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1 **An exploration and comparison of food and drink availability in homes in a sample family of**
2 **White and Pakistani origin within the UK**

3

4 **Abstract**

5

6 **Objective:** To explore home and drink food availability in UK homes. Knowledge of the types and
7 quantities of foods and drinks available in family homes supports the development of targeted
8 intervention obesity prevention or management programmes, or for overall diet improvement. In the
9 UK, contemporary data on foods that are available within family homes are lacking.

10 **Design:** An exploratory study using researcher conducted home food availability inventories,
11 measuring all foods and drinks within the categories of fruits, vegetables, snack foods and
12 beverages.

13 **Setting:** Bradford, a town in the North of the UK

14 **Subjects:** Opportunistic sample of mixed ethnicity families with infants approximately 18 months
15 old from the Born in Bradford birth cohort.

16 **Results:** All homes had at least 1 type of fruit, vegetable and snack available. Fresh fruits
17 commonly available were oranges, apples, satsumas and grapes. Commonly available fresh
18 vegetables included potatoes, cucumber, tomatoes and carrots. The single greatest non-fresh fruit
19 available in homes was raisins. Non-fresh vegetables contributing the most were frozen mixed
20 vegetables, tinned tomatoes and tinned peas. Ethnic differences were found for the availability of
21 fresh fruits and sugar sweetened beverages, which were both found in higher amounts in Pakistani
22 homes compared to White homes.

23 **Conclusions:** These data contribute to international data on availability and provide an insight into
24 food availability within family homes in the UK. They have also supported a needs assessment of
25 the development of a culturally specific obesity prevention intervention in which fruits and
26 vegetables and sugar-sweetened beverages are targeted.

27

28 **Background**

29

30 There has been increasing interest in the role that food availability in the home has on food
31 consumption and obesity ⁽¹⁻⁷⁾. Such information has the potential to increase understanding of the
32 causes of energy over-consumption and provide direction to help create effective obesity prevention
33 interventions. However, research in this area is limited by the methods used to assess food
34 availability. Much of the literature uses data collected using food checklists; a quick and relatively
35 inexpensive method to assess the presence or absence of a predefined list of selected foods using
36 participant self-report. Data collected using this method is limited to the items that have been pre-
37 defined and cannot therefore, capture information on ethnically diverse habits or unexpected
38 patterns. An alternative method to self-report checklists is to conduct researcher administered
39 inventories of the home food environment. These involve researchers going in to participants
40 homes and recording all foods and drinks available (fully exhaustive inventories) or all foods and
41 drinks available within pre-defined categories (partially exhaustive inventories). They are not
42 limited to recording only foods that the researchers have previously assumed to be available in a
43 pre-defined list. However, few attempts have been made to collect this kind of data owing to issues
44 related to the feasibility of collection and analysis.

45

46 A review of methods to collect home food availability data in 2006 ⁽⁸⁾, identified just three other
47 published studies that had used fully or partially exhaustive inventories since 1975. Since then,
48 some investigators have used this approach, ⁽⁹⁻¹²⁾ however, the majority of work has continued to
49 focus on data collection using pre-defined checklists ^(5, 6, 13). This work has so far, been dominated
50 by the USA, and indicates that the availability of foods is generally related to consumption in
51 infants and children ^(5, 14-16) and weight status ^(2, 5, 6) though findings are somewhat equivocal, likely
52 due to the methodologies employed.

53

54 To our knowledge, there are no published studies describing home food availability, collected using
55 a researcher conducted approach within populations in the UK. We aimed to explore the home food
56 environment as part of an objective to develop a culturally appropriate obesity prevention
57 intervention within the Born in Bradford-1000 Programme of research ⁽¹⁷⁾. Since no other data of
58 this kind have been collected in a mixed-ethnic sample in the UK (and thus, no appropriate
59 checklist was available), open inventories of foods and drinks within pre-specified categories of
60 fruits, vegetables, snack foods and drinks were conducted by researchers within participant homes
61 using a well-defined protocol already tested by the authors as part of their work in the US ^(10, 11).

62 This study reports our findings from the inventories to explore which foods were available in the
63 homes of a sample of families of mixed ethnicity when their infants were approximately 18 months
64 old and to identify any differences in availability between White British and Pakistani homes.

65

66 **Experimental Methods**

67

68 Sample: Participants were opportunistically recruited from Born in Bradford 1000 (BiB1000); a
69 nested cohort within ‘Born in Bradford’ (BiB). BiB is a longitudinal multi-ethnic birth cohort
70 aiming to examine environmental, psychological and genetic factors that impact on health and
71 development perinatally, during childhood and subsequent adult life, and those that influence their
72 parents’ health and wellbeing. All mothers booked in for a delivery of their baby in Bradford Royal
73 infirmary from March 2007 to December 2010 were invited to take part in the research during their
74 routine 26-28 week glucose tolerance test. A total of 12,453 pregnant women enrolled who
75 subsequently gave birth to 13,776 babies. A full account of the methods is published elsewhere ⁽¹⁸⁾.
76 All mothers recruited to the main BiB cohort study between August 2008 and March 2009 (and
77 who had completed the baseline questionnaire) were approached to take part in ‘BiB 1000’ and a
78 total of 1,736 agreed. One hundred participants were then drawn opportunistically from the BiB
79 1000 cohort to take part in the current food availability study during the 18 month BiB 1000
80 assessment in which all approached agreed to take part. Due to the exploratory nature of the
81 research, a formal sample size calculation was not performed. Inventory data from 100 homes was
82 chosen as this was considered comparable to previous research ⁽⁸⁾; within calculations to detect
83 small to moderate group differences ⁽¹⁹⁾; and due to issues of feasibility.

84

85 This study was conducted according to the guidelines laid down in the Declaration of Helsinki and
86 all procedures involving human subjects/patients were approved by the Bradford Research Ethics
87 Committee; (07/H1302/112). Written or verbal (for mothers unable to read and/or speak English)
88 informed consent was obtained from all participants. Verbal consent was witnessed and formally
89 recorded.

90

91 Data collection

92 Researcher conducted food availability inventories: Researcher conducted inventories were
93 conducted in 100 homes when infants were approximately 18 months old. Data collection method,
94 staff training and quality assurance were conducted using a standardised protocol using well-
95 established methodologies from previous research ^(10, 11). Participants were told that researchers

96 would be visiting their homes and that they would need access to all places in their homes were
97 foods were stored. No incentives were provided. Researchers measured the availability (yes/no),
98 quantity and size of all foods from all food storage areas in participants homes within the higher
99 categories of fruit (with sub-categories: fresh, tinned, dried and frozen), vegetables (with sub-
100 categories fresh, tinned and frozen), snack foods (with sub-categories: crisps/tortillas, biscuits,
101 salted nuts, chocolate, sweets, cakes and ice-cream) and beverages (with sub-categories sugar-
102 sweetened and sugar-free). These categories were chosen because; (1) they are often the target of
103 obesity interventions; (2) there is some evidence that their intake is related to obesity in children ^{(20,}
104 ²¹⁾; (3) and/or literature indicates a relationship between availability in the home and either diet ^(3, 22)
105 or obesity ^(6, 23). Our previous studies also indicated that these items could be reliably and validly
106 collected ^(10, 11). Within each sub-category, open 'exhaustive' data were collected rather than using
107 a pre-defined checklist of items (i.e. details on all of the available foods and drinks available were
108 recorded). This method was used as this was an exploratory study with no a-priori data to suggest
109 the nature or type of foods which were present in the homes of this sample. For fresh produce,
110 researchers recorded the number of whole pieces (e.g. apples) or the number of handfuls (e.g.
111 grapes). For non-fresh items, researchers recorded the number of foods and drinks within pre-
112 specified size ranges of small, medium and large units. These were defined by weight and were
113 based on data previously collected ⁽¹⁰⁾ plus the actual package sizes available to purchase in the UK.
114 For example, tinned vegetables that weighed less than 250g were defined as small; those weighing
115 between 250-450g were considered to be medium and any weighing more than 450g were defined
116 as large.

117
118 Other measures pertinent to these analyses: The majority of demographic data were obtained at
119 recruitment including (26-28 weeks of pregnancy): household structure; marital status; residence
120 type, educational status and ethnicity. Maternal smoking behaviour was ascertained at this point to
121 determine whether participants were currently smoking during pregnancy by self-report. All
122 questionnaires were transliterated into Urdu and Mirpuri language, as the majority of Pakistani
123 populations residing in Bradford are of Mirpuri origin and one of the official languages of Pakistan
124 is Urdu. The process of transliteration involved translation, back-translation and several rounds of
125 piloting by bilingual and monolingual groups in collaboration with local experts in Bradford
126 (Bradford Talking Media). Since Mirpuri does not have a written form, transliterations were made
127 available for administration by bilingual study administrators. There were no language restrictions
128 for eligibility into this study and bilingual staff were trained to collect data from homes in which the
129 parents were unable to speak English.

130

131 Data cleaning

132 Open, exhaustive data from 836 food and drink items that were identified within the homes of this
133 sample were grouped to 215 individual food and drink types by a nutritionist (MB). For example, a
134 ‘packet of chocolate digestive biscuits’ was grouped as ‘biscuits with chocolate topping’ within the
135 sub-category of ‘Biscuits/Sweet snacks’ (under the higher category of snacks). Similarly, all crisps
136 that were made with corn, were assigned to the group of ‘tortillas’ within ‘Crisps/Savoury snacks’
137 and ‘red grapes’ and ‘green grapes’ were grouped as ‘grapes’ within the sub-category of fresh fruits
138 (under the higher category of fruit). For the purpose of these analyses, 1 handful of fresh produce
139 represented 1 serving. Other fresh produce that were recorded as whole units (e.g. melons) were
140 converted to the number of servings by a nutritionist (MB) using standards provided by
141 <http://nutritiondata.self.com/facts> and USDA <http://ndb.nal.usda.gov/ndb/foods>. Scores were
142 generated for the analysis of non-fresh produce based on the number of each food item within pre-
143 defined sizes. Small items were assigned a score of 1 per item; medium, a score of 2; and large, a
144 score of 3 per item. These can be viewed as equivalent to the total number of small sized items.
145 For example, a score of 4 for tinned vegetables is equivalent to having 4 small tins of vegetables in
146 the home, even though it may have actually have been available as 1 large tin (score of 3) plus 1
147 small tin (score of 1).

148

149 Statistical analysis

150 Descriptive data (with 95% confidence intervals) presenting the types and quantities of each type of
151 food and drink are provided overall, and stratified by ethnicity. General linear regression models
152 (PROC GLM) were then used to compare mean food and drink availability levels between homes
153 with White British and Pakistani groups only (owing to insufficient numbers in the Other ethnicity
154 category). The LSMEANS option was used to estimate the adjusted mean availability for both
155 ethnic groups. Regression model 1 was unadjusted. Model 2 was adjusted for the total number of
156 people reported to live in each household (un-weighted) as this has been shown to impact on home
157 food availability previously ^(11, 19) and differs between the White and Pakistani families in this
158 cohort ⁽¹⁷⁾. Full covariate adjustment was not deemed necessary here however, given the
159 exploratory nature of the research. Data were analyzed using SAS version 9.2 (SAS Institute, Cary,
160 NC).

161

162 **Results**

163 Sample

164 Of the 100 participants that agreed to take part, full food availability data were available from 97
165 homes (whole categories of foods/drinks were missing from 3 participant homes). There were
166 similar numbers of White British (n=46, 47%) and Pakistani (n=41, 42%) of mothers, with less
167 mothers from a combined ethnicity defined as 'other' category (n=10, 11%). Data from all 3 ethnic
168 categories are provided for the descriptive, exploratory findings; however, only data from White
169 British and Pakistani mothers were included in analyses comparing ethnic differences in food
170 availability. Fifty one percent of mothers were normal weight at the booking appointment; 29%
171 were overweight ($BMI \geq 25 \text{kg/m}^2$), and 17% were obese ($BMI \geq 30 \text{kg/m}^2$).

172

173 Presence/absence of foods/drinks in the home

174 Table 1 shows the frequency of homes that had at least 1 item of food or drink available within
175 higher food categories. All homes had at least 1 type of fruit, at least 1 type of vegetable and at
176 least 1 type of snack available. The majority of homes had at least 1 type of fresh fruit available
177 and this was similar in all ethnicities. Availability of other forms of fruit (i.e. canned, dried and
178 frozen) was less popular; however, around half of all homes had at least 1 type of canned or dried
179 fruit. Availability of crisps/tortillas was also popular, with 80% and 90% available in Pakistani and
180 White British homes respectively. Over 80% of White British and Pakistani homes also had at least
181 1 type of sweet biscuit available to them. Approximately 65% of White homes had at least 1 type
182 of chocolate available; whereas less than 30% of Pakistani homes had chocolate available.
183 Similarly, there were a higher percentage of cakes and sweets in White homes. Approximately half
184 of all homes had at least 1 type of ice-cream available and this was similar across ethnicities (albeit
185 somewhat lower in homes of 'Other' ethnicities). Eighty five percent of Pakistani homes had
186 sweetened beverages available, compared to 60% of White homes and 50% of homes of 'Other'
187 ethnicity. Conversely, the proportion of homes with unsweetened (or 'diet') drinks available to
188 them was lower in the Pakistani homes (25%) compared to White homes (30%).

189

190 Availability of individual foods

191 Figures 1-4 show the average availability of individual foods within the categories of fruit and
192 vegetables by ethnicity. Fresh fruit commonly available in family homes were oranges, apples,
193 satsumas and grapes. Commonly available fresh vegetables included potatoes, cucumber, tomatoes
194 and carrots. The single greatest non-fresh fruit available in homes was raisins. Within the category
195 of non-fresh vegetables, foods contributing the most were frozen mixed vegetables, tinned tomatoes
196 and tinned peas. Crisps were the most commonly available type of snack food across all ethnic
197 groups (data not shown).

198

199 Ethnic comparisons

200 Table 2 compares the availability of foods and drinks in homes of White British and Pakistani
201 families. These analyses indicate that Pakistani homes had a greater availability of fresh fruits and
202 sweetened drinks compared to White British homes; with more than twice the amount of these
203 items available, even after adjustment for household size. Eighty five percent of Pakistani homes
204 had sweetened beverages available, compared to 60% of White homes. Conversely, the proportion
205 of homes with unsweetened (or 'diet') drinks available to them was lowest in the Pakistani homes
206 (25%) compared to White (31.1%) and 'Other' ethnicity (78%) homes. Availability of sugar-
207 sweetened beverages in Pakistani homes was equivalent to approximately 16 cans of fizzy drink per
208 household on average, compared to an average of 6 in White British homes.

209

210 **Discussion**

211 Findings from this exploratory study showed that all homes had some form of fruit and some form
212 of vegetable available in them. More homes had fresh fruits and vegetables available compared to
213 canned, frozen and dried fruits and vegetables. At least one type of snack food was also available
214 in all of homes in which inventories were conducted. Of these, crisps and biscuits were most likely
215 to be available. Further exploration of the availability of individual foods showed that apples were
216 available in the greatest quantity, with an average of between 3-8 apples available in each home.
217 The vegetable that was available in the greatest quantity was potatoes, with an average of
218 approximately 8-12 servings available in each home. Within non-fresh items, items that were
219 available in the greatest quantities included raisins, frozen mixed vegetables and tinned tomatoes.
220 Ethnic differences between homes of White British and Pakistani participants were found for the
221 availability of fresh fruits and sugar sweetened beverages, which were both found in higher
222 amounts in Pakistani homes, even after adjustment for household size.

223

224 It is difficult to compare these findings to those of existing data, since there are currently no other
225 comparable contemporary data on foods that are actually available within families homes in the
226 UK. The UK Office of National Statistics collects self-reported availability by asking families to
227 report availability via purchasing habits. These data have been compared to data from other
228 countries, and indicate that UK households tend to have higher availability of cereals, but lower
229 availability of fresh fruits and vegetables than most of the 10 other countries. However,
230 comparisons do not include availability of beverages and they do not indicate differences by
231 participant characteristics ⁽²⁴⁾. A recent study in the US indicates some differences in home food

232 availability by ethnicity, in which similar differences are reported, with a greater availability of
233 fresh vegetables and soft-drinks in the homes of Hispanic participant's compared to African
234 American homes ⁽²⁵⁾. However, these data were collected by self-report. Variability in the methods
235 employed in these studies may well account for inconsistencies in findings. Studies measured using
236 open, researcher conducted inventories that have been published the last decade (i.e. since the last
237 systematic review of home food availability measures ⁽⁸⁾) indicate some differences by weight status
238 ⁽²³⁾ and provide evidence of a relationship between availability and dietary intake ⁽²⁶⁾. These
239 provide support for the use of such methods in leading towards interventions to encourage
240 optimising the healthfulness of foods and drink available; however, they do not explore whether
241 findings were dependent on ethnicity and both were conducted in the US.

242
243 The present study indicates that availability of sugar-sweetened beverages (predominantly fizzy
244 drinks) was high in family homes, especially in Pakistani homes, with the equivalent of an average
245 of 16 cans per household and 85% having at least 1 sweetened drink available. Though evidence is
246 not always clear, there is general support that consumption of sugar-sweetened beverages
247 contributes significantly to obesity ⁽²⁷⁻²⁹⁾. Data from randomised controlled trials support this work,
248 with interventions targeting a reduction in sugar-sweetened beverages showing significant
249 reductions in BMI compared to control groups ^(30, 31). Further, previous work indicates that this may
250 also be linked to a greater odds of families consuming fast foods as part of their weekly family
251 meals ⁽³²⁾. Some minority ethnic groups in the UK, including those of Pakistani origin, are more
252 likely to experience poorer health outcomes, such as cardiovascular disease and type II diabetes,
253 compared with the White British population. The etiology of this is likely to be multi-faceted,
254 including impact of acculturation, genetic predisposition and access/use of health care, which are
255 likely to impact on diet and other health behaviours. Data from a UK sample of mixed ethnicity
256 showed that Pakistani boys (11-13 years) in particular were more likely to consume 'fizzy' drinks
257 daily compared to White British boys. These data also suggest that Pakistani boys are less likely to
258 meet targets for consuming 5-a-day for fruits and vegetables ⁽³³⁾. These availability data show that
259 homes with participants of Pakistani origin had a higher availability of fresh fruits compared to
260 White British homes. However, they do not provide details of the patterns of consumption by
261 individual family members. Alarming, other data (not shown) from the Born in Bradford 1000
262 study shows a higher consumption of sugar sweetened beverages in 18 month old infants born to
263 Pakistani mothers compared to those born to White British parents after adjusting for mothers age
264 and parental education (OR 2.03 95% CI 1.53, 2.70). Consumption of water, however, was similar
265 between infants of different ethnicity (OR 1.09; 95% CI 0.84, 1.42).

266 Seasonality, in terms of the month in which inventories were completed may have an impact on the
267 foods available. Inventories were conducted every month over the period of one year, but there
268 were fewer conducted during August and December due to staffing issues (coinciding with
269 Ramadan and Christmas holidays). The influence of seasonality was considered by re-running
270 analysis with adjustment for the month of data collection and did not change the findings; Pakistani
271 homes had more fresh fruit and sugar-sweetened beverages than White British homes and no other
272 foods were found to differ significantly between ethnicities (data not shown).

273

274 The impact of other variables such as socio-economic status on home food availability and their
275 influence on the relationship between food availability and outcomes such as diet and obesity was
276 not the focus of the current study. However, comparisons of food availability by maternal weight
277 status did not identify any clear relationships (data not shown). Correlations with child BMI were
278 not assessed in the 18 month old infants but it is possible that the influence of home food
279 availability on diet and BMI is greater in young children compared to adults, who are more likely to
280 eat away from home ⁽²⁶⁾. Studies examining the relationship between home food availability and
281 diet or BMI in children report inconsistent findings with variability in the strength of this
282 relationship ^(5-7, 32, 34), although there is general agreement that the relationship is positive (especially
283 for intake of vegetables). Few studies report the impact of socio-economic status. Ding et al.,
284 (2012)⁽⁷⁾ found an influence of household income, with more 'healthy' foods reported in homes
285 with higher incomes. However, this study did not observe a reverse relationship with unhealthy
286 foods. Clearly, more work is required to un-piece the explanatory factors and mediators that impact
287 on the relationship between foods in the home and diet and health outcomes such as obesity.

288

289 Although this exploratory study has a relatively small sample size, it is comparable (if not greater)
290 to other studies that have collected home food availability data using direct observations by
291 researchers. Previous work indicates that 63 households would be required per comparison group
292 to detect a moderate different of 50% of 1 SD and only 28 households per group would be needed
293 to detect a difference as large as 75% of 1 SD (based on one measurement per household) ⁽¹⁹⁾. It is
294 possible that other ethnic differences in availability might have been identified with a greater
295 sample size. However, as there are currently no other studies that have measured, in-depth, the
296 types of foods and drinks within White British and Pakistani homes in the UK, the aim of this study
297 was more exploratory in order to inform potential targets for the development of future
298 interventions. It could also be argued that, due to the transitional nature of foods in the home (i.e.
299 changing via purchasing and consumption), more than one visit would be required for accurate

300 estimates of availability. Previous evidence actually suggests that the within household variability
301 of food availability is considerably lower than the between household variability and that addition
302 of multiple visits does not appreciably impact on estimates ⁽¹⁹⁾. A further argument may be that
303 participants changed their shopping habits in advance of the inventories due to social desirability.
304 Following extensive data collection in a different cohort, this was found to be unlikely ⁽¹¹⁾ and when
305 the participants were fully aware of the procedures (i.e. after they had already had completed an
306 inventory), no efforts were made to change the environment for subsequent inventories, as within
307 house variability was very low ⁽¹⁹⁾.

308

309 Knowledge of the types and quantities of foods and drinks available in family homes supports the
310 development of targeted intervention programmes wishing to improve the foods available within
311 family homes for obesity prevention or management, or for overall diet improvement. This has the
312 ability to identify population subgroups at nutritional risk and implement appropriate health
313 promotion and disease prevention programmes. Descriptive data shown here indicates that
314 potential targets might be: (a) promoting the variety, availability and quantity of all types of fruits
315 and vegetables (e.g. encouraging purchase of tinned/frozen fruit in addition to fresh fruit); (b)
316 reducing purchase of crisps and biscuits (which were both available in over 80% of homes); and (c)
317 discouraging purchase of sweetened beverages, especially within homes of Pakistani mothers (in
318 which 85% of homes had at least one type of sweetened beverage available). This information has
319 been fed into a needs assessment stage of an intervention mapping process in which a culturally
320 appropriate obesity prevention intervention has been developed in Bradford (a city in the North of
321 the UK).

322

323

324 **Figure legends**

325 Figure 1. Availability of individual fresh fruits

326 Figure 2. Availability of individual fresh vegetables

327 Figure 3. Availability of individual non-fresh fruits

328 Figure 4. Availability of individual non-fresh vegetables

329

330 **Supplementary material**

331 Table S1. Participant demographics

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