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# Exploring childhood obesity prevention among diverse ethnic groups in schools and places of worship: Recruitment, acceptability and feasibility of data collection and intervention components

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## ABSTRACT

Small-scale, detailed exploration of the recruitment, assessment, and evaluation processes of obesity intervention among minority ethnic children. The study took place in schools and places of worship during 2008–2010 in London, UK. Measures included 3-day food diaries, 24 h dietary recalls, the Youth Physical Activity Questionnaire, accelerometry, and diet and physical activity self-efficacy questionnaires. Potential intervention components were evaluated via observation, questionnaires, and focus group discussions. Schools and places of worship that reflected the ethnic and religious diversity of inner city London populations (Hindus, Muslims and Christians) were targeted. Telephone invitations to 12 schools achieved recruitment of five schools (42% response); 181 invitations to 94 places of worship, recruited eight organisations (9%). Multi-strategy approaches were required to build relationships with faith organisations. Sixty-five children aged 8–13 years participated in the testing of measures. High completion rates were achieved for 24 h recalls, diet and PA self-efficacy questionnaires (ranging from 89% to 100%), with more consistent quality in schools. Dietary assessment highlighted inadequacies in composition data for minority ethnic foods. Intervention sessions were tested among 155 children in all five schools, and 33 children in a church, temple and mosque. Evaluation coverage was more consistent in these places of worship than in schools. Schools may logistically be more straightforward settings for delivery of interventions but, despite complex issues (engagement strategies; cultural foodways), places of worship provide opportunities for effective reach of children, families and communities. We suggest community based participatory research between researchers, schools and community organisations to harness culturally-specific support.

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## 1. Introduction

Minority ethnic status is a correlate of adult obesity and greater metabolic consequences for some ethnic groups, such as significantly increased risk of type 2 diabetes and hypertension (Balfour et al., 2015; Tillin et al., 2012). As childhood obesity tracks into adulthood this pattern of ethnic differences in health outcomes is set to worsen if childhood obesity is not tackled.

The likely success of an intervention needs to be assessed in exploratory and pilot phases before investment is made (Craig et al., 2008).

Within the limited evidence-base for effective obesity prevention interventions, there is a lack of studies on minority ethnic groups (Waters et al., 2011) and little knowledge of the appropriateness and acceptability of potential intervention components (Liu et al., 2012). Ethnic minorities are conventionally considered ‘hard to reach’ populations in research (Johnson, 2011; p.230) but also in home-school engagement (Crozier and Davies, 2007). Schools are a frequent choice for childhood obesity prevention, with some evidence of effectiveness (Sobol-Goldberg et al., 2013), but although convenient, they may not engage sufficiently with the cultural contexts of families and communities. Minority ethnic children and their families are much more likely than the White majority to regularly attend a place of worship (Harding et al., 2007) suggesting potential for community based activities. Places of worship have not been greatly explored in the UK as intervention settings, compared to in the US (Bopp et al., 2012; Lancaster et al., 2014; Yeary et al., 2012). Furthermore, few studies in the UK have examined the extent to which necessary baseline and follow-up diet and PA assessments are acceptable and appropriate among children from different ethnic groups (Adab et al., 2014).

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The aim of the DiEt and Active Living (DEAL) exploratory phase obesity intervention was to conduct developmental research among children from minority ethnic groups, in schools and places of worship. The objectives were to 1). Describe the recruitment challenges; and 2). Explore the acceptability and feasibility of (i). Diet and PA assessment techniques, (ii) Obtaining diet, PA, and body mass index (BMI) outcome data, and (iii) The delivery and evaluation of culturally appropriate intervention components.

## 2. Methods

Informed by the guidance for iterative development of complex interventions (Craig et al., 2008), small scale fieldwork using qualitative and quantitative methods took place in London, UK, during 2008–10. Full details of the DEAL study rationale and methods can be found elsewhere (Harding et al., 2011; Maynard et al., 2009); <http://dash.sphs.mrc.ac.uk/public/DEAL/>. Approval for the study was obtained from the University of Glasgow Medical Faculty Ethics committee, schools, and religious organisations. Parents received a written or orally administered information sheet. Parental consent was obtained on an opt-out basis, where parents signed and returned a form if they did not want their child to participate. Information sheets and consent forms were provided in English, and were also available in Urdu, Punjabi and Gujarati. Separate information sheets with age appropriate language was given to the children who provided written assent for their own participation in the study.

### 2.1. Sample and setting

The target was six schools (three primary, three secondary) and six places of worship (two churches, two temples and two mosques). Headteachers in secondary schools that had previously participated in a cohort study (Harding et al., 2007) and their feeder primary schools were telephoned. Religious or community leaders in places of worship in the areas around participating schools were also telephoned, and additional strategies included mass-mailing an invitation letter and follow-up call, site visits by the principal investigator (SH), acting on recommendations from schools and local academics, and engaging with an inter-faith forum.

A pragmatic sample of 44 children from Black Caribbean, Black African, Indian, Pakistani, Bangladeshi and White UK ethnic groups was sought for the testing of measures, selected by the contacts in both settings. A screening questionnaire was completed by all participants to ensure representation across ethnic, age, gender, and socio-economic status groups.

### 2.2. Measures

#### 2.2.1. Diet measures

Food and drink consumption was estimated using multiple-pass twenty-four hour (24 h) recall (Johnson et al., 1996) and a three day diary. Portion size was assessed using household measures, a computer-based interactive portion size assessment system (IPSAS), and photographs taken by the children with digital cameras.

#### 2.2.2. PA measures; height and weight

Activity was objectively measured using the ActiHeart (Brage et al., 2005), and a diary reporting daily usage and issues with the Actiheart completed. Activity was also subjectively measured using the Youth Physical Activity Questionnaire (YPAQ) (van Sluijs et al., 2008). As part of the Actiheart process, height and weight were measured using a portable stadiometer and calibrated Salter™ scales.

#### 2.2.3. Self-efficacy

Dietary self-efficacy was assessed with a 10-item questionnaire, rated on a 5-point scale (Adamson et al., 2000; Zabinski et al., 2006).

Physical activity self-efficacy was assessed using a 22-item (Saunders et al., 1997) and an 8-item questionnaire (Motl et al., 2000), also on 5-point scales.

#### 2.2.4. Measurement process

Information/data collection sessions were held at the study sites over several weeks, and prior to the intervention sessions. Questionnaires were completed in the presence of researchers to establish how much assistance was required with comprehension, and time needed for completion. The 24-h recall and IPSAS were administered by researchers. Verbal instructions, demonstrations and practice of the correct procedures for the diet diary, food photographs, Actigraph and activity diaries occurred in the sessions, with written instructions and materials/equipment provided to the children to take home. Further sessions took place to collect the equipment, completed diaries, etc. and check data.

#### 2.2.5. Outcomes

As part of the assessment of the feasibility of the measures used to provide plausible outcome information and identify any limitation in the analysis process, the diet, physical activity, and BMI data were analysed.

### 2.3. Intervention sessions and evaluation

#### 2.3.1. Session content and delivery

'Taster' intervention sessions in schools and places of worship, involved activities which might potentially be included in the intervention programme of a subsequent trial, informed by focus groups with children and parents (Rawlins et al., 2013) and a review of the literature. Sessions focussed on healthy habit formation, reducing intake of energy dense foods and sugar-sweetened beverages (SSBs), increased activity, and decreased sedentary behaviours, and addressing knowledge gaps. The skills and knowledge required to incorporate healthy eating and activity messages were conveyed in interactive, learning, and goal setting activities. The measurements sample also took part in these one-off intervention sessions delivered to whole classes in schools, or small groups in places of worship. Sessions were delivered by the research team except for a primary school PA session delivered by a local authority PA in schools co-ordinator; and a secondary school dance session delivered by a professional dancer from a charity promoting dance in schools.

#### 2.3.2. Evaluation

Responsiveness to the components (compliance, enjoyment, appropriateness and relevance of activities), was evaluated using observations recorded in a study log, discussions, and open text and scores from self-completed questionnaires distributed to all participants where used (solely qualitative evaluation was conducted in some sessions). Written and oral instructions, enjoyment, and the general view of the activity (or the overall session if there was more than one activity) were rated in the questionnaires on 'smiley face' scales (see questionnaire extract in Supplementary Figure).

### 2.4. Analysis

Participation rates; acceptability of design, wording, content, length of questionnaires; and clarity of instructions were assessed. Data quality indicators were three or more valid days of ActiHeart measures ( $\geq 10$  h of activity/day, not including time asleep); % in category 1 or 2 of a confidence code applied to each food analysed which indicated full confidence in coding the food and portion size (category 1); food coded but standard portion size data used (category 2); or assumptions required in coding food or both food and portion size (category 3) (Holden et al., 2002); % adequate quality digital photographs (food and portion size identifiable); and % missing data in the YPAQ, diet

and PA self-efficacy questionnaires. Dietary and PA outcomes included consumption of fruit and vegetables, fruit juice, and key energy-dense foods that lack micro-nutrients (sugar/confectionery, cakes and biscuits, savoury snacks and sugar sweetened beverages). Energy (Kcal/day) and macro-nutrient intake (g/day) were calculated using 'Composition of Foods' food tables (Food Standards Agency, 2002) and household measures, IPAS values, or age-specific standard portion sizes (Wrieden et al., 2008). Minutes per week of all PA, screen- and non-screen sedentary activities were calculated. BMI was calculated from the height and weight measures (kg/m<sup>2</sup>) and SD scores (BMI z-score) estimated using the UK 1990 growth reference charts (Cole et al., 1995). Children were categorised as underweight, healthy weight, overweight or obese using the 2nd, 85th and 95th centile cut-points, respectively. Evaluation scores for each intervention session were summed to provide a mean (sd) total per session. The maximum total score was 15, 25 or 30 depending on the number of components in the session. The normality of the distribution was checked for each variable. *t*-tests (normally distributed data), Chi-squared and Mann Whitney *U* tests (proportions/skewed data) were used to identify statistically significant patterns between schools and place of worships ( $p < 0.05$ ). Ethnic group differences were also explored, however the sample size of individual ethnic groups, by design, necessitates cautious interpretation with regard to statistical inference.

### 3. Results

#### 3.1. Recruitment

Table 1 shows that one invitation each was made to 12 schools. Seven schools registered interest; however two of the schools subsequently withdrew citing inability to recruit sufficient numbers of children in one case, and failure to appoint a study coordinator in the other. Recruitment of five schools was therefore achieved (42% response). Of the 94 places of worship receiving 181 invitations, 10 organisations expressed interest. Mass mailing resulted in interest from two churches; however both subsequently withdrew due to lack of contact

between administrators and the religious leader, and not being able to recruit participants. Telephone contact with places of worship was least profitable due to unanswered telephone calls and no response to voicemail messages; calls answered by someone who did not speak English; or the appropriate person not being available. Consequently, eight organisations (one Church of England and two Pentecostal churches, one mosque, and four temples) took part in the study (9% response). A Jain temple was only involved in a qualitative aspect of the study reported elsewhere (Harding et al., 2011), and therefore the place of worship participants were recruited from seven organisations.

Characteristics of the measurements sample, by setting (school or place of worship), are shown in Table 2. Overall, 65 children, aged 7–13 years, took part in the dietary and PA assessment measures. Children in the faith settings were younger and less likely to be in higher SEC groups compared to the children recruited in schools. Participants were Black Caribbean, Black African, Indian, Pakistani, Bangladeshi, White UK and of mixed/other ethnicity. The numbers recruited indicate oversampling in the Indian ethnic group (~30% of the sample) and that children were recruited from non-target ethnic groups.

#### 3.2. Completion rates and data quality

Completion rates and quality indicators for the dietary and PA measures, by setting, are shown in Table 3. Completion of the diet diary and the portion size assessments was lower than the 24 h recalls in both settings. Insufficient time for the sessions in schools, and/or sporadic attendance of the sample at places of worship also contributed to low completion rates for the portion size assessment (IPSAS and digital cameras). Very high completion rates were achieved for the dietary self-efficacy questionnaire.

Coding confidence was lower for diaries compared to 24 h recalls across settings. Furthermore, the proportion of foods coded with confidence for both recalls and diaries was significantly lower in place of worship settings than in schools. A lower proportion of the portion size digital photographs were of adequate quality in the places of worship sample than the school sample, but still >85%.

Skin irritation caused by the paediatric electrodes on the Actiheart device reported by 77% of participants impacted on completion rates (81% overall). The activity diary that accompanied the Actiheart was poorly completed. By contrast, a high percentage of participants completed the YPAQ in schools and places of worship. The questionnaire was comprehensible to the children (except for the term 'aerobics' which required clarification), and had a short completion time (approximately 5–15 min) with minimal researcher assistance. Completion of

**Table 1**  
Number of sites recruited, by recruitment strategy, London, UK 2008–2010.

Setting	Recruitment strategy	Number of invitations N	Sites recruited N
Primary schools	Direct telephone contact with head teacher of "feeder" primary schools associated with the targeted secondary schools	6 <sup>a</sup>	3
Secondary schools	Direct telephone contact with head teacher of secondary schools using previously established links	6 <sup>a</sup>	2
Total		12	5
Churches	Direct telephone contact	11 <sup>b</sup>	1
	Mass mailing	10	0
	Site visit <sup>c</sup>	1	1
	Personal recommendation (school head teachers, local academics)	1	1
Temples	Direct telephone contact	32 <sup>b</sup>	0
	Mass mailing	32	1
	Site visit <sup>c</sup>	2	2
	Personal recommendation (school head teachers, local academics)	1	1
Mosques	Direct telephone contact <sup>b</sup>	45 <sup>b</sup>	0
	Mass mailing	45	0
	Local authority inter-faith forum	1	1
Total		181	8
Overall total		193	13

<sup>a</sup> One invitation was made to each of 6 primary and 6 secondary schools, therefore the number of invitations is equal to the number of organisations approached (i.e. 12).

<sup>b</sup> Subsequently included in the mass mailing approach if direct contact did not result in recruitment, therefore the total number of organisations approached = 94.

<sup>c</sup> Visits were made by the principal investigator (SH).

**Table 2**  
Sample description, London, UK 2008–2010.

Sample descriptors	All	Schools	Places of worship	<i>p</i> -value for difference <sup>a</sup>
N	65	32	33	–
Age in years, mean (range)	10.35 (7–13)	10.65 (10–12)	10.06 (7–13) <sup>c</sup>	0.001
N (%) boys	26 (40)	11 (34)	15 (45)	0.36
% parents with higher SEC <sup>b</sup>	34	50	19 <sup>c</sup>	0.007
% two parent households	80	78	90	0.20
Ethnicity, N: Black Caribbean	7	4	3	–
Black African	10	6	4	–
Indian	19	4	15 <sup>c</sup>	0.02
Pakistani	11	5	6	–
Bangladeshi	6	3	3	–
White UK	5	3	2	–
Mixed/other ethnicity	7	7	0 <sup>c</sup>	0.02

<sup>a</sup> Based on chi-squared/fishers exact tests for proportions and *t*-test for the continuous variable (age).

<sup>b</sup> Higher managerial/administrative, professional and intermediate professions.

<sup>c</sup> Significantly differently than school sample.

**Table 3**  
Completion rates and data quality by setting (schools vs. places of worship), London, UK 2008–2010.

	Schools	Places of worship	p-value for difference <sup>a</sup>
<b>Diet measures</b>			
Completion rates, N (%) <sup>b</sup> :			
24 h recalls	31 (97)	29 (88)	0.17
3 day diet diary	27 (84)	26 (79)	0.56
Interactive portion size assessment	20 (62)	14 (42)	0.10
Digital camera portion size assessment	20 (62)	17 (51)	0.37
Dietary self-efficacy questionnaire	32 (100)	32 (97)	–
Quality of measures, median (inter-quartile range (IQR)) <sup>b</sup> :			
% high quality data (category 1 or 2 of confidence code):			
24 h recall	82 (80–90)	70 (61–78) <sup>c</sup>	0.001
3-day diary	50 (33–57)	36 (29–50) <sup>c</sup>	0.001
Number of digital photos taken per person	22.5 (10.0–32.7)	10.0 (5.0–22.0)	0.13
% good quality digital photos (food and portion size identifiable)	100 (92–100)	87 (73–97) <sup>c</sup>	0.01
Dietary self-efficacy questionnaire missing data, mean % (sd)	0.09 (0.53)	0.12 (0.55)	0.82
<b>Physical activity (PA) measures</b>			
Completion rates, N (%) <sup>b</sup> :			
Actiheart	26 (81)	27 (82)	0.95
Activity diary	18 (56)	10 (30) <sup>c</sup>	0.03
Youth physical activity questionnaire (YPAQ)	30 (94)	28 (85)	0.43
PA self-efficacy questionnaire (22-item)	24 (75)	19 (57)	0.14
PA self-efficacy questionnaire (8-item)	32 (100)	33 (100)	–
Height and weight measures	24 (75)	27 (82)	0.50
Quality of measures, median (IQR) <sup>b</sup> :			
Number of Actiheart days achieved			
	3.00 (1–5)	2.00 (1–5)	0.96
% achieving 3 valid Actiheart days, N (%)	15 (58)	13 (48)	0.49
YPAQ missing data, mean % (sd):			
	0.78 (2.01)	1.38 (2.74)	0.11
PA self-efficacy questionnaire (22-item) missing data, mean % (sd)			
	0.08 (0.28)	0	–
PA self-efficacy questionnaire (8-item) missing data, mean % (sd)			
	0	0.06 (0.35)	–

<sup>a</sup> Based on chi-squared tests for proportions, t-tests for normally distributed continuous variables and Mann Whitney *U* tests for variables not normally distributed.

<sup>b</sup> Unless otherwise stated.

<sup>c</sup> Significantly lower than school sample.

the 22-item PA self-efficacy questionnaire was poor, but all participants completed the 8-item counterpart, and rated it easy to comprehend (except 'coordination'). Discomfort associated with the Actiheart (see above) resulted in only 53% of the sample providing three or more valid days of data. As height and weight were measured as part of the accelerometry sessions, the percentage of the sample measured (79%) was influenced by Actiheart completion, but was not otherwise problematic.

### 3.3. Dietary, PA and BMI outcomes

Dietary and PA outcomes were from the 24 h recalls and the YPAQ as these provided the most robust data (Table 4). Around 60% of participants reported consuming vegetables, and 65% reported eating fruit, whereas 82% of the sample reported having at least one sugar-sweetened beverage (other than fruit juice). The total weight of food consumed and vegetable consumption were significantly lower among the place of worship sample compared to the school sample, otherwise there were no differences between settings in the reported amounts of food, drink, energy or macronutrient intake. Overall, >1000 min per week (~2.4 h per day) of both PA and screen-related sedentary activity were reported. PA levels were similar between settings, however sedentary activities were significantly lower in the places of worship, due to lower reporting of screen-related sedentary activities (possibly due to the younger children having less access to electronic games). Around 35% of the sample were categorised as overweight or obese, with similar proportions across settings.

### 3.4. Intervention sessions and evaluation

The sessions involved 155 children in schools and 33 in the places of worship, with no refusals to take part. Session location, number of participants, % completing evaluation tasks and mean evaluation score for quantitative evaluations are shown in Table 5 (see Supplementary Table 1 online for a summary of the full analysis). Sessions were

delivered in all schools but in only three places of worship. Despite enthusiasm of religious leaders, children and their families, irregularity in attendance, attendance at more than one place of worship, and often lack of suitable space to conduct intervention activities hampered delivery.

In primary schools where qualitative evaluations were conducted, the completion rate was 100% of all participants. Completion of quantitative evaluations was more variable ranging from 19% (diet session) to 100% (PA session) of participants. In secondary schools the capture rate ranged from 77% (PA session) to 95% (diet session). By contrast, evaluations were completed by all participants in place of worship sessions. Quantitative evaluation scores were highest in one of the secondary schools, at 94% of the maximum possible value for both of the sessions delivered there. The lowest score proportionally was for the diet only session delivered in a church. Qualitative focus group discussions and questionnaire free text also indicated the popularity of interactive/practical sessions (e.g. tasting of diverse foods, cricket, dance and shuttle runs). The less popular didactic sessions, required due to lack of support and/or space for more interactive sessions, were nevertheless useful for identifying gaps in dietary knowledge and habits (e.g. types of fats; skipping breakfast). Children in the same group conflictingly regarded content as both 'too easy' and having 'too many difficult words'. There was no apparent gender or age bias in participation or session ratings.

### 3.5. Patterning of results by ethnic group

There was no ethnic patterning in completion rates for both diet and PA measures. The proportion of 24 h recalls with high coding confidence was similar among White, Black African, Black Caribbean Bangladeshi and Other groups (82–85%), but lower for Indian and Pakistani groups (67% and 75% respectively;  $p = 0.02$ ). Ethnic specific dishes (see Supplementary Table 2) and drinks (e.g. 'Supermalt'; mango juice) were reported by the minority ethnic groups, and were three times more likely to be recalled in the place of worship setting than in schools. Black Africans reported significantly higher consumption of vegetables and pulses



**Table 4**Diet<sup>a</sup> and physical activity outcomes by setting (schools vs. place of worship), London, UK 2008–2010.

	Schools Mean (sd)	Median (IQR)	Places of worship Mean (sd)	Median (IQR)	p-value
Total number of foods/drink items reported in 24 h recall	17.74 (5.38)	16.0 (15.0–19.0)	15.90(3.58)	15.0 (13.5–19.0)	0.29
Food and drink consumption (g day <sup>-1</sup> ):					
Total weight of foods & drinks	2012.74 (569.83)	2007 (1661.0–2309)	1762.69 (376.62)	1673.0 (1498–1976.5)	0.04 <sup>c</sup>
Vegetables	131.28 (57.87)	119 (89.75–170.50)	86.72 (44.08)	72.5 (52.00–120.00)	0.02 <sup>c</sup>
Vegetable dishes	181.67 (69.61)	141.00 (71.00–200.00)	134.33 (67.18)	148.00 (61.75–316.00)	0.75
Fruit	143.68 (99.02)	98 (83.25–173.25)	141.88 (82.48)	106.00 (93.00–177.00)	0.41
Fruit juice	302.85 (139.01)	302.85 (139.01)	228.50 (92.43)	300.00 (165.00–384.00)	0.42
Sugar/confectionery	38.20 (33.16)	30.00 (10.00–55.50)	32.94 (41.13)	20.50 (7.25–38.25)	0.39
Cakes and biscuits	142.92 (86.95)	127.00 (67.00–222.50)	114.95 (91.91)	97.00 (57.00–134.5)	0.11
Savoury snacks	31.57 (11.04)	29.50 (15.59)	34.00 (27.25–34.25)	26.50 (18.50–32.50)	0.19
Sugar sweetened beverages	422.11 (227.85)	404.50 (248.00–572.00)	395.61 (277.27)	300.00 (220.00–524.00)	0.30
Energy and macronutrient intake (g day <sup>-1</sup> )					
Kcal	1975.79 (628.36)	1975.32 (1443.86–2307.45)	1799.98 (573.23)	1671.03 (1330.35–2168.66)	0.26
Carbohydrate	278.22 (90.4)	259.42 (221.73–335.11)	240.62 (69.38)	239.75 (179.94–285.07)	0.14
Total fats	74.43 (32.0)	71.32 (53.38–88.24)	70.55 (28.37)	57.21 (49.44–94.99)	0.55
Protein	62.39 (25.22)	58.35 (44.69–78.17)	63.39 (25.89)	59.78 (45.28–74.91)	0.99
Physical activity (PA) (minutes week <sup>-1</sup> )					
All PA	956.67 (665.63)	967.50 (402.75–1348.75)	1564.64 (1407.45)	1073.50 (630.12–2119.75)	0.13
All sedentary activities:	2566.37 (1884.16)	2525.0 (1396.25–3037.12)	1766.13 (1515.90)	1344.00 (620.00–2431.87)	0.01
Screen related	1426.53 (1337.97)	1136.25 (650.0–1644.37)	1003.69 (1005.80)	818.75 (285.00–1306.25)	0.09
Non-screen related	1139.83 (840.76)	836.50 (573.12–1494.37)	762.45 (657.01)	495.00 (296.12–1016.25)	0.12
BMI z-score	0.32 (1.68)	0.17 (–0.91–1.47)	0.88 (1.01)	0.69 (0.38–1.80)	0.12
Healthy weight <sup>b</sup>	15 (63)		17 (63)		
Overweight/obese	8 (33)	–	10 (37)	–	0.96

<sup>a</sup> From 24 h recalls.<sup>b</sup> 1 participant (4%) in the school sample was in the underweight category.<sup>c</sup> Significantly lower than value for schools sample.

than all other groups (Median (IQR) g day<sup>-1</sup> = 119.00 (50.50–170.50;  $p = 0.02$ ); Bangladeshis reported the highest consumption of savoury snacks, and lowest intakes of energy (kcal day<sup>-1</sup>), total fats and protein (g day<sup>-1</sup>) (1362.14 (1292.56–1462.41);  $p = 0.03$ ; 42.82 (39.19–55.69);  $p = 0.02$ ; 41.35 (32.00–52.61);  $p = 0.03$ ), respectively. Black Caribbeans reported the highest total PA (1190.00 (1185.00–1900.00);  $p = 0.01$ ) and non-screen related sedentary activity (1282.50 (750.00–2520.00);  $p = 0.03$ ) compared to all other ethnic groups. There was no ethnic patterning of BMI z-scores or BMI categories, or suggested by the intervention session evaluations.

## 4. Discussion

Few previous studies have explored the viability of obesity prevention interventions among minority ethnic children in the UK (Adab et al., 2014; Pallan et al., 2012; Pallan et al., 2013). We know of no other UK childhood obesity programme which has been formally tested, delivered, and evaluated in places of worship and we have generated

formative data which will be valuable in progressing to the next stage i.e. a pilot trial. Key learning is detailed below.

### 4.1. Lessons learned

#### 4.1.1. Significant time and resources were needed to recruit a small number of places of worship

Compared to schools, considerable researcher time was required to promote the study with faith organisations. Commonly cited barriers to community participation in research include uncertainty about the research process, lack of staff and researchers from within their own communities (Davidson et al., 2013; Douglas et al., 2011; Rooney et al., 2011). Building relationships and trust was essential and multi-strategy approaches were required with faith organisations. Combined proactive and indirect/reactive methods (telephone contact, mass-mailing, cold-calling, and engaging with community networks) were needed to recruit faith organisations, and the time and other resources required for this diverse approach need to be adequately planned for as significant study costs (Ibrahim and Sidani, 2014).

**Table 5**

Intervention 'taster' sessions: number of participants (% completing evaluation and mean (sd) evaluation score, London, UK 2008–2010.

Location	Session	N	N (%) completing evaluation	Mean evaluation score (SD)
Primary school #1	1. 5-a day fruit and vegetables	32	6 (19)	25.23 (2.73) <sup>1</sup>
	2. Benefits of PA; PA and maintaining healthy body weight <sup>4</sup>	32	32(100)	26.19 (4.25) <sup>1</sup>
Primary school #2	1. Energy balance	25	24 (96)	24.46 (3.87) <sup>1</sup>
	2. PA preference - football (boys only); Girls and PA (girls only)	24	24 (100)	Qualitative evaluation
Primary school #3	PA, diet and heart health	38	38 (100)	Qualitative evaluation
Secondary school #1	1. Healthy snacks	30	20 (67)	23.60 (5.39) <sup>2</sup>
	2. Physical activity preference - "Street dance" <sup>5</sup>	30	24 (80)	14.17 (0.82) <sup>3</sup>
Secondary school #2	1. Fats in the diet	21	20 (95)	20.04 (3.81) <sup>2</sup>
	2. PA frequency, intensity, type and time (FITT) principles	30	23 (77)	25.22 (3.09) <sup>3</sup>
Church #1	Healthy breakfast options	13	13 (100)	23.38 (6.68) <sup>1</sup>
Temple #1	PA, energy balance and cardiovascular disease	7	7 (100)	12.86 (1.46) <sup>3</sup>
Mosque	PA and energy balance	13	13 (100)	Qualitative evaluation
Church #2	No sessions conducted			
Temple #2	No sessions conducted			
Temple #3	No sessions conducted			

<sup>1,2,3</sup> Maximum evaluation total score <sup>1</sup> = 30, <sup>2</sup> = 25, <sup>3</sup> = 15. All sessions were delivered by the research team except <sup>4</sup>delivered by a local authority PA advisor and <sup>5</sup>delivered by a professional dancer.

#### 4.1.2. Diet and PA behaviour measures were acceptable and feasible, but more consistent in schools

Twenty-four hour recalls yielded the best dietary data results. Dietary assessment technologies and associated food composition data adapted with ethnic-specific foods and recipes would improve the consistency of dietary data in place of worship settings (Maynard, 2015). Completion of the YPAQ was straightforward, is valid for group level estimates (Corder et al., 2009), and would be cost-effective for use in a pilot trial. Alternative objective methods to the ActiHeart such as devices worn around the waist, avoiding skin irritation problems, would be used in the next phase, and have been acceptable in other studies in diverse ethnic groups (Griffiths et al., 2013; Owen et al., 2009). Preparedness for the challenges of places of worship, such as tracking variable attendance could improve the quality of both the dietary and PA measures. Diet, PA and BMI outcome values were similar to those from studies among representative samples of majority (Bates et al., 2016) and minority ethnic children (Donin et al., 2010; Harding et al., 2008; Owen et al., 2009), adding credibility to the appropriateness of the measures.

#### 4.1.3. Delivery of interventions was more straightforward in schools but evaluation was more consistent in places of worship

The high rating of all interventions regardless of format or setting, show the importance of integrating qualitative methods into the evaluation to bring to light subtleties of views and ways to improve sessions. Where lack of infrastructure limits the scope of sessions to mostly educational materials and presentation, careful planning is needed to make them as engaging as possible. Comments on these more didactic sessions also highlighted the difficulties in delivering interventions to mixed-ability audiences. Some overlap with a previous study among South Asians of feasible and acceptable activities, such as additional PA in schools, indicates transferability of components to different contexts (Pallan et al., 2013).

The question remains whether this research, and ultimately intervention programmes, would be more effectively conducted in schools or in the community. Schools provided consistent access to children, facilities and staff resulting in more intervention sessions being delivered. The ability to formally evaluate intervention sessions in places of worship, however, is encouraging, and intervention evaluation coverage was more consistent in places of worship than in schools. Places of worship additionally provide access to parents and other family members, opportunities for cultural tailoring of interventions, and potentially wider community support of children engaged in obesity prevention activities. A community based participatory research (CBPR) approach which forges relationships between research teams, schools and community groups could be advantageous future developments. A grant proposal for the pilot trial of cross sector local community coalitions and youth health champions in schools, churches and mosques in deprived and ethnically dense London neighbourhoods, building on the lessons learned in DEAL, is under review.

## 5. Study limitations

The low response rate was particularly unfavourable for faith organisations. Poor response rates did not hamper the completion of the study as participation rates of individuals were high. However, the recruitment efforts do underscore the likely impact on the time and financial resources required to engage gatekeepers to studies among minority ethnic groups. This in turn may raise questions around statistical power, sample representativeness and external validity in full-scale studies (Campbell et al., 2012). DEAL needed to be sufficiently small in scale to achieve the aim of detailed exploration. Although ethnically diverse, sample sizes within ethnic groups were small and therefore firm conclusions about ethnic specific differences could not be made.

## 6. Conclusions

Despite complex recruitment issues, delivery of intervention components can take place in both school and community contexts, among different ethnic groups. Methods and tools (e.g. food composition tables) which can accommodate diverse cultural frameworks are required. Delivery may be more straightforward in schools, but places of worship provide opportunities for effective reach of minority children, families and communities. The challenges outlined can affect all stages of programmes from resourcing and development, through to delivery and assessment of efficacy. However with awareness of these issues, community participatory approaches forging relationships between schools and communities (including places of worship) may be fruitful developments in this area of research.

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## Conflicts of interest

None.

## Transparency document

The Transparency document associated with this article can be found, in the online version.

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