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Variation in outcomes of the Melbourne Infant, Feeding, Activity and Nutrition Trial (InFANT) Program according to maternal education and age ☆

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ABSTRACT

Objective. To assess the effectiveness of the Melbourne Infant Feeding, Activity and Nutrition Trial (InFANT) Program according to maternal education and age.

Methods. A cluster-randomised controlled trial involving 542 mother/infant pairs from 62 existing first-time parent groups was conducted in 2008 in Melbourne, Australia. The intervention involved 6 × 2-hour dietitian-delivered sessions, DVD and written resources from infant age 4–15 months. Outcomes included infant diet (3 × 24h diet recalls), physical activity (accelerometry), television viewing and body mass index. We tested for moderation by maternal education (with/without a University degree) and age (<32 and ≥32 years). The trial was registered with the ISRCTN Register (identifier 81847050).

Results. Interaction effects with the treatment arm were observed for maternal education and age. The intervention effects on vegetable (positive effect) and sweet snack consumption (negative effect) were greater in children with higher educated mothers while intervention effects on water consumption (positive effect) were greater in infants with lower educated mothers. The intervention was also more effective in increasing both vegetable and water consumption in infants with mothers aged <32 years.

Conclusions. Child obesity prevention interventions may be differentially effective according to maternal education and age. Evidence of differential effects is important for informing more sensitively targeted/tailored approaches.

Introduction

A growing body of evidence now suggests that overweight and obesity in childhood and adolescence have adverse health consequences in adulthood and confer a greater risk of premature mortality (Reilly and Kelly, 2011). During childhood and adolescence, excess body weight is also associated with a greater likelihood of psychosocial problems including social discrimination and reduced self-esteem (Hesketh et al., 2004; Latner and Stunkard, 2003). Body weight and its inherent cardiovascular risk are patterned according to socioeconomic indicators in most developed countries, with socioeconomic position being inversely related to obesity rates and the accumulation of cardiovascular risk in both adults and children (Australian Bureau of Statistics, 2009; Brunner et al., 1999; Sassi et al., 2009; Shrewsbury and Wardle, 2008; Wells et al., 2010).

Differences in weight according to socioeconomic indicators of either maternal education or parental occupation have been reported from as early as three months of age (Wijlaars et al., 2011). In Australia, as well as in England, recent studies in school-aged children have found socioeconomic gradients (in income and social class in England, and in area-level disadvantage in Australia) in the prevalence of obesity to be increasing over the past decade (Hardy et al., 2012; Stamatakis et al., 2010). Variation in obesity-related behaviours (increased television viewing and consumption of energy-dense snacks and drinks as well as decreased consumption of fruits and vegetables) by parental education and income has also been observed in preschool children and persists throughout childhood and into adolescence (Cameron et al., 2012). Maternal age is likewise a strong determinant of obesity-related behaviours in infants and children independent of child age. Although studies of sedentary behaviour (King et al., 2011) and physical activity (McMinn et al., 2008) find younger maternal age to be protective (associated with greater activity and less sedentary time), studies of infant diets (Giovannini et al., 2004; Navia et al.,

Abbreviations: InFANT, The Melbourne Infant, Feeding, Activity and Nutrition Trial; USA, United States of America; BMI, body mass index; WHO, World Health Organization.

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2009; Smithers et al., 2012) find the opposite (younger maternal age is a risk factor for poor diets). For childhood obesity, one recent study in 10–12 year old Greek boys and girls found younger maternal age to be a risk factor while conversely, a recent study among 7 to 14 year old Brazilian boys reported older maternal age to be associated with overweight or obesity (Bernardo and Vasconcelos, 2012; Farajian et al., 2012). A large American study of maternal age and the health of adult offspring found a strong link between adult obesity and having been born to a mother of <25 years (Myrskyla and Fenelon, 2012). Considering the findings above, the impact of maternal age on childhood obesity-related behaviours is uncertain but clearly warrants further investigation.

Although the majority of behavioural intervention studies in diet and activity (or obesity prevention more generally (Waters et al., 2011)) do not report moderation effects of their findings (Kremers et al., 2007; Yildirim et al., 2011), such analyses are important in order to generate stronger hypotheses which can be tested in the next generation of intervention studies (Kraemer et al., 2002). Moderation analyses are also important for identifying target groups for whom interventions may be more or less effective even where an overall intervention effect may be null (Kraemer et al., 2002).

The Melbourne Infant Feeding, Activity and Nutrition Trial (InFANT) Program was a cluster-randomised controlled trial of an early childhood obesity prevention intervention implemented in first-time parent groups in Melbourne, Australia (Campbell et al., 2008). The primary outcomes of this trial in children aged 20 months have previously been published (Campbell et al., 2013). Here we present analyses of the effects of the intervention according to both maternal education and maternal age.

Methods

The study design, sample selection, intervention features and details of each of the primary outcome measures of the Melbourne InFANT Program have been reported previously (Campbell et al., 2008, 2013). This trial has been registered with the ISRCTN (International Standard Randomised Controlled Trial Number) Register (http://isrctn.org) (identifier ISRCTN81847050). A brief summary of the study methods is presented here.

Study design

The study was a cluster-randomised controlled trial among first-time parent groups in Melbourne, Australia. Hanna et al. provide an overview of the purpose and scope of the Government-funded first-time parent groups that all new parents are invited to attend (with their child) in the state of Victoria (which includes Melbourne) (Hanna et al., 2002). Existing first-time parent groups active during the study period and with eight or more English speaking parents were eligible for involvement (n = 74). Individual parents provided informed written consent to participate. A total of 542 (86%) eligible parents (541 mothers and 1 father) in 62 groups consented to participate. Equal numbers of parent groups (randomly allocated) were assigned to the intervention and control arms respectively. As the study was among first-time parent groups, parity and number of children per household were constant (n = 1). Over 98% of the sample were either married or living as married. The final sample size was chosen based on the ability to detect a 25% increase in consumption of vegetables in the intervention group accounting for within-group clustering and likely attrition (Campbell et al., 2013). Local government areas randomly chosen for inclusion in the study spanned the socioeconomic spectrum. Analysis according to an area level index of relative disadvantage (Australian Bureau of Statistics, 2006) showed that three areas from each of the lowest and highest tertiles of disadvantage were included, with another eight areas from the middle tertile (Campbell et al., 2013).

The dietitian-delivered intervention occurred between June 2008 and February 2010. Six 2-hour sessions were delivered quarterly with data collection at child ages approximately 4 months (baseline) and 20 months (intervention conclusion). The intervention, described in detail elsewhere (Campbell et al., 2008), sought to build parent knowledge, skills and social support regarding infant feeding (though breast feeding was not a focus), physical activity and sedentary behaviours. Intervention delivery consisted of peer support as well as group discussion of the barriers to (and facilitators of) healthy eating and activity. Six key messages were the focus of the intervention which also incorporated a purpose-designed DVD, written materials and a regular newsletter reinforcing key messages. Control parents received usual care from their maternal and child health nurse as well as six newsletters regarding non-obesity-related aspects of child health or development.

Measures

Outcome variables

Outcome variables and analyses were chosen based on those reported in the primary outcome paper for this study (Campbell et al., 2013).

Diet. Infant diets were assessed at the conclusion of the intervention by telephone-administered multipass 24-hour recall with parents (n = 389) (Blanton et al., 2006; Spence et al., 2013). Two or three days of dietary data were collected, including one weekend day (note that in >90% of cases, three days of data were collected) (Lioret et al., 2013). A food measurement booklet was created including both photographs of food in measured quantities based on available serving size information (Webb et al., 2008), and pictures from the food model book used in the 2007 Australian Child Nutrition and Physical Activity Survey (Department of Health and Ageing, 2008; Spence et al., 2013). Each food/beverage item recorded was matched to an appropriate nutrient composition and quantity, using the 2007 AUSNUT Database (Food Standards Australia New Zealand, 2008). The average daily intake of fruits (excluding juice), vegetables (excluding potatoes), non-core sweet foods (e.g., chocolate, candy, cakes), non-core savoury foods (e.g., crisps, savoury biscuits), non-core drinks (i.e. fruit juice, soft drinks) and water was calculated (Campbell et al., 2013).

Objectively assessed physical activity. Infant physical activity of light-, moderate-, or vigorous-intensity (assessed together as the intervention aimed to increase physical activity of any intensity) was assessed using ActiGraph accelerometers (Model GT1M, Pensacola, Florida, USA) at intervention conclusion (Hnatiuk et al., 2012). Validated cut-points of 192–1672 and >1672 counts per minute were used to determine activity of light and moderate/vigorous intensity respectively (Hnatiuk et al., 2012). Data were recorded in 15 second epochs for seven consecutive days. All those with at least 4 days of valid data (where counts were recorded for at least 7.4 h) (Hnatiuk et al., 2012) were included in the analyses of physical activity (n = 286), as we have previously shown that 4 days of data were sufficient to achieve acceptably reliable estimates (Hnatiuk et al., 2012). Non-wear time was defined as 20 or more consecutive minutes of zero counts; these data were excluded.

Television viewing time. Infant television viewing time was assessed at intervention conclusion via a parent-completed questionnaire asking about time spent watching TV on a typical day (n = 459). This measure was shown to have good test–retest reliability (Campbell et al., 2013).

Body mass index (BMI). Infant weight and height/length were measured by trained staff at 4 months and 20 months (n = 457). BMI (kg/m^2) and BMI z-score were calculated using World Health Organization (WHO) sex-specific BMI-for-age growth charts (WHO growth reference study group, 2006).

Moderator variables

Maternal education. Maternal education was used as an indicator of socioeconomic position (the data from one father who completed the main carer questionnaire was excluded from these analyses). Maternal education was collapsed into two groups (university education (54.1%) vs. no university education) in order to maximise power available for between-group comparisons. Income was not assessed in this study.

Maternal age. Maternal age was calculated based on maternal report of date of birth at baseline. A dichotomous maternal age variable was created with the cut-point of 32 years being the median age of mothers in the sample.

Statistical analyses

Differences in outcomes between those in the intervention and control arms were assessed using random effects linear regression models, estimated using maximum likelihood and accounting for clustering of participants in first time parent groups. As some outcomes exhibited highly skewed distributions,