⁷⁾.

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814 N=3228. Perception of body size was assessed using the question “Given your height and weight would you say you
 815 are...” and 4 response categories were used: 1) About right 2) Too heavy 3) Too light and 4) Not Sure. Based on their
 816 BMI, participants were classified as underweight, normal weight, overweight or obese based on the 1990 British age
 817 and gender specific growth reference curves ⁽⁷⁸⁾. Participants were classified into 8 categories which are combined here
 818 as concordant or discordant weight status perception relative to measured weight status.

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829 **Table 1.** Correlates of <5 portions of fruit and vegetables per day from 11-13 years⁽⁸¹⁾ to 14-16
 830 years⁽⁷⁶⁾. The Determinants of young Adult Social well-being and Health (DASH) study.
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	Boys (N=2,161)			Girls (N=1,890)		
	OR	95% CI	P	OR	95% CI	P
Ethnicity (vs. White British)						
Black Caribbean	1.74	1.22-2.48	0.002	1.65	1.10-2.48	0.015
Black African	2.59	1.77-3.79	<0.001	2.71	1.78-4.13	<0.001
Indian	1.42	0.90-2.22	0.129	1.17	0.68-2.00	0.571
Pakistani/Bangladeshi	3.08	1.97-4.81	<0.001	2.06	1.12-3.79	0.021
Others	1.23	0.92-1.65	0.162	1.02	0.72-1.44	0.922
Parental care (vs. high tertile)						
Medium tertile	1.36	1.09-1.69	0.006	1.21	0.93-1.56	0.153
Low tertile	1.31	1.04-1.65	0.024	1.33	1.00-1.75	0.048
Not stated	2.32	0.88-6.13	0.089	0.69	0.25-1.91	0.473
Parental control (vs. low tertile)						
Medium tertile	1.08	0.87-1.33	0.502	0.86	0.67-1.11	0.262
High tertile	1.18	0.93-1.49	0.178	1.03	0.79-1.35	0.818
Not stated	0.82	0.34-2.00	0.670	0.96	0.33-2.75	0.934
Family activities score (vs. high tertile)						
Medium tertile	1.29	1.01-1.64	0.038	1.38	1.03-1.85	0.031
Low tertile	1.91	1.48-2.47	<0.001	1.82	1.34-2.49	<0.001
Not stated	1.53	0.83-2.82	0.169	1.81	0.86-3.83	0.118
Age (vs. 11-13 years)						
14-16 years	0.83	0.68-1.01	0.057	0.61	0.49-0.76	<0.001
Not stated	1.57	0.05-51.81	0.800	0.11	0.00-4.22	0.234
Physical activity (vs. ≥ 5 times per week)						
3 or 4 times per week	1.75	1.41-2.16	<0.001	2.29	1.75-3.01	<0.001
Twice per week	2.73	2.06-3.61	<0.001	3.03	2.23-4.13	<0.001
Once per week	3.10	2.22-4.34	<0.001	3.48	2.51-4.83	<0.001
Less than once per week	3.74	2.16-6.49	<0.001	4.78	3.17-7.22	<0.001
Not stated	0.38	0.15-0.99	0.049	4.29	0.93-19.84	0.062
Family affluence (vs. high)						
Medium	1.19	0.97-1.47	0.096	1.13	0.90-1.42	0.308
Low	1.16	0.67-2.01	0.585	0.68	0.37-1.24	0.206
Not stated	0.89	0.60-1.32	0.572	1.13	0.73-1.76	0.589

832 Odds ratios were estimated by multilevel mixed-effects logistic regression, adjusted for ethnicity, age, generational
 833 status, physical activity, smoking, drinking alcohol, vegetarian, religious prohibition of food, slimming diet, worry
 834 about weight gain, unhappy if overeating, paternal smoking, maternal smoking, paternal overweight, maternal
 835 overweight, parental care, parental control, family activities score, family affluence, and family structure. Parental care
 836 and control were measured using the Parental Bonding Instrument⁽²⁵⁾, with scores recoded into tertiles (based on
 837 thresholds for tertiles at 11-13 years); Family activities⁽²⁶⁾ included watching TV or videos, playing indoor games,
 838 eating a meal, going for a walk or playing sports, visiting friends or relatives, and going other places; a score was
 839 derived based on frequencies of all six activities, with a higher score indicating better family connectedness; the score
 840 was recoded into tertiles (based on thresholds for tertiles at 11-13 years). Physical activity measured frequency of 19 or
 841 more activities over last 7 days. Family Affluence Scale⁽⁷⁴⁾ was derived from number of cars, computers, holidays and
 842 own bedroom, coded 'high (≥ 3)', 'medium (1-2) and 'low (0)'.
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846 **Table 2.** Association between fruit and vegetable consumption and breakfast skipping from early
 847 adolescence (11-13 years) to early 20s. Determinants of young Adult Social well-being and Health
 848 (DASH) study ⁽⁵³⁾.
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	Odds Ratio	95% CI	<i>P</i>
Fruit and vegetable consumption (vs. ≥ 5 portions/d)			
<5 portions/d	1.72	1.22-2.42	0.002
Not stated	0.92	0.41-2.09	0.844
Age (vs. 11-13 years)			
21-23 years	2.39	1.74-3.29	<0.001
Gender (vs. male)			
Female	1.13	0.80-1.59	0.483
Employment (vs. yes)			
No	1.55	1.07-2.23	0.020
Not stated	1.67	0.86-3.27	0.132

850 Based on 10% pilot sample (N=558). Odds ratios were estimated by multilevel mixed-effects logistic regression,
 851 adjusted for fruit and vegetable consumption, age, gender, ethnicity, parental care, parental control, and parental/own
 852 employment. Interaction term 'ethnicity \times fruit and vegetable intake' was not significant. Skipping breakfast was
 853 defined as not eating breakfast every day. Parental care and control were measured using the Parental Bonding
 854 Instrument ⁽²⁵⁾, with scores recoded into tertiles (based on thresholds for tertiles at 11-13 years). Parental employment
 855 was used as the measurement of employment at 11-13 years, while own employment was used at 21-23 years.
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858 **Table 3.** Concept Mapping results for the domains of influence on dietary behaviours ⁽⁷⁹⁾.

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Domain	# of items	Examples of items	Average Importance Score*	Average Modifiability Score*
Home life and moderation	23	"Small quantity of food is good so I don't overeat", "Parents should ration food", "I shop with mum"	3.57	3.66
Strong opinions or beliefs	13	"One day a week for treats", "One day a week for treats", "Fat is not healthy"	3.48	3.43
Food literacy influences	13	"Dairy messes with your stomach", "Balance fruits and vegetables with chocolate", "Dairy messes with your stomach"	2.96	3.11
School context	4	"Teachers should watch what we eat at break time", "The canteen shouldn't sell fizzy drinks"	3.09	2.9
Neighbourhood influences	12	"Too many fast food places in my neighbourhood", "Tesco near school makes me buy sweets", "I get attracted by the smell of the fast food shops"	3.12	3.15
TOTAL	65		3.24	3.25

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