

Development and evaluation of an intervention for the prevention of childhood obesity in a multiethnic population: the Born in Bradford applied research programme

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Scientific summary

The Born in Bradford applied research programme

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Scientific summary

Childhood obesity is a major global public health threat that impacts on health and well-being in childhood and through to adult life. There is emerging evidence that early life environments are important in the aetiology of obesity but there is a notable gap in the research evidence on effective interventions to prevent and treat obesity, particularly in early childhood and for those of South Asian origin.

The aim of this National Institute for Health Research (NIHR) programme was to study the patterns and aetiology of childhood obesity in a multiethnic population and to use this evidence to develop a tailored obesity prevention intervention. The design and development of effective interventions requires a robust empirical evidence base to identify the right targets (modifiable behaviours) for preventing obesity and the right timing (in the growth trajectory) for implementing the intervention. We set out to measure and analyse data on growth trajectories in a multiethnic population alongside an assessment of hypothesised modifiable environmental and behavioural risk factors for obesity.

Programme workstreams (Figure a)

1. To recruit a subsample of the Born in Bradford (BiB) cohort for intensive follow-up to collect data on growth and modifiable risk factors in a deprived multiethnic community.
2. To describe ethnic differences in risk factors for childhood obesity and to identify modifiable behaviours and risk factors to target in future interventions.
3. To undertake a systematic review of diet and physical activity interventions to prevent or treat obesity in South Asian children and adults.
4. To explore wider determinants of, and cultural differences in, feeding and eating patterns and beliefs, attitudes and practices with regard to obesity, diet and exercise.
5. To design a theory-based innovative intervention to improve modifiable behaviours in both parents and children to prevent childhood obesity.
6. To undertake a feasibility trial to evaluate the intervention.

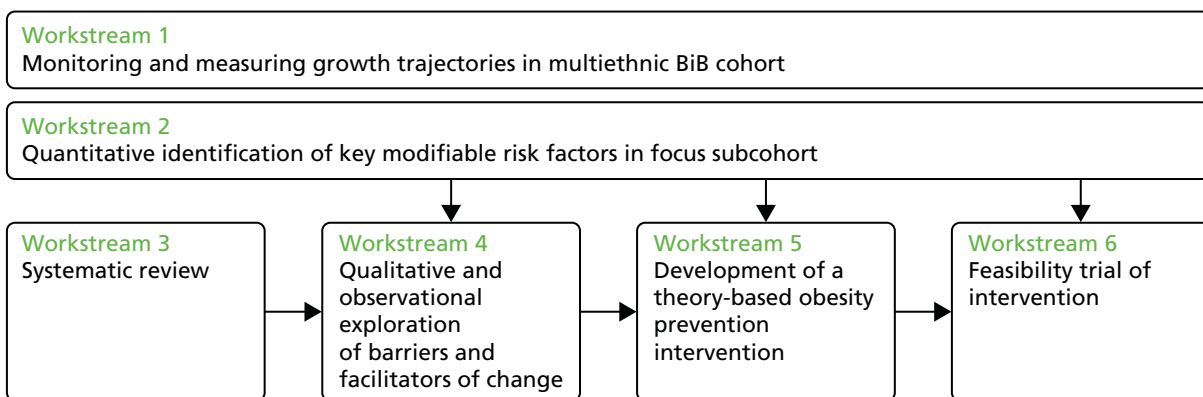


FIGURE a Outline of programme workstreams.

Methods

Workstream 1: recruitment of a childhood obesity cohort (BiB1000)

Data were collected from families during pregnancy, at birth and during early childhood. In addition to prespecified hypothesised targets for obesity prevention (diet, activity), the BiB1000 study explored qualitative determinants of behaviours and other exposures with less evidence (food environments, sleep, parenting practices).

A reliability study assessed routinely collected growth measures. Multilevel linear spline models were used to model growth trajectories and logistic regression was used to develop prediction equations to model the risk of childhood obesity.

Workstream 2: ethnic differences in risk factors for childhood obesity and association with body mass index at age 3 years

We used exposure data (feeding, parenting, diet, physical activity and sleep) from the BiB1000 questionnaires to describe ethnic differences. We used outcome data on 987 participants with body mass index (BMI) measurements at age 3 years, of whom 382 (39%) were of white British origin and 474 (48%) were of Pakistani origin. Linear regression was used to assess the association between risk factors and BMI standard deviation scores and Poisson regression was used to determine the relative risk between risk factors and infant overweight. Models included adjustment for maternal and child characteristics.

Workstream 3: a systematic review of diet and physical activity interventions to prevent or treat obesity in South Asian children and adults

Studies of any type of lifestyle intervention of any length of follow-up that reported any anthropometric measure for children or adults of South Asian ethnicity were included in the systematic review. There was no restriction on the type of comparator, and randomised controlled trials (RCTs), controlled clinical trials and before-and-after studies were included. A comprehensive search strategy was implemented.

Workstream 4: investigation of social, cultural and environmental determinants of childhood obesity

Four methods were utilised to investigate social, cultural and environmental determinants of childhood obesity. Qualitative interviews with 14 mothers focused on decisions to breastfeed and decisions about weaning with a view to identifying personal imaginative worlds and interactional contexts in which choices were made. A further 38 mother–child dyads were observed during typical mealtimes and coded using the Mealtime Observation Schedule. Observed interactions were compared with mothers' self-reports on questionnaire assessments of feeding, parenting styles and infant characteristics. Food inventories recorded the availability of key food and drink items within a sample of 100 homes. Finally, food outlets in five contiguous inner-city wards in Bradford were identified and linked to individual-level data on a sample of 1198 women using geographic information systems (GIS) methodology to examine the association between food outlet location, deprivation, weight status and ethnicity.

Workstream 5: development of a theory-based obesity prevention intervention

Intervention mapping was applied as follows: (1) needs assessment of parents, the wider community and practitioners and consideration of the evidence base, policy and practice; (2) identification of outcomes and change objectives following identification of barriers to behaviour change; (3) selection of theory-based methods and practical strategies to address barriers to behaviour change; (4) design of the intervention by developing evidence-based interactive activities and resources; and (5) adoption and implementation: parenting practitioners were trained by health-care professionals to deliver the intervention within children's centres. The intervention was named the Healthy and Active Parenting Programme for early Years (HAPPY).

Workstream 6: feasibility trial of the Healthy and Active Parenting Programme for early Years

A feasibility RCT was conducted. A total of 120 overweight pregnant women were recruited between 10 and 26 weeks' gestation and allocated on a 1 : 1 basis to either a 12-week intervention programme (six sessions antenatally, six sessions postnatally; $n = 59$) or usual care ($n = 61$). Assessments took place at baseline and when the infant was aged 6 and 12 months and included the mother's BMI, infant's length and weight and mother's and infant's physical activity and diet. Outcomes were recruitment rate, attrition, acceptability of randomisation and measurement tools and acceptability of the intervention. Fidelity was assessed through observations and facilitator feedback. Focus groups and structured interviews were conducted with mothers to gauge their reactions to the research methods and the content of the intervention.

Results

Workstream 1: recruitment of a childhood obesity cohort (BiB1000)

A total of 1735 mothers agreed to take part in detailed assessments focused on risk factors for obesity. Of these, 1707 had singleton births. Approximately half of the mothers ($n = 933$) were of South Asian ethnicity, of whom just under half were born in the UK. The prevalence of obesity in the BiB1000 cohort was similar to that in the full BiB cohort and to UK national averages.

Pakistani boys and girls were lighter at birth and had a shorter predicted mean length at birth than white British boys and girls but gained weight and length quicker in infancy. By age 2 years both ethnic groups had a similar weight but Pakistani boys and girls were taller on average than white British boys and girls. Data-driven prediction equations for risk of childhood obesity were developed and incorporated into a mobile phone application.

Workstream 2: ethnic differences in risk factors for childhood obesity and association with body mass index at age 3 years

Pakistani mothers were more likely to initiate breastfeeding than white British mothers; however, there were no ethnic differences in exclusive breastfeeding at 4 months. Pakistani infants were more likely than white British infants to have a higher intake of sweet commercial foods, chips and roast potatoes, fruit and high-sugar drinks at 12 months. White British infants had higher intakes of savoury baby foods and processed meat products. By 18 months of age, the above differences were shown to persist and increase, indicating evidence of early tracking of consumption patterns. Pakistani infants had later sleep onset and wake times than white British infants at both 18 and 36 months. There were no ethnic differences in total daily physical activity or sedentary time; however, there were differences in the types of physical and sedentary activities undertaken. Pakistani mothers were less likely to adopt a hostile approach to parenting.

There were consistent associations between maternal smoking, maternal booking BMI, feeding style and parenting style and greater mean BMI at age 3 years and a higher relative risk of being overweight or obese at this age. There was no strong evidence that the relationship between the risk factors and BMI differed by ethnic group.

Workstream 3: a systematic review of diet and physical activity interventions to prevent or treat obesity in South Asian children and adults

Twenty-nine studies were included in the systematic review, seven of children, 21 of adults and one of mixed-age participants. Meta-analysis of a limited number of controlled trials found an unclear picture of the effects of interventions on BMI in South Asian children. Meta-analysis of a limited number of controlled trials showed that interventions resulted in a significant improvement in weight for adults but no significant differences in BMI and waist circumference. One high-quality study in South Asian children found that a school-based physical activity intervention that was delivered within the normal school day and which was culturally sensitive was effective. There was also evidence of culturally appropriate

approaches to, and characteristics of, effective interventions in adults, which we believe could be transferred and used to develop effective interventions in children.

Workstream 4: investigation of social, cultural and environmental determinants of childhood obesity

There were many competing and contradictory sources of advice for mothers with new babies. Professional concerns about obesity had not translated into parental concerns about growth in their child. There were differences between South Asian and non-Asian mothers in terms of both meal structures and mother–child interactions. South Asian mothers used negative parenting behaviours more frequently and less positive behaviour. In the healthy-weight South Asian group this was paralleled by greater levels of negative child behaviour. Availability of foods in the home was similar between ethnic groups except for fresh fruits and sugar-sweetened beverages, which were available in greater quantities in homes of Pakistani mothers. More than 95% of all participants lived within 500 m of a fast-food outlet. Women in higher areas of deprivation had greater access to fast-food outlets and to other forms of food shops. Contrary to hypotheses, there was a negative association between BMI and fast-food outlet density in close proximity (250 m) to the South Asian group.

Workstream 5: development of a theory-based obesity prevention intervention

The HAPPY intervention was developed using an intervention mapping approach. The programme is aimed at pregnant women (BMI ≥ 25 kg/m²) and consists of 12 \times 2.5-hour sessions (six antenatal sessions from 24 weeks and six postnatal sessions up to 9 months). It addresses (1) the mother's diet and physical activity, (2) breastfeeding or bottle-feeding, (3) infant diet and parental feeding practices, (4) infant physical activity, and (5) parenting practices: parenting styles and skills.

Workstream 6: feasibility trial of the Healthy and Active Parenting Programme for early Years

The recruitment rate of women screened with a BMI of ≥ 25 kg/m² was 30% ($n=120/396$). Retention at 12 months was 66% for the intervention group and 75% for the control group. Of the 59 allocated to the intervention, 26 (44%) attended at least one antenatal appointment (attending on average 4.8 sessions) and 18 (31%) attended at least one postnatal session (average 4.6 sessions). Group clustering was minimal. An adjusted effect size of -0.25 standard deviation weight score at 12 months (95% confidence interval -0.16 to -0.65) favouring the intervention was observed.

Conclusions

This programme has established a new childhood obesity cohort with longitudinal data collection to develop a deep and extensive understanding of the predictors and influences of health-related behaviours and help develop a feasible and appropriate culturally specific intervention for the prevention of obesity. A unique quality of this cohort is its ethnic composition, which is generalisable to other large multiethnic cities in the UK. Importantly, the cohort also provides a unique foundation for the study of the long-term consequences of growth and weight through linkage with primary care health data for child health outcomes and educational attainment.

For the first time in the UK we estimated South Asian growth trajectories and found that Pakistani boys and girls were lighter and had a shorter predicted mean length at birth than their white British counterparts but gained weight and length quicker in infancy. By age 2 years both ethnic groups had a similar weight but Pakistani boys and girls were taller on average than white British boys and girls. These differences in postnatal growth were not explained by maternal height, smoking during pregnancy and gestational age. We also developed data-driven prediction equations for risk of childhood obesity and incorporated them into a mobile phone application.

We found ethnic differences in breastfeeding, infant diet, sleeping patterns and the types of physical and sedentary activities that the children engaged in. There was also evidence of dietary patterns that emerged at 12 months tracking to 18 months, indicating that, once established, these patterns may become ingrained and difficult to change. There was little evidence that parenting styles differed between ethnic groups.

Smoking during pregnancy, maternal BMI, feeding style and parenting style were all associated with infants' BMI at age 3 years. The associations between these risk factors and childhood BMI did not vary by ethnicity. Interventions to reduce childhood obesity should target smoking and maternal weight in the antenatal period and postnatally should encourage the adoption of warmer, less hostile parenting styles and responsive feeding styles.

Our systematic review concluded that there was no evidence that interventions were more or less effective according to whether or not they were targeted at South Asian families or that they differed in terms of effectiveness according to the socioeconomic status of the recipients. In addition, there was evidence of culturally appropriate approaches to, and characteristics of, effective interventions in adults, which we believe could be transferred and used to develop effective interventions in children.

Our qualitative and observational studies identified a major gap in the cultural appropriateness of current measures or existing interventions for South Asian families. Interventions need to consider how parents, in particular mothers, negotiate between the many factors that influence their behaviour, including cultural and family influences. That negotiation will be aided by interventions that support the development of self-efficacy and which offer support in how to evaluate the wide variety of advice that parents receive. Knowledge of the types and quantities of foods and drinks in family homes supports the development of intervention programmes that target an improvement of the foods available, both for obesity prevention or management and for overall diet improvement. Specifically, increasing the consumption of fruit and vegetables and reducing the consumption of sweetened drinks, crisps and biscuits should be a target. The stronger association between deprivation and fast-food density than with obesity argues for more detailed accounts of the obesogenic environment that include measures of individual behaviour. The proliferation of fast-food outlets has public policy relevance and should be considered in planning applications.

Intervention mapping provided a feasible approach to developing a complex health behaviour change intervention (HAPPY). The framework was used to produce a transparent and replicable intervention whereby mechanisms of change can be investigated and identified and strategies used to manipulate them can be appropriately refined. Integration with the existing Family Links Nurturing Programme enabled the expertise of existing parenting programme co-ordinators to be utilised to deliver the programme, thus increasing sustainability.

The HAPPY intervention was evaluated in a feasibility RCT and was found to be feasible and acceptable. However, the recruitment rate was low and attrition between randomisation and intervention attendance was high. Qualitative interviews with women who chose not to attend intervention sessions identified strategies to recruit and retain women in these types of sustained complex interventions. A proposal for a full multisite cluster RCT has incorporated these strategies and has been submitted for funding to evaluate the cost-effectiveness of the HAPPY intervention.

Trial registration

This trial is registered as ISRCTN56735429.

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