

Relationships between children's sugar consumption at home and their food choices and consumption at school lunch

Abstract

Objective: To investigate the relationships between children's food and drink choices at school lunch for children who consume high or low sugar intakes at home.

Mixed Method Design: Children's food and drinks consumption at home was assessed using diet diaries over three consecutive days. Children were classified as "high" or "low" sugar consumers at home using the WHO recommendation that free sugars should be less than 10% of their daily total energy intake. A purposive sample of children was then selected and observed during school lunch, recording food selections, food left on plates and content of packed lunches.

Setting: Six primary schools in Newham and Kent, England

Participants: Parents and children aged six-seven years

Results: Seventy-one parents completed diet diaries. From the 71, 39 children were observed during school lunch. Twenty children were high sugar consumers, 19 children were low sugar consumers; 31 children had a school meal.

Eleven of the 15 children (73%) who had school meals and who were high sugar consumers, selected a high sugar dessert rather than fruit. Only five of the 16 (31%) children who had school meals and were low sugar consumers at home chose a high sugar dessert. Most of the children who had packed lunches had sweet items, despite school policies.

Conclusions: Children who consumed high sugar intakes at home tended to select foods high in sugar for school meals or had packed lunches containing high sugar foods. The implications for public health programmes include healthy eating workshops and implementing school food policies.

Key words: Children –School lunch - Dietary - Sugar

1 **Introduction**

2 There is an increased focus on children’s dietary habits spurred by the rise in child obesity and
3 tooth decay⁽¹⁾. The UK National Child Measurement Programme found that 33% of children
4 aged 10-11 were obese or overweight in 2016⁽²⁾. Similarly, approximately a third (31%) of
5 five-year-olds and nearly half (46%) of eight-year-olds had experienced tooth decay in their
6 primary (baby) teeth. The frequent consumption of food and drinks containing free sugars is a
7 common-risk factor for both child obesity and tooth decay in children^(3; 4). The Scientific
8 Advisory Committee on Nutrition (SACN) reported in 2015 that high sugar intakes increase
9 the risk of developing type 2 diabetes, weight gain and tooth decay in children⁽⁵⁾. Free sugars
10 (FS) are mono and disaccharides added to food or drinks; or sugars naturally present in honey,
11 syrups and fruit juices excluding sugars in milk⁽⁶⁾. The SACN recommended that FS intake in
12 the UK should account for no more than five percent of a person’s daily energy intake⁽⁵⁾. The
13 World Health Organisation (WHO) guidelines also recommended restricting FS in children’s
14 diets to less than 10% of their daily total energy intake⁽⁷⁾. However, data from national nutrition
15 surveys in England shows that children’s consumption of FS exceed these recommendations⁽⁸⁾.
16 Children aged four to 10 years and 11 to 18 years consumed an average of 15% and 16% of
17 their energy intake on free sugars in 2012. Developing strategies to support healthy eating
18 requires a deeper understanding of the factors that influence children’s food choices.

19
20 Children spend a significant amount of their time outside of the home environment in school
21 which means that they have access to food or drinks available outside the home environment⁽⁹⁾.
22 However, few studies have explored the relationship between dietary habits at home and food
23 choices outside the home environment. The Department for Education in England reported that
24 one-million primary school children (85%) have school meals across England⁽¹⁰⁾.

25
26 The two key factors that influence what children eat at school are the availability of food
27 options in the school meals; and, what parents decide to include in children’s packed lunches.
28 A study of primary school children in England found that sugar and total carbohydrate content
29 in children who had packed lunches were higher than those eating school meals⁽¹¹⁾. Although
30 studies have explored children’s food choices in school lunch, no studies have looked at the
31 relationship between children’s food consumption both at home and at school.

32

33 Several studies examining food consumption have used an ethnographic approach, which
34 involved participant-observations of children as the main methodology^(12; 13). The advantage of
35 participant observations is that it provides a visual and objective assessment of behaviour rather
36 than beliefs or perceptions⁽¹⁴⁾. The purpose of the school meal and packed lunch observation in
37 this study was to assess children's food selection and choices outside of the home environment
38 at school. This study addressed the research question: Is there a relationship between children's
39 FS consumption at home and their food choices and consumption at school lunch?

40

41

42 **Methods**

43 **Mixed methods study design**

44 This study used a mixed method explanatory design⁽¹⁵⁾ which involved both quantitative and
45 qualitative research methods in two sequential phases. In phase 1, quantitative data was
46 collected to assess children's food and drinks consumption at home using a parent report three-
47 day food diary, including one weekend day. This data was input into INTAKE24⁽¹⁶⁾. The
48 INTAKE24 is an online dietary assessment method. It is specifically designed to include the
49 portion size of foods and it is linked to the NDNS Nutrient Databank⁽¹⁷⁾. The data was analysed
50 to determine children's sugar consumption at home and then used to select children to take part
51 in a qualitative study, which included non-participant observation of children's school lunch.
52 The classification of children into high and low free sugars (FS) consumers at home was based
53 on the percentage of energy that FS comprised of their daily energy intake as compared to the
54 recommendation that FS should be less than 10%⁽⁷⁾. Children who had low sugar intakes at
55 home had FS intakes that were less than 10% of their energy intake, while children who had
56 high sugar intakes at home had sugar intakes that exceeded 10% of their energy intake.
57 Following this classification, all the children who were high or low free sugars consumers at
58 home were selected to take part in a qualitative study, which included non-participant
59 observation of children's school lunch.

60

61 **Study population**

62 The study population comprised children attending primary schools in Kent and Newham in
63 England and their parents/carers. These areas were selected to study families from both low
64 and middle socioeconomic groups in an inner city, ethnically diverse urban population living

65 in the capital city of London, in the borough of Newham; and, from a suburban, less diverse
66 population outside London, in Kent. Newham and Kent were selected to represent two
67 contrasting areas in England. Newham is in the top 20% of deprived areas in England; more
68 than a quarter (28%) of children live in low-income households. In contrast, Kent is ranked
69 amongst the 50% least deprived areas in England with 15% of children living in poverty^(18; 19)

70

71 **Sample selection: School**

72 State-maintained (government funded) primary schools in Kent and Newham were the setting
73 for this study. A list of primary schools in Kent and Newham was obtained and categorised
74 based on the number of children within the school and the percentage of children whose first
75 language was English. Schools with large numbers and fewer non-English speaking children
76 were prioritised to maximise the opportunities for a good response from parents. Seventy-six
77 schools were approached using an invitation letter sent to the head teachers asking them for
78 permission to involve their school. Six schools agreed to participate; three schools in Newham,
79 and three schools in Kent.

80

81 **Sample selection: Participants**

82 The participants were Year 2 children aged six-seven years old attending the six primary
83 schools and their parents who gave their positive consent for their child to participate. Sample
84 size requirements for participant observation studies are not based on a priori calculation but
85 on data saturation when no new themes emerge from the observations⁽²⁰⁾. Guidance on
86 ethnographic studies that include non-participant observations estimate that 25–50
87 observations are often sufficient to obtain thematic saturation⁽²¹⁾.

88

89 **Quantitative assessment of children's dietary intakes at home**

90 Parents/carers who attended the six schools were asked to complete a 24-hour diet diary over
91 three days noting their child's food and drinks intake; and, to complete a demographic
92 questionnaire. Three consecutive days were preselected to include one weekend and two
93 weekdays. The purpose of collecting dietary information on at least one day in the weekend
94 was to take into account variations in children's diets, including on special occasions that occur
95 more frequently at weekends. The diet diaries had instructions for recording food and drinks
96 with details of the amount, portion size, brand name provided to their child, and the amount of
97 food and drink left after the meal or snack.

98 The data collected in the diet diaries was entered into INTAKE24⁽¹⁶⁾ which computes the daily
99 intake based on nutrient groups analysed to calculate free sugar intake and total energy intake.
100 INTAKE24 is a validated method to be used by parents of younger children to assess dietary
101 intake⁽¹⁶⁾.

102 Each child was classified based on the daily dietary intake using the WHO recommendation.
103 Extreme (or deviant) sampling⁽²²⁾ was then used to identify the children who consumed high
104 sugar intakes (daily total energy percentage from free sugars exceeded 10%) or low sugar
105 intakes (daily total energy percentage from free sugars less than 10%).

106 **Description of food availability in the schools selected**

107 Schools provided a range of food options including set meals, fruit, vegetables and dessert such
108 as cakes, pudding, flavoured yogurt, ice-cream and custard. The content of school meals varied
109 depending on the schools' fixed main course menus. Table 1 shows the main differences and
110 similarities between the school menus and the availability of free sugars containing food
111 (dessert) in all six schools. The study was carried out during the summer term of 2016 and the
112 analysis was based on the summer term menus (Table 1). All participating schools in Newham
113 and Kent offered vegetables and fruit at school meals. Fish was usually served on Fridays in
114 schools and the majority of schools offered a vegetarian option. Vegetables were also available
115 in all menus including sweetcorn, salad, peas and mixed vegetables.

116
117 All six schools provided healthy drinks for children (water and milk). Only one school offered
118 only fruit or yoghurt for dessert. Other schools served different sugar-containing dessert
119 options. In Kent, one school had three options for lunch, either school meals, packed lunch or
120 catering option, which included sandwiches. Only milk and water were available as drinks for
121 children who had school meals in all schools; while children with packed lunches brought
122 either apple or orange juice.

123

124 **School food policies**

125 Two of the three schools in Newham had Healthy School status⁽²³⁾ (Table 1), which meant they
126 followed specific requirements as part of the "Healthy Schools in London" Programme. One
127 of these requirements was having a school food policy. Two schools in Ken had food policies
128 based on the Eatwell plate, Change4life and Nutritionist resource ⁽²⁴⁾.

129

130 **School lunch observations**

131 A qualitative researcher carried out the observations in the school on the purposive sample of
132 children who were categorised as high and low sugar consumers. This researcher was aware of
133 whether the child was categorised as a low or high sugar consumer during the participant
134 observations. Each child was observed individually based on their sugar classification. Detailed
135 information about children's food choices and observation data was written up in field
136 notebooks. The notes were then transferred into a descriptive narrative on a digital file.

137

138 The non-participant observation of school lunches used an observation checklist developed to
139 record the observations of both school meals and packed lunches. This checklist recorded food
140 content, the food left on plate, the interaction between children in terms of food choices and
141 the contribution of free sugars. Photographs of the available food at school lunch and
142 photographs of children's plates were used to taken to provide a visual record of the content of
143 school meals or packed lunches and the content of the food left on plate.

144

145 **Data analysis**

146 Children's diet diaries were analysed using the Statistical Package for the Social Sciences
147 statistical software package version 22.0 (SPSS Inc., Chicago, IL, USA) to calculate their daily
148 free sugar intake and total energy intake. Conventional content analysis⁽²⁵⁾ was used to analyse
149 the data gathered during school lunch observations from the observation checklists,
150 photographs and school menus. Thirty-one children who had a school meal and eight children
151 who had a packed lunch were included in the analysis.

152 **Results**

153 **Description of study population**

154 One hundred and thirty-four families agreed to participate in the study and were invited to
155 complete a three-day diet diary. Of those parents, 71 parents completed the three-day diet
156 diaries (38 children in Newham and 33 children in Kent). Forty-three parents out of 71 (60%)
157 completed the demographic questionnaire. Nearly half of the mothers (46%), and fathers (49%)
158 had a university degree while 40% of mothers and 28% of fathers completed further education
159 at college.

160

161 Thirty-nine children were purposively sampled to take part in the school lunch observations.
162 The mean age of the children was 7.2 years (SD=0.2). Twenty children were observed in Kent

163 and 19 in Newham. Most of the parents of the 39 children who were observed had completed
164 either further education or had a university degree (90%).

165

166 **Assessment of children's macronutrients and sugar intake at home**

167 Thirty-nine children were selected for school lunch observations. Table 2 shows the daily mean
168 intake of energy, carbohydrates, total sugars, fat, saturated fat, proteins and the mean free
169 sugars intake of the 39 children. The mean energy intake for six to seven-year-old children was
170 1931 kcal/day (1789 kcal in Newham and 2073 kcal in Kent). Children in Kent consumed more
171 free sugars (75 grams/day) than children in Newham (49 grams/day) (Table 2). The FS
172 consumption and the energy percent from FS were measured for meals and snacks at home
173 (excluding reported free sugars from lunches during weekdays). Twenty children were
174 categorized as high sugar consumers (total energy from FS was $\geq 10\%$) and 19 low sugar
175 consumers (total energy from FS was $< 10\%$). The mean daily sugar intake was 56 grams/day for
176 high sugar consumers and 12 grams /day for children who had low sugar intakes. The total
177 energy from free sugars was 17% for children in the high sugar group and 5% for children in
178 the low sugar group. The analysis of diet diaries showed that the mean intake of fruits and
179 vegetables at home in children who had low sugar intakes was higher than the intake of children
180 who had high sugar intakes (Table 3).

181

182 **Description of school lunch process**

183 Children who had school lunches usually sat at the same table and talked to each other. The
184 food choices of children who sat together were similar. The time taken for children to finish
185 eating their school lunches ranged from 10 to 15 minutes. All the schools followed the same
186 system during school lunch, whereby the class teachers stood in front of the dining area to
187 oversee the children who selected their own food items. Children chose items from the salad
188 bar, as well as a main dish option and a dessert. Children who had school meals usually sat at
189 the same table; children with packed lunches also sat together. All six schools had the same
190 size of colour plate but the amount of food allocated to children varied in each school
191 determined by the serving staff. Two schools in Kent served small food portions compared to
192 other schools. After the meal, some teaching assistants checked the remaining food on
193 children's plates and encouraged the children to finish their food.

194

195

196 **School meals food selection and consumption by children who consumed high and low**
197 **sugar intakes at home**

198 Seventeen children (89%) out of the 19 children in Newham had a school meal while 14 out of
199 the 20 children (70%) in Kent, had a school meal. Table 4 shows the school lunch dessert
200 selections and food consumed by children in Newham and Kent. In Newham, the sugar
201 containing desserts were mainly flavoured yogurts while in Kent the sugar-containing desserts
202 were puddings.

203

204 Eleven of the 15 children who had high sugar intakes at home selected a dessert with a high
205 free sugars content rather than fruit when it was available. Figure 1a shows an example of the
206 food selected at school lunch by a child who was a high sugar consumer at home. In contrast,
207 only five of the 16 children categorised as “low” sugar consumers at home selected a high sugar
208 dessert at school lunch (Figure 1c). Children who had low sugar intakes at home selected
209 mainly flavoured yoghurts as their chosen dessert at school, while children who had high sugar
210 intakes at home tended to select sweetened desserts at school such as ice-cream, cake, custard,
211 pudding, flapjack and chocolate mousse. The food left on the plate of children with high sugar
212 intakes at home included fruit and vegetables. Eight children with high sugar intakes at home
213 left fruit and vegetables on their plates (Figure 1b). Children with low sugar intakes at home
214 selected more fruit at school lunch but like children who had high intakes at home, they also
215 left some vegetables on their plates (Figure 1d).

216

217

218 **Packed lunch content in children who consumed high and low sugar intakes at home**

219 Eight children had packed lunches. The content of packed lunches was usually a sandwich,
220 fruit and a dessert (e.g, sweets or sweet biscuits) but there were differences in the content of
221 food between the children. Schools had guidance that recommended avoiding unhealthy
222 options such as sweets, confectionery and crisps and encouraging a healthy alternative instead
223 such as bread sticks or low sugar snack bars. Four of six schools had some restrictions on
224 confectionery and sweets as a part of their packed lunch policies. Despite this, four of the five
225 children who had sugar intakes at home had either sweets or sweet biscuits in their packed
226 lunches, while all three children who had low sugar intakes at home had fruit in their packed
227 lunches. Seven of eight children had small cartoons of fruit juice and only one child had a water
228 bottle in their packed lunch. Children left fruit and sandwiches in their packed lunches.

229 **Discussion**

230 This study compared the school meal selection and content of packed lunches in children with
231 high and low sugar intakes in heterogeneous school environments in Newham and Kent,
232 England. Whilst recognising the relatively small purposive sample size, this study suggests that
233 there could be a trend in the relationship between children's sugar consumption at home and
234 their choices and consumption at school. More children who had high sugar intakes at home
235 selected foods that were high in sugar at school rather than fruit while children who had low
236 sugar intakes at home were less likely to pick foods that were high in sugar at school lunch. This
237 relationship may be influenced by children's learned food preferences. A preference for sweet
238 taste is universally present in neonates, along with an aversion to sour or bitter tastes^(26; 27; 28).
239 Both cross-sectional studies and longitudinal studies demonstrate a preference towards sweet
240 taste in children^(29; 30). Children have an unlearned preference for sweet and salty foods and an
241 innate dislike of sour and bitter tastes⁽³¹⁾. This innate preference for sugar-containing foods and
242 drinks can further develop during childhood through repeated exposure to sweetened food⁽³²⁾.
243 Experience can also enhance taste preferences; earlier experiences of a particular food eaten at
244 home are the major determinants for developing children's food acceptance patterns.

245 The findings in our study showed that children who high low sugar intakes at home consumed
246 more fruits and vegetables than high sugar foods during school lunch. However, both children
247 with high and low sugar intakes at home left fruit and vegetables on their plates at school lunch.
248 Current evidence recommends that children eat at least five portions of a variety of fruit and
249 vegetables each day⁽²⁴⁾. Previous research has also shown the benefit of providing fruit and
250 vegetables at school during early school years^(33; 34). A recent systematic review assessed the
251 effect of school food environment policies on children's dietary habits and found that school
252 food environment policies improved targeted dietary behaviours⁽³⁵⁾. Our study suggests that
253 offering children only fresh fruit and yoghurt as dessert options at school lunch could support
254 children to reach their daily fruit and vegetable consumption recommendations, whilst also
255 reducing their intake of free sugars⁽³⁶⁾. To support this objective, fresh fruit dessert options in
256 school meals and school food policy should follow the Eatwell Guide⁽²⁴⁾ and sugar swaps ideas.
257 Previous studies have shown that repeated exposure of vegetables at a younger age may be
258 effective in encouraging children to eat more fruit and vegetables, especially before the onset
259 of neophobia⁽³⁷⁾. When the repeated exposure to vegetables strategy was used, younger
260 children were less fussy about their food choices, enjoyed food more and reported lower satiety
261 responsiveness⁽³⁷⁾. However, findings from interviews and focus groups with children

262 suggested that their perceptions about fruit and vegetables change over time through cognitive
263 development ⁽³⁸⁾. The participant observation in our study showed that fruit and vegetables
264 were available to all children. This highlights the role that catering staff could have to
265 encourage children to consume those fruit and vegetables, to facilitate higher consumption
266 through repeated exposure and encouragement.

267

268

269 The school lunch observations showed that the majority of children had a school meal. Since
270 2014, government funded schools in England provide every child in reception (aged 4-5), Year
271 1 and Year 2 with a hot lunchtime meal under the Universal Infant Free School Meals (UIFSM)
272 policy. A recent cross-sectional study assessed the effect of the UIFSM policy in schools and
273 found that it increased the uptake of school meals from over a third (38%) of children in 2013-
274 14 to 80% in 2015-16, evident across most schools⁽³⁹⁾. School meals are a communal experience
275 creating opportunities to encourage healthy eating at lunchtime ^(40;41).

276 Our study found that the minority of children had a packed lunch. One school in Kent allowed
277 crisps and sweet snacks such as cake or chocolate-coated biscuits and fruit juice to be brought
278 to school in packed lunches. A study in English primary schools that compared the food and
279 nutrient intakes of children eating school dinners and packed lunches found that the sugar
280 content of packed lunches was higher in packed lunches than in school dinners⁽¹¹⁾. Our findings
281 agreed with Golley et al., (2010) that children having school meals were no longer consuming
282 drinks other than milk or water, confectionery or savoury snacks compared to children who had
283 packed lunch⁽⁴²⁾. Children's eating behaviour at home, such as feeding practices, parenting
284 style⁽⁴³⁾ and parental autonomy may contribute to parents' lunch packing decisions. A qualitative
285 study of seven-eight -year-old children in Wales found that some children preferred packed
286 lunches because they had greater control over what they ate at school lunch⁽⁴⁴⁾. Parents often
287 capitulated to their children's preference for unhealthy options in packed lunches, which could
288 explain the high sugar content of food items in packed lunches identified in our study.

289

290 The findings from this study suggest that reducing children's high sugar choices at school also
291 needs to take into account and aim to reduce their sugar choices and intakes in the home
292 environment. Similarly, recent studies have considered food choices outside the home
293 environment, when high sugar snacking is common at home^(45; 46). A cross-sectional study
294 examined the association between the home availability of sugar-sweetened beverages and total

295 sugar-sweetened beverage consumption and found that when sugar-sweetened beverages were
296 available at school, adolescents' sugar-sweetened beverage consumption was higher among
297 those with more frequent availability of sugar- sweetened beverages in the home. A systematic
298 review investigated the association between the family environment and children's fruit and
299 vegetable consumption⁽⁴⁷⁾. Their findings highlighted the importance of targeting the family
300 environment for the promotion of healthy eating behaviours among children and adolescents.
301 There is a need for whole family approach interventions as well as trying to reduce high sugar
302 options at school.

303

304 Families food choices at home strengthen children's preference for sugary foods and parents are
305 usually in charge of limiting children's sugar consumption by controlling access to foods⁽⁴⁸⁾.
306 Therefore, there is an opportunity to change children's food preferences by supporting families
307 with tools that encourage healthy food choices. One example is the using sugar swaps ideas such
308 as the Change4 Life Public Health initiative in the UK (<http://www.nhs.uk/Change4Life>). The
309 Change4Life programme encourages families and schools to promote healthy eating workshops
310 that involve parents' education highlighting the need to restrict free sugars consumption at home.

311 Whilst it is possibly easier to monitor and regulate the nutritional content of school meals, there
312 also needs to be clearer guidance for packed lunches to support parents to improve the quality
313 of foods brought from home at lunchtime⁽⁴⁹⁾. Schools are encouraged to promote healthy eating
314 workshops that involve parents' education highlighting the fact of controlling free sugar
315 consumption at home. Experiential learning healthy eating workshops for both parents and
316 primary school children have been shown to reduce children's sugar consumption^(50; 51).

317

318 **Strength and limitations**

319 This was a mixed methods study, which included participant observations based on a
320 qualitative research methodology reflecting the small purpose sample size. This inductive and
321 explorative study generated hypotheses from the trends that were observed about the
322 relationship between children's sugar intakes at home and at school. However, as with all
323 qualitative research studies, one should be caution about generalizing the findings of this study
324 to different settings. Transferability needs to be established in a given context.

325 Several methods were used to ensure the quality and convey rigour and trustworthiness in this
326 study⁽⁵²⁾ including the time spent in the field and using photographs and a checklist to verify

327 the observations. One limitation of this study was only observing the lunch period on one
328 occasion. Although the observations were carried out by a researcher who knew the child's
329 status, the coding and analysis were carried out by multiple coders (KB, VM and CP). This is
330 consistent with qualitative data analysis, which conveys credibility by using multiple coders to
331 reduce biases.

332

333 **Conclusions**

334 This exploratory study suggested that children who consumed high sugar intakes at home,
335 selected foods that were high in sugar in their school lunch meal or had packed lunches that
336 also included high sugar items. School lunch creates opportunities to influence children's
337 common food choices but requires change at the school organisation, policy and family levels.
338 The findings from this study reinforce the conceptualized relationship between children's food
339 choices in the school and home environments. This study highlighted the importance of school
340 polices, which should contain guidance on both school meals and packed lunches. Implications
341 for future public health programs include healthy eating workshops for families, both parents
342 and children; and, clearer guidance that promotes healthier packed lunches.

343

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Figure legends

Figure 1. Photographs illustrating the foods selected by four different children and the food left on the plates in school meals by children who had high and low sugar intakes at home in six-seven year old children in Newham and Kent

Figure 1a: Photograph of a food selected as a school meal from a high-sugar child: strawberry flapjack

Figure 1b: Photograph of food left on the plate of a high-sugar child fruit and vegetables

Figure 1c: Photograph of a food selected as a school meal from a low sugar child: fruit, vegetables, cheese and pasta

Figure 1d: Photograph of food left on the plate of a low-sugar mainly vegetables

Table 1: A summary of the school menus and food availability for the school meals for the six schools in Newham and Kent who participated in the study in May-July 2016.

School number (area)	Set Main Meal	Desserts provided	School food policy
School 1 (Newham)	<ul style="list-style-type: none"> ▪ Three main choice options provided including ethnic foods (e.g. chicken curry and sweet potato curry) ▪ Vegetables provided including mixed vegetables, peas, sweetcorn and baked beans. ▪ Food served by school was Halal. 	Fruit, flavoured yoghurt, chocolate cake, banana cake with custard, chocolate ice-cream, cheesecake, apple pie with custard and jelly.	No food policy for both school meals and packed lunches
School 2 (Newham)*	<ul style="list-style-type: none"> ▪ Two main choice options including a carbohydrate side choice (e.g. rice, chips or potato) and vegetable choice ▪ Asian food was available ▪ Food served by school was Halal. 	Only dessert options were fruit or yoghurt.	The policy is based on the Eatwell Plate and is reviewed every 3 years (for school meals and packed lunch)
School 3 (Newham)*	<ul style="list-style-type: none"> ▪ A wide range of main meals options available providing both Asian and British cuisine ▪ A vegetables bar was available ▪ Food served by school was Halal. 	Pudding, fruit flapjack, syrup sponge with custard, jelly, ice-cream, apple pie and chocolate muffins	The policy is based on the Eatwell Plate (for school meals and packed lunch)
School 4 (Kent)	<ul style="list-style-type: none"> ▪ Two main choice options provided including Asian and British cuisine: fish was served on Friday. ▪ Selection of vegetables available 	Pudding, fruit, sticky toffee (custard), chocolate tart, ice-cream, carrot cake and jelly.	The policy is based on the Nutritionist resource (for school meals and packed lunch)
School 5 (Kent)	<ul style="list-style-type: none"> ▪ A variety of main meal options including pasta, a designated meat-free day (Monday) and fish on ▪ Vegetables available including salad and beans 	Fruit, cake, jelly, cookies, iced finger bun and mousse.	No policy for both school meals and packed lunches
School 6 (Kent)	<ul style="list-style-type: none"> ▪ Different options available including meat (with pork option) and vegetable options, Italian and British cuisine. ▪ Fish was served on Friday. 	Fruit, ice-cream, fruit yoghurt, chocolate mousse, Tutti Fruity cake, cheesecake and raspberry cake	The policy is based on the Eatwell Plate and Change4Life (for packed lunch)

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Table 2: The macronutrient intakes of six -seven year old children who participated in the study in Newham and Kent, England based on three-day food diaries reported by parents in May-July 2016.

Macronutrient intakes	Children in Newham (n=19)		Children in Kent (n=20)		All children (n=39)	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Energy (kcal)	1788	(476)	2073	(914)	1931	(717)
Carbohydrate (g)	232	(63)	286	(118)	255	(92)
Fat (g)	68	(29)	83	(60)	76	(48)
Saturated Fat (g)	26	(10)	34	(23)	30	(18)
Protein (g)	73	(26)	75	(28)	74	(27)
Total sugars (g)	101	(43)	142	(73)	123	(51)
Free sugars(g)	49	(31)	75	(60)	63	(50)

(SD)-standard deviation.

Table 3: The mean daily fruit and vegetables intake at home (grams) of six -seven year old children who participated in the study in Newham and Kent, England based on the three day food diaries reported by parents in May-July 2016.

Fruit and vegetables intakes	Children in Newham (n=19)		Children in Kent (n=20)		All children (n=39)	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Fruit (g)	150	(101)	94	(47)	120	(80)
Vegetables (g)	40	(31)	43	(87)	41	(66)

Fruit and vegetables intakes	All children who had low sugar intakes at home* (n=19)		All children who had high sugar intakes at home** (n=20)		All children (n=39)	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Fruit (g)	123	(93)	118	(58)	120	(80)
Vegetables (g)	52	(72)	35	(53)	41	(66)

*Children had FS intakes that were less than 10% of their energy intake at home.

** Children had sugar intakes exceeding 10% of their energy intake at home.

Table 4: The dessert selections and food consumed at lunch by six -seven year old children who had school meals in Newham and Kent, England, May-July 2016

Food selection at school lunch	Children who had high sugar *intakes at home		Children who had low sugar *intakes at home	
	Children in Newham (n=8)	Children in Kent (n=7)	Children in Newham (n=9)	Children in Kent (n=7)
Number of children who selected desserts containing free sugars (%)	6 (75)	5 (71)	3(33)	2 (29)
Number of children selected desserts not containing free sugars (%)	2 (25)	2 (29)	6 (67)	5 (71)
Number of children who selected vegetables (%)	3 (38)	4 (57)	8 (88)	7 (100)
Number of children who left vegetables on the plate (%)	2 (25)	3 (43)	7 (77)	2 (29)

* Children had high intakes of free sugars at home that exceeded 10% of their energy intake.

**Children had low free sugars intakes at home that were less than 10% of their energy intake.