Child eating behaviour outcomes of an early feeding intervention to reduce risk indicators for child obesity: The NOURISH RCT

Lynne Allison Daniels\textsuperscript{a,b,c}, PhD, Kimberley Margaret Mallan\textsuperscript{a,b}, PhD, Diana Battistutta\textsuperscript{a}, PhD, Jan Maree Nicholson\textsuperscript{d,e,f}, PhD, Josephine Emma Meedeniya\textsuperscript{a,b}, Jordana Kim Bayer\textsuperscript{e,g}, Anthea Magarey\textsuperscript{c,h}, PhD

Affiliations: \textsuperscript{a}Institute of Health and Biomedical Innovation and \textsuperscript{b}School of Exercise and Nutrition Sciences, Queensland University of Technology, Queensland, Australia; \textsuperscript{c}Nutrition and Dietetics, Flinders University, Adelaide, South Australia, Australia; \textsuperscript{d}Parenting Research Centre, Melbourne, Victoria, Australia; \textsuperscript{e}Murdoch Childrens Research Institute, Melbourne, Victoria, Australia; \textsuperscript{f}Centre for Learning Innovation, Queensland University of Technology, Queensland, Australia; \textsuperscript{g}School of Psychological Science, La Trobe University, Melbourne, Victoria, Australia.

Key words: childhood obesity, randomised controlled trial, child eating behaviours, parenting practices

Short title: Child eating behaviour outcomes of the NOURISH RCT

Address correspondence to: Lynne Daniels, School of Exercise and Nutrition Sciences, Queensland University of Technology, Victoria Park Road, Kelvin Grove, Queensland, Australia, 4059, [l2.daniels@qut.edu.au], +61 7 3138 6139.

Abbreviations: CEBQ – Children’s Eating Behaviour Questionnaire; MANOVA – Multivariate Analysis of Variances; RCT – Randomised Controlled Trial

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‘What is already known about this subject’

- Child eating behaviours, food preferences and intake are influenced by and plausibly mediate associations between maternal parenting and feeding practices and child weight status.
- Few high quality trials have evaluated interventions commencing in infancy that were designed to modify these maternal and child behaviours.

‘What this study adds’

- Anticipatory guidance appropriate for development stage on early parenting and feeding practices resulted in some positive outcomes in parent-report child eating behaviour.
Abstract (200 words)

Objective: Describe parent-reported child eating behaviour and maternal parenting impact outcomes of an infant feeding intervention to reduce child obesity risk.

Design and Methods: An assessor masked Randomised Controlled Trial (RCT) with concealed allocation of individual mother-infant dyads. The NOURISH RCT enrolled 698 first-time mothers (mean age 30.1 years, SD=5.3) with healthy term infants (51% female) aged 4.3 months (SD=1.0) at baseline. Outcomes were assessed six months post-intervention when the children were 2-years old. Mothers reported on child eating behaviours using the Child Eating Behaviour Questionnaire (CEBQ), food preferences and dietary intake using a 24-hour telephone recall. Parenting was assessed using five scales validated for use in Australia.

Results: Intervention effects were evident on the CEBQ overall (MANOVA $P=.002$) and 4/8 subscales: child satiety responsiveness ($P=.03$), fussiness ($P=.01$), emotional overeating ($P<.01$), and food responsiveness ($P=.06$). Intervention children ‘liked’ more fruits ($P<.01$) and fewer non-core foods and beverages ($Ps=.06, .03$). The intervention mothers reported greater ‘autonomy encouragement’ ($P=.002$)

Conclusions: Anticipatory guidance on protective feeding practices appears to have modest positive impacts on child eating behaviours that are postulated to reduce future obesity risk.

Clinical Trial Registration: Australian and New Zealand Clinical Trials Registry Number 12608000056392.
Introduction

Child eating behaviours, food preferences and dietary intake are established before two years of age and are prospectively associated with obesity risk.\textsuperscript{1-3} Although heritable,\textsuperscript{4} these behaviours plausibly mediate associations between maternal feeding practices and child weight status.\textsuperscript{3,5} Feeding occurs within the context of overall parenting interactions. There is accumulating evidence that authoritative parenting (balance of warmth and limit setting) is prospectively associated with reduced child overweight.\textsuperscript{5-7} Few randomised controlled trials (RCTs) have targeted these potentially modifiable determinants of obesity risk in infancy.\textsuperscript{8}

The NOURISH RCT\textsuperscript{9} evaluated an intervention for first-time mothers that provided anticipatory guidance on early feeding, commencing when the infants were four months old. Content promoted authoritative parenting and feeding practices related to the ‘when, what and how’ of feeding solid foods that have been associated with child weight status, primarily via descriptive and cross sectional studies.\textsuperscript{4,10,11}

We have previously reported maternal feeding practices and child weight, six months after completion of the first module (infants 14 months old)\textsuperscript{12} and also at final follow up, six months after completion of the total planned intervention (i.e. both modules, infants two years old).\textsuperscript{13} Typically, child obesity trials have reported adiposity outcomes; whereas, changes in eating behaviours and dietary intake are rarely reported.\textsuperscript{14} The recent Cochrane review of obesity prevention interventions in children\textsuperscript{15} recommended more comprehensive reporting of a wider range of outcomes, both positive and negative, to help identify effective components and key mediators of intervention effect and reduce reporting and publication bias. None of the obesity prevention interventions reported to date that commenced in the
first year of life \(^{16-18}\) have reported impact on child eating behaviour or food preferences or parenting practices.

The aim of this paper was to report impact evaluation of the NOURISH intervention on child eating behaviour, food preferences, dietary intake and parenting practices. The hypotheses tested were that compared to self-directed standard care, this intervention would result in changes in (i) child eating behaviours, food preferences and dietary intake (primary), and (ii) parenting practices (secondary), consistent with reduced obesity risk.
Subjects and Methods

Study Design

NOURISH was conducted from 2008-2011 in two Australian cities, Brisbane and Adelaide. The protocol and recruitment have been reported elsewhere. Assessments and intervention delivery by study staff occurred at child health clinics located across both cities. Measurements were taken at baseline and follow up when the children were 2-7 months and 21-27 months old. The trial was approved by the Queensland University of Technology Human Research Ethics Committee.

Recruitment, participants and randomisation

A consecutive sample of first-time mothers with healthy term infants was approached at seven maternity hospitals. Inclusion criteria were ≥ 18 years of age, infants > 35 weeks gestation and birth weight ≥ 2500g, living in the study cities, facility with written and spoken English and no recent history of intravenous substance abuse, domestic violence or eating disorders. Consenting mothers were recontacted for full enrolment when their infant was four (range 2-7) months old. After baseline measurement, mothers were randomly allocated to intervention or control by a statistician external to the study, using a permutated-block schedule within each assessment clinic to balance participant socio-economic characteristic across study groups.

Treatment Components
The first intervention module started immediately after base-line (children aged 4-7 months) with the second module commencing six months after completion of the first (children aged 13-16 months). Each module comprised six interactive group sessions (10-15 mothers per group, total 40 groups) of 1-1.5 hours duration, co-facilitated by a dietitian (n=13) and psychologist (n=13). Developmentally appropriate content addressed: (i) repeated neutral exposure to unfamiliar foods combined with limiting exposure to unhealthy foods to promote healthy food preferences\(^4,10,20\) and (ii) responsive feeding that recognises and responds appropriately to cues of hunger and satiety to promote self-regulation of energy intake to need.\(^11,21,22\) A third theme was 'feeding is parenting' and positive parenting (encouragement of autonomy, warmth, self-efficacy).\(^7,23,24\) Content was presented to mothers in the context of healthy eating and growth, rather than obesity prevention. Anticipatory guidance regarding appropriate management of ‘normal’ feeding behaviours aimed to pre-empt and prevent rather than resolve entrenched feeding-related problems. A social cognitive approach\(^25\) promoted maternal competence and confidence. The intervention was piloted with 25 mothers. Group facilitators received standardised training, intervention manual and presentation materials, and participated in fortnightly teleconferences to promote intervention quality and integrity. All intervention participants were provided with detailed written information covering session content.

The control group had access to universal community child health services, which, at the mother’s initiative, could include child weighing and web- or telephone-based information. An important distinction was that controls did not receive anticipatory guidance but sought advice on a specific problem. No data were collected on the frequency with which mothers accessed usual care.
Measurements

Data were collected at first contact (face-to-face), then at baseline and follow up by self-report questionnaire.

Child eating behaviours were assessed at follow up via the parent-report Children’s Eating Behaviour Questionnaire (CEBQ) which includes 35-items in eight subscales validated in 2-8 year olds.26

Child food preferences were assessed at follow up using a standardised tool27 adapted to reflect foods commonly consumed by Australian children.28 Mothers rated the extent to which their child liked (1='likes a lot' to 5='dislikes a lot') each of 61 items. An additional response option of ‘never tried’ provided a proxy estimate of exposure to common foods. Outcome variables were the number of food items the child liked (‘likes a lot’ or ‘likes a little’) and had 'never tried' (i.e. restricted exposure) from the lists of vegetables (23 items), fruits (17 items), non-core foods (18 items), and non-core beverages (8 items).9 Non-core foods are high fat/sugar, nutrient poor foods that are not an essential component of a healthy diet.29

Child food intake was assessed using a three-pass 24-hour dietary recall conducted via telephone by a dietitian trained in a standardised protocol.30 Mothers did not have prior knowledge of the day of interview, or that the caller was a dietitian. Participants were provided with visual aids (e.g. actual-size images of metric cups and spoons, a centimetre
Recipes for home-prepared dishes were collected. Intake was analysed using FoodWorks (Professional Version 9) with additional composition data for infant commercial foods added. Quantities consumed and total energy and macronutrient intakes were checked by study dietitians for plausibility. Based on the AUSNUT 2007 database and national survey the proportion of children consuming any fruit, vegetables, sweet snacks (cakes, biscuits, pastries), savoury snacks (crisps, extruded snacks), and non-milk sweetened beverages in the 24-hour recall period was determined.

Two parenting measures were included at baseline and follow up. Parental warmth refers to nurturing, responsive parenting whereas irritable parenting describes parent’s feelings of anger or frustration towards their child. Another two measures were used at follow up only. Autonomy encouragement refers to parenting behaviours that promote children’s self-regulation of behaviour, while overprotective parenting seeks to shield children from difficult situations. These were not developmentally relevant and hence not assessed at baseline. All measures were shortened subscales from the Child Rearing Questionnaire and Bayer et al.’s early childhood parenting scale, and have been used with large Australian samples. In the present sample reliability of all scales was good (Cronbach’s $\alpha$: .70—.86).

Covariate data were collected at the initial postnatal contact and birth weight from hospital records. At baseline infant feeding details (ever breastfed, ever had solids) and current feeding mode (breastfeeding, formula feeding or a combination) were recorded via self-completed questionnaire.
Statistical Analysis

Sample size estimates utilised pilot\textsuperscript{34} and other\textsuperscript{35} data to estimate meaningful differences in selected child outcomes.\textsuperscript{9} Our target sample of 265 per group at follow up was powered to detect control vs. intervention differences in the proportion of children consuming sweetened beverages of 44\% vs. 25\% and not consuming fruit and vegetables of 18\% vs. 5\% and 33\% vs.16\%, respectively.\textsuperscript{9} The outcomes reported here were not age-appropriate and hence not assessed at baseline or follow up at 14 months. As such, last observations could not be carried forward for non-completes and analysis was conducted using data from completers only as per allocated group. No covariate adjustments were undertaken as there were no control versus intervention baseline differences across a range of maternal and child variables (Table 1). Similarly, there were no differences at follow up between the treatment groups in key covariates such as maternal BMI (see results). Thus, comparisons between conditions on continuous and dichotomous outcomes variables used independent samples t-tests and likelihood ratio chi-square tests, respectively. Two exceptions were: (i) Multivariate Analysis of Variance (MANOVA) was performed on the CEBQ data due to the theoretical and statistical relatedness of the individual subscales ($r$s -.70 to +.67)$^{26}$, and (ii) Mann-Whitney U tests were used to compare 'liked' and 'never tried' food/beverage data due to non-normal distributions. All statistical analysis used SPSS Version 19 with $P <.05$ (two-tailed) indicating statistical significance with the exception of the non-core food and beverage intake data from the 24 hr recalls in which adjustment for multiple comparisons (.05/6) resulted in a significance level of $P <.008$. 
Results

Participants

Participant flow through the study is reported in Figure 1. Differences between consenters and non-consenters have been reported elsewhere.\(^{19}\) Those who declined consent were younger (M=28.0, SD=5.5 years vs M=30.1, SD=5.3 years), less likely to have a university education (36 vs. 58\%\) and be living with a partner (90 vs.95\%) and more likely to smoke during pregnancy (21 vs. 12\%). There were no differences by intervention group on key maternal and infant characteristics at baseline (Table 1). At follow up (20 months from baseline) attrition was 22\% (n=157): 26\% intervention (n=92) and 19\% (n=65) control (\(P=.01\)). Compared to the completers, those lost to follow up were younger (M=28.0, SD=5.5 years vs M=30.6, SD=5.2 years), less likely to have a university degree (40\% vs. 63\%) and their children were slightly older at baseline (M=4.5, SD=0.7 months vs. M=4.3, SD=0.7 months) but not different on other characteristics in Table 1, including maternal BMI. Despite differential attrition, non-completer baseline characteristics did not vary by treatment group (data not shown). At follow up, the mean age of children (52\% female) was 24.1 months (SD=0.7) and there was no significant difference in BMI Z score between children in the control and intervention group. Twenty-five percent of mothers had a second child (control n=50, intervention n=65) and excluding those who were pregnant at follow up maternal BMI did not differ between groups: control (n=193) M=26.3, SD=6.3, intervention (n=185) M=25.8, SD=5.6, \(P=.42\). Attendance at 2 or more sessions for Module 1 was n=229 and Module 2 was n=130; 65\% and 45\% respectively of those retained at module commencement).
Parent-reported child eating behaviours, food preferences and dietary intake

Data from the CEBQ26 are shown in Table 2. There were group differences on parent-reported child eating behaviours overall (MANOVA: \( P = .002 \)); intervention group children were rated higher on satiety responsiveness (\( P = .03 \)) and lower on emotional overeating (\( P = .009 \)), fussiness (\( P = .01 \)), and food responsiveness (\( P = .06 \)) subscales.

Numbers of fruits, vegetables and non-core foods 'liked' and 'never tried' are shown in Table 3. Intervention children liked more fruits (\( P = .008 \)) and had been exposed to a wider variety of vegetables (\( P = .008 \)) and were more limited in the number of ‘liked’ and 'tried' non-core beverages (\( P_s = .03 \) and .01). Relative proportions of intervention vs. control children consuming (yes/no) the specified foods, based on three-pass 24-hour recalls, were consistently in the desirable direction, but not statistically different (\( P > 0.008 \)) (Table 4).

Parenting

There were no baseline differences for parental warmth or irritable parenting (data not shown). At follow up intervention mothers reported greater use of autonomy encouragement (\( M = 4.34, SD = 0.60 \) vs \( M = 4.16, SD = 2.90, P = .002 \)). Group differences were not observed for warmth, irritability or overprotective parenting (\( P_s \geq .10 \)). Parenting data were highly skewed to more positive practices. Transforming continuous scores to reduce the skew or by dichotomising at the 20\(^{th}\) percentile did not change interpretations.
Discussion

NOURISH is one of the first and largest RCTs to report detailed parent-reported child eating behaviour, food preference and dietary intake, as well as maternal parenting outcomes of a universal obesity prevention intervention commencing in infancy. Outcomes reported here at six months post intervention when the infants were two years old, provide evidence that anticipatory guidance on early feeding practices in the context of positive parenting has a modest impact on aspects of 'obesogenic' child eating behaviour, food preferences and dietary quality and resulted in parenting interactions with higher levels of autonomy encouragement.

The intervention encouraged repeated neutral exposure to a wide range of healthy foods and limited exposure to non-core foods. Consistent with these messages intervention mothers reported less fussiness, exposure to a wider range of vegetables and fewer non-core beverages and liking for a wider variety of fruits and fewer non-core beverages in their children, all of which have been associated with improved diet quality in older children.\(^{36}\) Although not statistically significant (adjusting for multiple comparisons), differences in dietary intake were consistently in the desirable direction. Overall, mothers reported their children had tried most of the listed commonly consumed fruit (15 /17) and vegetables (21/23). Intervention children appear to have been exposed to fewer (i.e. 'never tried' more) and liked fewer non-core foods and beverages. These data provide some support for the widely held notion that exposure increases familiarity, and consequently preferences.\(^{10,37}\) It is disappointing that these differences in preferences and exposure did not translate to statistical differences in frequency of consumption of these foods as assessed by the 24-hour recall. Although dietary quality does not necessarily predict energy intake, the absence of intervention effect on the proportion of children consuming non-core foods on the day of record may partly explain the
absence of statistically significant intervention effect on child BMI z score at 2 years of age as we have reported elsewhere. As in other studies, our data indicated that dietary quality issues emerge early. Approximately one in three children, on the day of survey, were reported to consume confectionary, sweetened beverages and high fat, high salt biscuits and one in five did not eat vegetables, even as part of other dishes. Consistent with the innate liking for sweet, the children 'liked' about three-quarters versus half of specified fruits and vegetables, respectively. We are unaware of other food preference data reported for this age group.

Two other obesity prevention RCTs commencing in infancy have reported child dietary intake outcomes but not eating behaviours or food preferences. The Australian Healthy Beginnings Trial evaluated six nurse-led home visits to first-time mothers when their infants were 1-18 months old. At age two years (n=483; 72% retention), based on a short food frequency questionnaire, the only significant difference was the proportion of children eating ≥ 1 serves of vegetables per day (intervention 89% vs. control 83%, \(P=.03\)). The INFANT cluster RCT delivered six intervention sessions over 15 months to existing social groups of first-time mothers with infants four months old at baseline. At age 20 months (N=389, 72% retention), data from 3x24 hour telephone-administered dietary recalls showed two differences: intervention children were less likely to consume non-core beverages (OR 0.48) and ate less sweet snacks (mean difference 16g/day).

The NOURISH intervention also focussed on responsive feeding that recognises and responds appropriately to child cues of hunger and satiety in order to maintain their capacity
to match intake to need and avoid overfeeding.\textsuperscript{6,11} Intervention mothers reported higher levels of child satiety responsiveness and lower levels of food responsiveness and emotional overeating in their children. Descriptive cross-sectional and longitudinal studies in older children have associated these eating behaviours with greater obesity risk.\textsuperscript{26,39} The increased use of a range of responsive feeding practices by intervention mothers reported previously\textsuperscript{12,13} appears to be mediating intervention effects on child feeding behaviours, providing prospective evidence that maternal responsive feeding practices can support the preservation of child capacity to self regulate intake.

Intervention mothers reported higher levels of autonomy encouragement. This is consistent with specific intervention emphasis on both parenting and feeding which encouraged ‘trust’ in the child's appetite\textsuperscript{21} and self feeding. However, the positive bias across the majority of general parenting measures, raise questions regarding the relevance of early interventions that address broadly based positive parenting skills in this well-educated sample, or alternatively, the need for parenting measures that are more sensitive to differences in parenting at this age.

A strength of NOURISH is the comprehensive evaluation employing multiple validated measures of feeding practices, child eating behaviours, preferences and intake behaviours and anthropometric indicators.\textsuperscript{9,12,13} The intervention format matched that of services being delivered in the community child health sector at the time. The robust RCT design, large sample size, good retention and blinding of both assessment and analysis strengthen internal validity. A number of limitations must be considered. The majority of outcome variables were not developmentally appropriate for assessment at baseline (e.g. only 34\% had tried solids. Given our sample comprised comparatively well-educated, older, first time mothers,
mostly born in Australia, the broader generalisability of the intervention is unknown. It is interesting to note the similarities in demographic profile of participants reported here and in the two similar intervention studies.\textsuperscript{16,18} Although there was differential attrition, characteristics of non-completers did not vary by group, suggesting this did not increase retention bias. Self-report data are always subject to potential acquiescence bias but are the only feasible option in large community-based studies. Module attendance was disappointing and has two implications. Firstly, intervention dose was substantially less than planned. Secondly, for the sizeable proportion of mothers who did not attend Module 2, the results reported here in effect represent 18-month follow up of the effects of Module 1 alone. Both factors may have contributed to the modest intervention effect sizes reported here. Consideration of delivery format and the need for ongoing support for mothers during the toddler years is required. However, it may be unrealistic to expect full participant engagement in a universal program. The absence of a true attention control group does not allow us to preclude a Hawthorne effect. However, we were unable to identify 18 matched hours of content that would not potentially affect obesity risk and parenting outcomes but would be of sufficient relevance to compensate for the increased cost and burden for control participants. The use of 'usual care' control groups is common in pragmatic community-based trials.

Overall, this study provides evidence that early anticipatory guidance on 'protective' feeding practices was associated with modest improvements in the child eating behaviours that are postulated to lay the foundation for long term healthy eating habits and reduce future obesity risk.\textsuperscript{3,11} Furthermore, this study provides prospective evidence for associations between these outcomes and substantially extends existing evidence that to date has been primarily based on
small, short term quasi-experimental studies and cross sectional descriptive studies. Together, the three Australian trials provide encouraging evidence that promoting 'protective' early feeding practices may be an effective approach to obesity prevention.\textsuperscript{13,17,18,40} It is plausible that the extent to which 'protective' feeding practices that focus on intrinsic determinants of eating habits, such as food preferences and appetite regulation, can confer resilience to the contemporary 'obesogenic' environment may not manifest until the child is older and moves well beyond the confines of maternal gate-keeping. Follow up of the children at 3.5 and 5 years of age is underway to shed light on the longer term efficacy of this universal obesity prevention intervention that starts in infancy and targets maternal feeding practices.
Conflict of Interest: The authors have no conflicts of interest to disclose and no financial relationships relevant to this article to disclose.
Acknowledgements: All authors contributed to interpretation of results and preparation of the manuscript. Lynne A. Daniels conceived the study, led the design, successful funding application and overall implementation of the study and drafted and edited the manuscript. Kimberley M. Mallan undertook the statistical analysis under the mentorship of Professor Battistututta and drafted the results and methods sections. Diana Battistututta contributed to the design, funding applications and implementation and provided mentorship of Dr Mallan. Jan M. Nicholson contributed to the parenting aspects of the intervention, design, funding applications and implementation. Josephine E. Meedeniya was involved in the delivery of the intervention, developed the dietary intake protocol and materials and contributed to data collection. Jordana K. Bayer contributed to the development of parenting component of the intervention. Anthea Magarey contributed to the development of the intervention, design, funding applications and implementation. Associate Professor Magarey led the development of the protocols, collection, statistical analysis and reporting of the dietary intake results. The authors have no conflict of interests or financial relationships relevant to this article to disclose.

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References


Table and figure legends

Figure 1. CONSORT diagram showing flow of all participants.

Table 1. Characteristics of mothers and children (N=698) allocated to the control group (n=346) compared to the intervention group (n=352).

Table 2. Maternal report on eight dimensions of their child’s eating behaviours at follow up (child age mean=24.1, SD=0.7 months; female 51%).

Table 3. Number of vegetables (n=23), fruits (n=17), non-core foods (n=18) and non-core beverages (n=8) ‘liked’ and ‘never tried’ by children based on maternal report at follow up.

Table 4. Number (%) of children not consuming fruit and vegetables and consuming non-core foods and beverages in the 24 hours prior to day of recall.
Table 1. Characteristics of mothers and children (N=698) allocated to the control group (n=346) compared to the intervention group (n=352).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n=346)</th>
<th>Intervention (n=352)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education (University degree)</td>
<td>199 (58)</td>
<td>207 (59)</td>
<td>406 (58)</td>
</tr>
<tr>
<td>Smoked during pregnancy</td>
<td>40 (11)</td>
<td>45 (13)</td>
<td>85 (12)</td>
</tr>
<tr>
<td>Born in Australia</td>
<td>270 (79)</td>
<td>272 (78)</td>
<td>542 (78)</td>
</tr>
<tr>
<td>Married/Defacto</td>
<td>327 (95)</td>
<td>332 (95)</td>
<td>659 (95)</td>
</tr>
<tr>
<td>SEIFA Index of Relative Advantage and Disadvantage (relative disadvantage ≤7th decile)</td>
<td>117 (34)</td>
<td>113 (32)</td>
<td>230 (33)</td>
</tr>
<tr>
<td>Age at delivery (years)</td>
<td>29.9 (5.3)</td>
<td>30.2 (5.3)</td>
<td>30.1 (5.3)</td>
</tr>
<tr>
<td>BMI</td>
<td>26.2 (5.5)</td>
<td>25.8 (5.1)</td>
<td>26.0 (5.3)</td>
</tr>
<tr>
<td>Infant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (female)</td>
<td>173 (50)</td>
<td>181 (51)</td>
<td>354 (51)</td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>3.5 (0.4)</td>
<td>3.5 (0.4)</td>
<td>3.5 (0.4)</td>
</tr>
<tr>
<td>Birth weight Z-score&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.38 (0.87)</td>
<td>0.39 (0.88)</td>
<td>0.38 (0.87)</td>
</tr>
<tr>
<td>Age (months) at baseline assessment</td>
<td>4.3 (1.0)</td>
<td>4.3 (1.0)</td>
<td>4.3 (1.0)</td>
</tr>
<tr>
<td>Current feeding mode&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully/exclusively breast fed</td>
<td>170 (55)</td>
<td>191 (60)</td>
<td>361 (57)</td>
</tr>
<tr>
<td>Formula only</td>
<td>93 (27)</td>
<td>84 (26)</td>
<td>167 (27)</td>
</tr>
<tr>
<td>Combination (formula+breast fed)</td>
<td>59 (19)</td>
<td>44 (14)</td>
<td>103 (16)</td>
</tr>
<tr>
<td>Ever breast fed&lt;sup&gt;b&lt;/sup&gt;</td>
<td>266 (96)</td>
<td>250 (98)</td>
<td>516 (97)</td>
</tr>
<tr>
<td>Ever given solids&lt;sup&gt;b&lt;/sup&gt;</td>
<td>114 (34)</td>
<td>115 (34)</td>
<td>229 (34)</td>
</tr>
<tr>
<td>Age solids introduced (weeks)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>22.7 (4.9)</td>
<td>22.8 (4.4)</td>
<td>22.8 (4.7)</td>
</tr>
</tbody>
</table>

No. (%) reported for dichotomous variables;
Mean (SD) reported for continuous variables;
SEIFA=Socio-economic Indexes for Areas;
<sup>a</sup>World Health Organization standards
<sup>b</sup>data collected from questionnaire administered at baseline.
<sup>c</sup>data collected from questionnaire administered at first follow up when infants aged 14 months (n=529)
Table 2. Maternal report on eight dimensions of their child’s eating behaviours at follow up
(child age mean=24.1, SD=0.7 months; female 51%).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Control (n=244)</th>
<th>Intervention (n=221)</th>
<th>P value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children’s Eating Behaviour Questionnaire (CEBQ)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional overeating (4 items; α=.76) e.g. My child eats more when anxious</td>
<td>1.60 (0.51)</td>
<td>1.48 (0.48)</td>
<td>.009</td>
</tr>
<tr>
<td>Fussiness (6 items; α=.90) e.g. My child refuses new foods at first</td>
<td>2.62 (0.76)</td>
<td>2.46 (0.65)</td>
<td>.01</td>
</tr>
<tr>
<td>Satiety responsiveness (5 items; α=.76) e.g. My child gets full up easily</td>
<td>3.01 (0.57)</td>
<td>3.12 (0.57)</td>
<td>.03</td>
</tr>
<tr>
<td>Food responsiveness (5 items; α=.80) e.g. My child’s always asking for food</td>
<td>2.25 (0.69)</td>
<td>2.14 (0.65)</td>
<td>.06</td>
</tr>
<tr>
<td>Desire to drink (3 items; α=.81) e.g. My child is always asking for a drink</td>
<td>2.91 (0.86)</td>
<td>2.79 (0.83)</td>
<td>.14</td>
</tr>
<tr>
<td>Enjoyment of food (4 items; α=.87) e.g. My child enjoys eating</td>
<td>3.78 (0.64)</td>
<td>3.84 (0.61)</td>
<td>.29</td>
</tr>
<tr>
<td>Slowness in eating (4 items; α=.70) e.g. My child eats slowly</td>
<td>2.94 (0.63)</td>
<td>2.96 (0.58)</td>
<td>.61</td>
</tr>
<tr>
<td>Emotional under eating (4 items; α=.79) e.g. My child eats less when s/he is upset</td>
<td>2.98 (0.84)</td>
<td>2.96 (0.89)</td>
<td>.70</td>
</tr>
</tbody>
</table>

CEBQ<sup>26</sup>: All scales scored 1 (‘never’) to 5 (‘always’);

α is Cronbach’s α;

<sup>a</sup> Based on MANOVA, F(8,456)=3.15, P=.002, η<sup>p</sup><sup>2</sup>=.052; Mean (SD) reported.
Table 3. Number of vegetables (n=23), fruits (n=17), non-core foods (n=18) and non-core beverages (n=8) ‘liked’ and ‘never tried’ by children based on maternal report at follow up.

<table>
<thead>
<tr>
<th>Outcome a</th>
<th>Control (n=245)</th>
<th>Intervention (n=222)</th>
<th>P value b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed items ‘liked’ c</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>13 (9, 16)</td>
<td>13 (11, 17)</td>
<td>.16</td>
</tr>
<tr>
<td>Fruits</td>
<td>12 (10, 15)</td>
<td>13 (11, 15)</td>
<td>.008</td>
</tr>
<tr>
<td>Non-core foods</td>
<td>13 (10, 15)</td>
<td>12 (10, 14)</td>
<td>.06</td>
</tr>
<tr>
<td>Non-core beverages</td>
<td>2 (0, 4)</td>
<td>1 (0, 3)</td>
<td>.03</td>
</tr>
<tr>
<td>Listed items ‘never tried’ d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>2 (1, 4)</td>
<td>2 (0, 3)</td>
<td>.008</td>
</tr>
<tr>
<td>Fruits</td>
<td>2 (1, 3)</td>
<td>2 (1, 3)</td>
<td>.32</td>
</tr>
<tr>
<td>Non-core foods</td>
<td>3 (5, 17)</td>
<td>4 (2, 6)</td>
<td>.07</td>
</tr>
<tr>
<td>Non-core beverages</td>
<td>6 (3, 7)</td>
<td>6 (0, 4)</td>
<td>.01</td>
</tr>
</tbody>
</table>

a Based on listed items from each food category (see Appendix) on modified food preferences questionnaire 27: Vegetables (23 items); Fruits (17 items); Non-core foods (18 items); Non-core beverages (8 items);
b Based on non-parametric Mann-Whitney U test; Median (Interquartile range) reported;
c ‘liked’= number of items rated as ‘likes a lot/likes a little’ vs. ‘neither likes nor dislikes/dislikes a little/dislikes a lot/never tried’.
d ‘never tried’= number of items rated as ‘never tried’ vs. ‘likes a lot/likes a little/neither likes nor dislikes/dislikes a little/dislikes a lot’.
Table 4. Number (%) of children *not* consuming fruit *a* and vegetables *a* and consuming non-core foods and beverages in the 24 hours prior to day of recall.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Control</th>
<th>Intervention</th>
<th>P value(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not consume any fruit <em>a</em></td>
<td>31 (11.7)</td>
<td>20 (8.0)</td>
<td>.17</td>
</tr>
<tr>
<td>Did not consume any vegetables <em>a</em></td>
<td>50 (18.8)</td>
<td>52 (20.9)</td>
<td>.55</td>
</tr>
<tr>
<td>Consumed salty snacks (crisps, cheezels, biscuits with cheese dip)</td>
<td>27 (10.2)</td>
<td>16 (6.4)</td>
<td>.12</td>
</tr>
<tr>
<td>Consumed fried potato</td>
<td>38 (14.3)</td>
<td>21 (8.4)</td>
<td>.04</td>
</tr>
<tr>
<td>Consumed sweet snacks (cakes, buns, pastries)</td>
<td>126 (47.4)</td>
<td>107 (43.0)</td>
<td>.32</td>
</tr>
<tr>
<td>Consumed savoury snacks (biscuits, pastries)</td>
<td>83 (31.2)</td>
<td>75 (30.1)</td>
<td>.79</td>
</tr>
<tr>
<td>Consumed chocolate, confectionery</td>
<td>81 (30.5)</td>
<td>71 (28.5)</td>
<td>.63</td>
</tr>
<tr>
<td>Consumed non-milk sweet beverages (fruit juice, cordial, carbonated drinks)</td>
<td>95 (35.7)</td>
<td>83 (33.3)</td>
<td>.57</td>
</tr>
</tbody>
</table>

\(^a\) Fruit and vegetables also included dishes where fruit/vegetables were the main ingredient - there were few of these for fruit but many for vegetables (other ingredients were one or more of cereal, dairy, meat);

\(^b\) Based on likelihood ratio chi-square test; No. (%) reported.