STUDY PROFILE

Design and characteristics of a new birth cohort, to study the early origins and ethnic variation of childhood obesity: the BiB1000 study

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Abstract

Epidemiological evidence indicates that early life factors are important for obesity development but there are gaps in knowledge regarding the impact of exposures during pregnancy and early life, especially in South Asian children. There is a corresponding lack of evidence to guide development of culturally-appropriate, obesity prevention programmes. This paper describes the methodology and characteristics of participants in Born in Bradford 1000 (BiB1000), a nested cohort of the Born in Bradford prospective birth cohort. BiB1000 aims to enable a deep and extensive understanding of the predictors and influences of health-related behaviours to develop a culturally-specific obesity prevention intervention. 1,735 mothers agreed to take part in detailed assessments focused on risk factors of obesity. Of these, 1,707 had singleton births. Data were collected from the families during pregnancy, at birth and when the infant was aged 6, 12, 18, 24 and 36 months. Approximately half of the mothers (n=933) are of South Asian ethnicity; of which, just under half were born in the UK. Prevalence of obesity in BiB1000 is similar to the full BiB cohort and to UK national averages. In addition to pre-specified hypothesised targets for obesity prevention, (e.g. parental feeding styles, diet and activity), BiB1000 is exploring qualitative determinants of behaviours and other exposures with a lesser evidence base (e.g. food environments, sleep, parenting practices). These data will enable a rich understanding of the behaviours and their determinants in order to inform the development of a culturally-relevant, childhood obesity prevention intervention.

Keywords: birth cohort, ethnicity, childhood, obesity, prevention, South Asian

Background

Born in Bradford (BiB) is a multi-ethnic, birth cohort study (based in Bradford, a northern city in the UK) aiming to examine environmental, psychological and genetic factors that impact on maternal and child health and wellbeing (Raynor and Born in Bradford Collaborative Group, 2008; Wright et al., 2012). BiB1000 is a sub-sample of this cohort which is specifically examining the determinants of childhood obesity, in order to aid development of a tailored prevention intervention, by recruiting women during pregnancy and following them up until the infant is aged 3 years.

There is a disappointing lack of evidence for effective childhood obesity prevention interventions (Summerbell et al., 2005). Data indicate that origins of obesity begin in early childhood and that children of South Asian origin are at particular risk of excess adiposity (Saxena, Ambler, Cole, & Majeed, 2004). There are gaps in our knowledge about the impact of important exposures in pregnancy and early life. Maternal gestational weight gain and gestational glucose metabolism, together with greater birth weight and rapid postnatal growth, are all associated with later obesity, though it is unclear if these are driven by causal mechanisms as currently hypothesized (Reilly et al., 2005). Infant weight gain is consistently associated with subsequent risk of childhood, adolescent and adult obesity and this risk is particularly high for infants with very rapid weight gain (>1.33 SDS, or two centile band crossings) (Baird et al., 2005). Parental obesity is associated with childhood obesity (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997) and although the mechanisms are unclear, they are likely to be influenced by an interaction between genes and the environment. Further, the prevalence of obesity in children born to less educated parents is greater than more educated counterparts (Wang & Beydoun, 2007).

However, it is the social, behavioural and environmental influences on childhood obesity that offer most potential for modification of obesity. A review of systematic reviews of early determinants of obesity identified the following factors associated with an increased risk of childhood obesity: maternal smoking, short sleep duration, less than 30 minutes of daily physical activity, consumption of sugar-sweetened drinks, screen-viewing, and parental feeding practices (Monasta, 2010). Importantly, however, the evidence of causality is not clear, especially in multi-ethnic populations.

BiB1000 aims to enable a deep and extensive understanding of the predictors and influences of health-related behaviours in a multi-ethnic sample, in order to develop a feasible and appropriate culturally-specific childhood obesity prevention intervention. The aim of this paper is to profile the BiB1000 cohort by providing an overview of the BiB1000 study methodology and describing maternal and infant demographic, obstetric and anthropometric characteristics.

Methods and Procedures

Study recruitment

The BiB1000 population were not selectively sampled. Instead, all mothers recruited to the full Born in Bradford study between August 2008 and March 2009, who had completed the baseline questionnaire, were approached to take part in BiB1000 during their routine 26-28 week glucose tolerance test. A sample size of 1080 was calculated based on the statistical ability to detect a difference in infant growth of 0.67 z-scores (one centile band) in weight at age over 1 year, and allowed for a 5% annual attrition. However, once recruitment had begun (and was highly successful), the team decided to oversample the population by up to 70% to optimise the amount of data that were available across all assessments. Ethical approval was obtained from the Bradford Research Ethics Committee and all participants provided written informed consent prior to inclusion in the research.

Data collection

Trained bilingual study administrators collected information from mothers in participants' homes, hospital-based clinics and in local Children's Centres. Anthropometric measurements were taken and structured questionnaires were self-completed. Routinely collected data were extracted from the maternity IT system (eClipse) and the Child Health system in Bradford and Airedale Primary Care Trust. A summary of all measures taken at each assessment is shown in Table 1. In addition, all data collection forms are freely available to download at http://www.borninbradford.nhs.uk/research_documents.htm.

Table 1. BiB1000 data collection measures (with references for each where appropriate)

	Booking (10-14 wks)	**Baseline** (26-28 wks)	**Birth**[2]	**6 mths**	**12 mths**	**18 mths**	**2 yrs**	**3 yrs**
ANTHROPOMETRY								
Mother height[1]		♦						
Mother weight	♦	♦		♦	♦	♦	♦	♦
Mother arm circumference		♦						
Mother triceps		♦						
Infant weight			♦	♦	♦	♦	♦	♦
Infant length				♦	♦	♦	♦	♦
Infant head circumference			♦	♦	♦	♦	♦	♦
Infant abdominal circumference			♦	♦	♦	♦	♦	♦
Infant mid-arm circumference			♦					
Infant skin folds (triceps, sub- scapular, thigh)			♦ (triceps and sub-scapular)	♦	♦	♦	♦	♦
MATERNAL CHARACTERISTICS & OUTCOMES								
Age of menarche		♦						
Previous births (stillbirths/deaths included)		Hospital records						
Obstetric History[3]	Extracted by hand from medical notes							
Glucose tolerance, lipids, insulin, Vitamin D		♦						

	Booking (10-14 wks)	**Baseline** (26-28 wks)	**Birth**[2]	**6 mths**	**12 mths**	**18 mths**	**2 yrs**	**3 yrs**
DEMOGRAPHICS								
Residence type (National Centre for Social Research and University College London. Department of Epidemiology and Public Health, 2010)		♦						
Household structure (National Centre for Social Research and University College London. Department of Epidemiology and Public Health, 2010)				♦	♦		♦	
Measures of poverty (Willitts, 2006)[4]		♦						
Educational status (Office for National Statistics, 2005)[5]		♦						
Employment status ((National Centre for Social Research and University College London, 2003) Module J & NS-SEC[6])		♦		♦	♦		♦	
Marital status and cohabitation (Office for National Statistics, 2005)		♦		♦	♦		♦	
Ethnic origin (Office for National Statistics, 2005)		♦						
Family tree (family relationships)		♦						
Migration history (Office for National Statistics, 2005)		♦						
Childcare arrangements (Australian Institute of Family Studies, 2007)				♦	♦	♦	♦	
Food Security (Bickel, Nord, Price, Hamilton, & Cook, 2000)					♦			
HEALTH RELATED BEHAVIOURS								
General health (National Centre for Social Research and University College London, 2003)				♦	♦	♦	♦	♦
Alcohol use (National Centre for Social Research and University College London. Department of Epidemiology and Public Health, 2010)		♦						

	Booking (10-14 wks)	**Baseline** (26-28 wks)	**Birth**[2]	**6 mths**	**12 mths**	**18 mths**	**2 yrs**	**3 yrs**
Smoking behaviour(National Centre for Social Research and University College London, 2003)		♦		♦			♦	
Consumption of caffeinated drinks/water/bread products*		♦						
Use of supplements/vitamins*		♦						
Breast Feeding (Australian Institute of Family Studies, 2003) (Section B)				♦	♦	♦	♦	♦
FFQ Parent (SFFFQ[7]: Cade et al., unpublished)		♦		♦		♦		♦
Eating habits*				♦				
Parent physical activity(Australian Institute of Health and Welfare (AIHW), 2003)		♦		♦		♦		♦
Infant Diet (Marriott, et al., 2008; Sheehy et al., 2008)					♦	♦		♦
Mother screen (Wareham et al., 2003)				♦	♦	♦	♦	♦
Child eating with others*							♦	
Infant screen time (Wareham et al., 2003)				♦	♦	♦	♦	♦
Sleep questions*				♦	♦	♦	♦	♦
Sleep diary*						♦		♦
Child physical activity*							♦	♦
Caregivers feeding styles (Hughes, Power, Orlet Fisher, Mueller, & Nicklas, 2005)					♦		♦	
Parenting Practices (PPQ)(Australian Institute of Family Studies, 2003) (Section F)				♦			♦	
PSYCHOLOGICAL WELL-BEING								
General Health (GHQ28) (Boardman, 1987)		♦		♦		♦		
Growth perception (Stunkard, Sorensen, & Schulsinger, 1983)				♦			♦	

	Booking (10-14 wks)	**Baseline** (26-28 wks)	**Birth**[2]	**6 mths**	**12 mths**	**18 mths**	**2 yrs**	**3 yrs**
Maternal mental health (Kessler, Andrews, & Colpe, 2002)					♦		♦	
Depression screening (National Institute of health and Clinical Excellence (NICE), 2007)					♦			
ENVIRONMENTAL INDICES								
Food outlet mapping		♦						
Home food availability inventory (researcher conducted)*						♦		♦
Foods in the home checklist*						♦		♦
OTHER								
Childhood Illness (Golding, Pembrey, Jones, & ALSPAC Study Team, 2001) (My Daughter Questionnaire)				♦		♦	♦	♦
Infant Characteristics (ICQ)(Bates, Freeland, and Lounsbury, 1979)				♦				

*Notes. [1]Booking BMI calculated using measured height at baseline and measured weight at booking; [2] Includes measures taken at birth (i.e. infant weight) and prior to discharge by paediatrician; [3] Includes gestational diabetes, parity, diabetes, pre-eclampsia, hypertension, delivery, adverse outcomes; [4] Includes material deprivation, subjective poverty, benefits received, financial coping; [5]Equivalent Pakistan qualifications provided by the School of Lifelong Learning and Development (University of Bradford) based on standard classifications used regarding HEFCE admissions/credits procedures [6]NS-SEC National Statistics Socio Economic Classification; [7] FFQ=Food Frequency Questionnaire, SFFFQ= Short Form Food Frequency Questionnaire; * Newly developed for BiB1000.*

***Anthropometry*:** Infant weight was measured at birth by midwives, and infant head circumference, mid upper arm circumference, abdominal circumference, sub-scapular skin fold and triceps skin fold were taken within the first 24 hours following delivery by paediatricians and midwives who were trained in measurement techniques according to written guidelines. Circumference measurements were taken using Lasso-o tapes (Harlow Printing Ltd South Shields, UK). Head circumference was measured at the most anterior part of the head (frontal eminence) and the most posterior part of the head (maximal head circumference). Abdominal circumference was taken at the umbilicus.

Postnatal measures of infant weight, length, head circumference and abdominal circumference were collected as part of routine practice by health visiting teams. These were supplemented by additional skinfold measures taken by specially trained BiB1000 study health workers at 6 months (actual range 4.9 to 9.4 months), 12 months (actual range 10.7-18.3 months), 18 months (actual range 15.2-22.9), 2 years (actual range 23.4-28.5 months) and 3 years (35.4 - 40.6), obtained using Tanner/Whitehouse Calipers (Holtain Ltd, UK) on the left side of the body. Infant weight was measured using Seca baby scales (Harlow Healthcare Ltd, London, UK). Length was measured using a standard issue neonatometer (Harlow Health Care, London, UK). Maternal weight was taken at all assessments using Seca 2in1 scales (Harlow Healthcare Ltd, London, UK). Maternal height was measured at baseline, and booking BMI (Body Mass Index (BMI kg/m^2)) was derived from antenatal booking weight (at ~12 weeks pregnancy) and baseline height. Reliability testing of the growth data measurements by BiB health workers indicated good quality control for inter- and intra-observer technical error of measurements (r=0.96-1.00) (Johnsonet al., 2009).

***Pregnancy and birth outcomes*:** Mothers' date of birth, parity, date of delivery, mode of delivery, birth weight, infant gender and gestational age were collected from eClipse. Medical and obstetric data were extracted by hand from medical records. Gestational diabetes was diagnosed by glucose tolerance test based on WHO (WHO/NCD/NCS/99.2) thresholds for impaired glucose tolerance or impaired fasting glucose, (i.e. fasting plasma glucose ≥6.0mmol/l and/or 2-hr post-challenge glucose ≥ 7.8mmol/l) at 26 weeks.

***Demographics*:** The majority of demographic data were obtained using structured self-reported questionnaires (Table 1). Items were generated and modified from the Millennium Cohort Study (National Centre for Social Research and University College London, 2003), Growing Up in Australia (Australian Institute of Family Studies, 2003), the 2001 Census (Office for National Statistics, 2005) and the European Prospective Investigation into Cancer and Nutrition (EPIC) (Riboli et al., 2002) questionnaires. Ethnicity and migration history was ascertained using items on the age that participants moved to the UK, plus questions on the country, cultural background and town of birth, (and name of Biraderi or other caste system) of each parent and grandparent.

***Behavioural measures*:** Behavioural measures were collected as part of the structured administered questionnaires, including; feeding style and practices, parental and infant diet, mental health, parental and infant activity, sleep patterns, home food availability, parenting practices and other health behaviours (e.g. smoking, alcohol consumption). Validated questionnaires were used where available, although appropriate ethnic modifications were made and tested using expertise within Bradford. Assessors were trained to collect data in a sensitive manner, including ensuring privacy were necessary and using female assessors of South Asian origin for interviewing other South Asian women.

All questionnaires were translated into Urdu (the national language of Pakistan) and Mirpuri, as the Mirpuri population are the single largest sub-group of the Pakistani populations in Bradford. Transliteration involved translation, back-translation and several rounds of piloting by bilingual and monolingual groups in collaboration with local experts in Bradford (Bradford Talking Media). Since Mirpuri does not have a written form, transliterations were made available for administration by bilingual study administrators.

***Qualitative and objective data collection*:** Qualitative and objective methodologies were employed in sub-samples to explore the lifestyles, behaviours and environments in this multi-ethnic population, including (a) food outlet mapping (b) home food availability inventories (c) a mealtime observation study of maternal feeding styles and (d) interviews with families.

(a) The association between food outlet location, deprivation, weight status and ethnicity was analysed using individual level data using geographic information systems (GIS) methodology. The study area included five inner city wards in Bradford Metropolitan District Council (BMDC) with a range of ethnic population mix (1.2%-63.8% South Asian). A radius of one ward in each direction was included to minimise edge effects in the analysis. Food outlet details were obtained from the BMDC's list of food outlets and the Bradford Yellow Pages (index of local businesses). Data were validated by physical 'ground truthing' a sample of the study area in a random selection of output areas (OAs) to ensure both that a food outlet existed where the list expected one, and whether there were any additional food outlets over and above what was expected.

(b) Home food availability inventories were conducted in an opportunistic sample of 100 participants during 18 month assessments. Researchers measured *all* foods from *all* storage areas within the categories of fruit, vegetables, snack foods and sugar-sweetened beverages. These categories were chosen because; (1) they are often the target of obesity interventions; (2) there is some evidence that their intake is related to obesity in children (Nicklas, Yang, Baranowski, Zakeri, & Berenson, 2003); (3) and/or early literature indicates a relationship between availability in the home and either diet or obesity (Byrd-Bredbenner & Maurer Abbot, 2009). Data collection method, staff training and quality assurance were conducted using a standardised protocol using well-established methodologies from previous research (Bryant et al., 2008).

(c) Ethnic and weight status differences in meal structures and mealtime interactions were investigated in an observational study when infants were aged 18 and 27 months. A daytime meal of 38 mother-child dyads was video-recorded. Mothers were selected according to their ethnicity (non-South Asian, South Asian) or weight status (healthy weight, obese). Mealtimes were coded using the Mealtime Observation Schedule (Sanders & Le Grice, 1989). The schedule measured positive and negative parent behaviours, and positive and aversive child behaviours.

(d) A purposive sample (by ethnicity, parity, cohabitation with extended family) of 14 mothers (and husbands/partners where possible) were interviewed in their homes when the baby was 4 months old to ascertain key cultural and social differences in feeding practices. Researchers sought to elicit the interviewee's responses in three areas: 1) The interviewee belief in what constitutes a healthy diet for their baby; 2) who in the family makes choices about diet for the baby, (are these choices influenced by advice from professionals such as Health Visitor or Children's Centre staff); and 3) interviewee self-efficacy to make decisions regarding the baby's feeding. Interviews were recorded and subsequently transcribed and translated.

Dealing with missing data

Missingness of variables such as obstetric data was dealt with by 'back-fill' (i.e. review of case notes by a physician and entry if available). For consideration of future analysis, missingness will be dealt with on a case-by-case basis and will employ imputation techniques as appropriate. Variability in missingness methodology is based on the study exposure and outcomes, and the amount of missingness in each dataset (i.e. <2% missing will likely not be imputed).

Results

Of 1,916 eligible women, 1,735 agreed to take part in the study. Of these, 28 mothers gave birth to twins. Descriptive statistics are provided here for singleton births only (n=1,707). 77%, 75%, 74%, 70% and 70% have been followed-up at 6, 12, 18, 24 and 36 month assessments respectively. 47% of participants completed all assessments to date, with 17% formally withdrawn from the research. The greatest impact on attrition rates was the inability to make contact with participants in order to book appointments, despite adoption of multiple efforts to contact participants. For example, calls were placed during evenings and weekends; participant details were searched on primary care electronic records; health visitors were approached to verify contact details; letters were mailed; and opportunistic visits were made to family homes.

Demographic information is shown in Table 2 according to maternal ethnicity. BiB1000 characteristics are similar to that of the full BiB cohort (Wright et al., 2012); with a similar distribution of age, marital status and parity. Demographic differences by ethnicity within BiB1000 were also observed, with White British

mothers tending to be younger, educated to a lower level, less likely to be married or cohabiting, and having fewer children than other ethnic groups. Gestational diabetes was greatest in South Asian ethnicities, with 10.5% prevalence in Pakistani women compared to 5.5% in White British. Gestational age, proportion of pre-term infants, mode of birth and the proportion of stillbirths were similar between ethnic groups. Over 35% of White British women reported smoking during pregnancy, compared to 4% and 3% of Pakistani and 'Other' South Asian ethnicities.

Table 3 shows descriptive data for maternal and infant anthropometry by ethnic group. A little over 40% of BiB1000 women were of normal weight (BMI 18.5-24.9) at booking, according to WHO criteria (World Health Organisation, 1998), with 25.6% and 18.2% of the sample overweight (BMI 25-29.9) or obese (BMI ≥30) respectively. By ethnicity, BMI was greatest in White British women compared to other groups. Birth weight of infants of Pakistani and Other South Asian mothers was on average approximately 200 grams lighter than in other ethnicities. These women were also more likely to have a lower birth weight infant (<2.5kg) and less likely to have a macrosomic infant (>4kg) than White British women, though differences in the proportion of women having an infant less than 2.5kg was not statistically significant. Circumference and skinfold thickness also differed between ethnic groups, indicating some ethnic differences in body fat distribution that warrant further investigation. However, it is important to note that up to 20.4% of circumference and skinfold measurements are missing. These measurements, normally taken in hospital at birth, were not always possible due to early discharge or competing demands (e.g. neonatal hearing screening; first examination; midwife checks; photographer etc.).

Table 2. Demographic and obstetric characteristics by maternal ethnicity

		White British (n=652)		Pakistani (n=808)		Other S. Asian[1] (n=125)		Other[2] (n=122)		All (n=1707)		p-value[4]
		N	%	N	%	N	%	N	%	N	%	
Maternal age	Mean (95% CI)	26.4	(25.9, 26.9)	27.5	(27.1, 27.8)	28.5	(27.6, 29.4)	27.2	(26.1, 28.3)	27.1	(26.9, 27.4)	0.0001
	<20 years	85	13.0	25	3.1	2	1.6	12	9.8	124	7.3	<0.0001
	20-24 years	187	26.7	230	28.5	26	20.8	29	23.8	472	27.7	
	25-29 years	190	29.1	295	36.5	43	34.4	41	33.6	569	33.3	
	30-34 years	108	16.6	164	20.3	37	29.6	21	17.2	330	19.3	
	≥35	82	12.6	94	11.6	17	13.6	19	15.6	212	12.4	
Maternal education	No qualifications	133	20.4	208	25.7	18	14.4	16	13.1	375	22.0	<0.0001
	School	242	37.1	261	32.3	28	22.4	25	20.5	556	32.6	
	Further	100	15.3	97	12.0	18	14.4	18	14.8	233	13.7	
	Higher	119	18.3	202	25.0	47	37.6	36	29.5	404	23.7	
	Foreign unknown	48	7.4	23	2.9	10	8.0	22	18.0	103	6.0	
	Missing	10	1.5	17	2.1	4	3.2	5	4.1	36	2.1	
Marital status	Married/cohabiting	473	72.6	767	94.9	120	96.0	95	77.9	1455	85.2	<0.0001
	Single	178	27.3	39	4.8	5	4.0	27	22.1	249	14.6	
	Missing	1	0.2	2	0.3	0		0		3	0.2	
Father's emp't status	Employed, non-manual	319	48.9	277	34.3	59	47.2	58	47.5	713	41.8	<0.0001
	Employed, manual	153	23.5	311	38.5	34	27.2	27	22.1	525	30.8	
	Self-employed	56	8.6	116	14.4	18	16.4	6	4.9	196	11.5	
	Student	15	2.3	12	1.5	4	3.2	12	9.8	43	2.5	
	Unemployed	91	14.0	79	9.8	10	8.0	17	13.9	197	11.5	

		White British (n=652)		Pakistani (n=808)		Other S. Asian[1] (n=125)		Other[2] (n=122)		All (n=1707)		p-value[4]
		N	%	N	%	N	%	N	%	N	%	
	Unknown	13	2.0	11	1.4	0		1	0.8	25	1.5	
	Missing	5	0.8	2	0.3	0		1	0.8	8	0.5	
Parity	0	303	46.5	244	30.2	48	38.4	58	47.5	653	38.3	<0.0001
	1	191	29.3	234	29.0	40	32.0	37	30.3	502	29.4	
	2	81	12.4	145	18.0	24	19.2	11	9.0	261	15.3	
	≥3	61	9.4	168	20.8	12	9.6	8	6.7	249	14.6	
	Missing	16	2.5	17	2.1	1	0.8	8	6.6	42	2.5	
GAD (weeks)[3]	Mean (95% CI)	39.1	(39.0, 39.3)	39.2	(39.0, 39.3)	39.2	(39.0, 39.4)	39.3	(39.0, 39.6)	39.2	(39.1, 39.2)	0.861
Preterm infants	(<37 weeks)	41	6.3	39	4.8	4	3.2	5	4.1	89	5.2	0.377
Mode of birth	Vaginal birth	507	77.8	646	80.0	97	77.6	88	72.1	1338	78.4	0.358
	Caesarean Section	138	21.2	155	19.2	27	21.6	31	25.4	351	20.6	
	Missing	7	1.1	7	0.9	1	0.8	3	2.5	18	1.1	
Still birth	Yes	0		0		0		0		0		
Pre-eclampsia	Yes	9	1.4	15	1.9	1	0.8	0		36	1.5	0.378
Gestational diabetes	Yes	36	5.5	85	10.5	15	12.0	2	1.6	138	8.1	<0.0001
Maternal smoking during pregnancy	Yes	230	35.3	32	4.0	4	3.2	25	20.5	291	17.1	<0.0001

Notes. [1] Other S. Asian = Indian (n=73); Bangladeshi (n=42); Asian other (n=10); [2]Other = White other (n=38); Black (n=34); Mixed White and Black (n=14); Mixed White and South Asian (n=8); Other (n=28).[3]Gestational age at delivery; [4] Continuous data were compared using ANOVA and categorical data using Chi-Squared tests.

Table 3. Maternal and infant anthropometry[1]

		White British (n=652)		Pakistani (N=808)		Other SA (n=125)		Other (n=122)		All (n=1707)		p-value[2]
		N	%	N	%	N	%	N	%	N	%	
MATERNAL												
Booking BMI	Mean (95% CI)	26.8	(26.3, 27.3)	25.3	(24.9, 25.6)	25.5	(24.4, 26.6)	24.8	(23.9, 25.7)	25.8	(25.6, 26.1)	<0.0001
BMI category[1]	Underweight	18	2.8	45	5.6	5	4.0	6	5.0	74	4.3	0.002
	Normal weight	254	39.0	355	43.9	60	48.0	54	44.0	723	42.4	
	Overweight	161	24.7	218	27.0	27	21.6	31	25.6	437	25.6	
	Obese	151	23.2	124	15.4	22	17.6	14	11.6	311	18.2	
	Missing[2]	68	10.4	66	8.2	11	8.8	17	14.1	162	9.5	
INFANT												
Birth weight (g)	Mean (95% CI)	3318	(3272, 3363)	3129	(3092, 3165)	3094	(3010, 3178)	3280	(3198, 3362)	3209	(3183, 3235)	<0.0001
	Missing	7	1.1	7	0.9	1	0.8	3	2.5	18	1.1	
Low birth weight	<2.5kg	46	7.1	72	8.9	9	7.2	5	4.1	132	7.7	0.2450
	Missing	7	1.1	7	0.9	1	0.8	3	2.5	18	1.1	

		White British (n=652)		Pakistani (N=808)		Other SA (n=125)		Other (n=122)		All (n=1707)		p-value[2]
		N	%	N	%	N	%	N	%	N	%	
Large birth weight	>4kg	70	10.7	35	4.3	2	1.6	8	6.6	115	6.7	<0.0001
	Missing	7	1.1	7	0.9	1	0.8	3	2.5	18	1.1	
Head	Mean (95% CI)	34.40	(34.27, 34.53)	34.07	(33.98, 34.18)	34.12	(33.88, 34.36)	34.46	(34.21, 34.72)	34.23	(34.16, 34.30)	0.0002
circumference (cm)	Missing	23	3.5	28	3.5	5	4.0	6	4.9	62	3.6	
Abdominal	Mean (95% CI)	31.74	(31.55, 31.93)	30.72	(30.54, 30.90)	30.60	(30.15, 31.05)	31.56	(31.13, 32.0)	31.16	(31.04, 31.28)	<0.0001
circumference (cm)	Missing	55	8.4	65	8.0	11	8.8	8	6.6	139	8.1	
Mid-arm	Mean (95% CI)	10.87	(10.78, 10.95)	10.63	(10.56, 10.70)	10.62	(10.44, 10.80)	10.77	(10.61, 10.94)	10.73	(10.68, 10.78)	0.0002
circumference (cm)	Missing	48	7.4	61	7.6	11	8.8	8	6.6	128	7.5	
Subscapular skinfold	Mean (95% CI)	4.84	(4.74, 4.94)	4.67	(4.58, 4.75)	4.61	(4.42, 4.81)	4.78	(4.55, 5.01)	4.73	(4.68, 4.79)	0.0364
(mm)	Missing	133	20.4	130	16.1	18	14.4	21	17.2	302	17.7	
Triceps skinfold (mm)	Mean (95% CI)	5.35	(5.25, 5.45)	5.16	(5.08, 5.24)	4.96	(4.78, 5.14)	5.26	(5.04, 5.48)	5.22	(5.16, 5.28)	0.0018
	Missing	133	20.4	130	16.1	18	14.4	21	17.2	302	17.7	

Notes. [1] Other S. Asian = Indian (n=73); Bangladeshi (n=42); Asian other (n=10); [2]Other = White other (n=38); Black (n=34); Mixed White and Black (n=14); Mixed White and South Asian (n=8); Other (n=28).[3]Gestational age at delivery; [4] Continuous data were compared using ANOVA and categorical data using Chi-Squared tests.

Discussion

This Research Note describes the profile and characteristics of a multi-ethnic nested birth cohort in Bradford, which aims to examine the patterns and aetiology of childhood obesity as a needs assessment in order to develop a tailored obesity prevention intervention. In addition to BiB measurements (Raynor and Born in Bradford Collaborative Group, 2008, Wright et al., 2012) further quantitative and qualitative data were collected on the BiB1000 participants to explore risk factors for, and consequences of obesity. A unique quality of this cohort is its ethnic composition, with approximately 50% being of South Asian origin. This new study will have the advantage of data on food availability and families' feeding styles. Antenatal data are freely available and have the capacity of combining with other similar cohorts to strengthen our understanding of early life and obesity outcomes. A registry of such cohorts can be found at http://www.birthcohorts.net. Postnatal data will also be available for open access upon completion of the BiB1000 study in mid-2014. Anyone wishing to access the BiB1000 data are advised to contact the BiB team via completion of an 'Application proforma' from the website. (http://www.borninbradford.nhs.uk/research_proformas.htm). The website provides full details about how to apply for data and further details for interested collaborators.

Trends shown in BiB1000 background characteristics data indicate ethnic inequalities in health that are consistent with existing literature. For example, infants born to women of Pakistani origin in BiB1000 are significantly lighter than babies born to White women. Previous research shows similar patterns (Leon & Moser, 2012; Margetts, Mohd Yusof, Al Dallal, & Jackson, 2002) and this is evident across generations moving to the UK, indicating a complex, and largely unknown, relationship between environmental influences (Kelly, et al., 2008) and biological mechanisms (Margetts, Mohd Yusof, Al Dallal, and Jackson, 2002). A continuous positive relationship (up to macrosomic weight) has been observed between birth weight and health (short and long term), with lower birth weight babies at greatest risk, including perinatal mortality (Ashworth, 1998). Consistent with existing literature (Ali & Dornhorst, 2011; Dornhorst et al., 1992), BiB1000 women of South Asian origin were more than twice as likely to have gestational diabetes compared to White women, despite a lower prevalence of obesity and a significantly lower number of South Asian women smoking during pregnancy.

The proportion of BiB1000 women categorised as overweight (26%) was similar to national prevalence data for the UK (27%) (Food Standards Agency Office, 2010). Rates of obesity in BiB1000 (18.2%) were lower than national rates (29%), but were comparable with age-specific rates in England (21.3%) in women aged 25-34 years (Health Survey for England 2010, 2012), suggesting that the higher national rates may be partially explained by the inclusion of women aged up to 65 years. Furthermore, South Asian women in BiB1000 had a lower prevalence of obesity compared to White British women. Thus, given the high proportion of South Asian women in this cohort compared to the UK generally, this may also partly explain the lower prevalence of obesity overall. BiB1000 weight status is based on data collected at week 12 of pregnancy, at which point there may be some (though negligible) impact on maternal weight. When comparing prevalence to other pregnant samples (where measurement was taken within the first trimester) obesity prevalence is similar. For example, in a recent national UK sample of 98,511 predominantly White British pregnant women, the prevalence of obesity was 15.6% (Heslehurst, Rankin, Wilkinson, & Summerbell, 2010). Clinically, the classification of obesity within pregnant women is often described as a BMI of 35kg/m^2 or greater, since this is the BMI beyond which referrals are often made. Using this cut-off, national data suggests approximately 5% of women are obese in the first trimester of pregnancy ((CMACE), 2010). By comparison, 7.3% of BiB1000 women had a BMI greater than 35.

Conclusion

While there is evidence supporting individual predictors of childhood obesity (e.g. parental obesity (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997)) little is currently known about the role of early modifiable exposures that are associated with

early childhood obesity and how they may interact to influence risk of obesity. This is especially apparent for South Asian populations living in the UK. Existing obesity programmes are generally based on best practice and often fail to consider culturally-specific influences of healthy weight behaviours. BiB1000 offers an opportunity to collect rich longitudinal data to create a picture of a child's environment over time, which will help to understand and explain the influence of this environment on behaviours, and will inform the development of a feasible culturally-specific intervention to prevent childhood obesity.

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