

## Short communication

# A pilot study of a telephone-based parental intervention to increase fruit and vegetable consumption in 3–5-year-old children

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## Abstract

**Objective:** To examine the potential efficacy of a brief telephone-based parental intervention in increasing fruit and vegetable consumption in children aged 3–5 years and to examine the feasibility of intervention delivery and acceptability to parents.

**Design:** A pre–post study design with no comparison group. Telephone surveys were conducted approximately 1 week before and following intervention delivery.

**Setting:** Participants were recruited through pre-schools in the Hunter region, New South Wales, Australia.

**Subjects:** Thirty-four parents of 3–5-year-olds received four 30-min interventional telephone calls over 4 weeks administered by trained telephone interviewers. The scripted support calls focused on fruit and vegetable availability and accessibility within the home, parental role modelling of fruit and vegetable consumption and on implementing supportive family eating routines.

**Results:** Following the intervention, the frequency and variety of fruit and vegetable consumption increased ( $P=0.027$ ), as measured by a subscale of the children's dietary questionnaire. The intervention was feasible to be delivered to parents, as all participants who started the intervention completed all four calls, and all aspects of the interventional calls, including the number, length, content, format and relevance, were considered acceptable by more than 90% of parents.

**Conclusions:** A brief telephone-based parental intervention to encourage fruit and vegetable consumption in pre-school-aged children may be effective, feasible and acceptable. Further investigation is warranted in a randomised controlled trial.

**Keywords**  
Fruit  
Vegetables  
Pre-school  
Children  
Telephone  
Parent

Adequate consumption of fruit and vegetables during childhood is an issue of public health importance as a diet that includes plenty of fruit and vegetables helps children achieve optimal growth and development<sup>(1)</sup> and maintain a healthy weight<sup>(2–4)</sup>; it can also protect against chronic diseases in adulthood<sup>(5,6)</sup>. Despite this, internationally, many children consume insufficient quantities of fruit and vegetables<sup>(7)</sup>. Initiatives to increase the consumption of fruit and vegetables in childhood may therefore represent an effective strategy in the prevention of childhood obesity and future chronic disease.

Early childhood represents a critical period in the formation of children's dietary behaviours<sup>(8)</sup> and parents are

particularly influential in this process<sup>(9)</sup>. A number of parent-modifiable factors within the home environment have been found to be consistently associated with increased consumption of fruit and vegetables in children. These factors include the availability and accessibility of fruit and vegetables<sup>(10–12)</sup>, parental role modelling of fruit and vegetable consumption<sup>(10,12)</sup> and the presence of supportive family eating routines<sup>(10,11)</sup>. As such, supporting parents to make positive changes to the home environment may represent an appropriate focus for interventions attempting to increase fruit and vegetable consumption in young children.

Parents report the need for support in overcoming skill and knowledge barriers<sup>(13–16)</sup> in order to facilitate healthy

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eating behaviours in their children. Methods of providing parental support that are effective in increasing fruit and vegetable consumption, that can be feasibly delivered to a large number of parents at a relatively low cost and that are considered acceptable to parents represent public health approaches likely to benefit children's nutrition<sup>(17)</sup>. Against these criteria, the provision of support by means of telephone calls appears to compare favourably with other modes of delivering support to parents. Telephone-based interventions have been identified as effective<sup>(18)</sup>, efficient<sup>(19)</sup>, feasible<sup>(20)</sup> and acceptable<sup>(21)</sup> in changing physical activity, smoking and dietary behaviours in adults. The telephone provides a potential means of accessing most parents having pre-school-aged children and currently has a broader reach than interventions delivered through the Internet<sup>(22)</sup>; it can also be delivered more feasibly to a large number of parents compared with face-to-face strategies<sup>(18)</sup>.

Despite the potential advantages of support delivered by means of the telephone, systematic reviews of obesity prevention interventions for children aged 0–5 years<sup>(23)</sup>, of parental interventions targeting children's nutrition and physical activity<sup>(24)</sup> and of interventions to increase children's fruit and vegetable consumption<sup>(25)</sup> have failed to identify any telephone-based interventions for parents targeting fruit and vegetable consumption in their pre-school-aged children. Given the lack of published data, best practice models of intervention development and evaluation recommend that new interventions be developed systematically on the basis of relevant theory and research and then pilot tested to assess acceptability, compliance, delivery of intervention, recruitment and retention before initiating a randomised controlled evaluation<sup>(26)</sup>. As such, the aim of the present pilot study was to assess the potential efficacy of a brief telephone-based parental intervention in increasing the consumption of fruit and vegetables among 3–5-year-old children, as well as to assess the feasibility of the intervention and its acceptability to parents.

## Experimental methods

### Design

The present pilot study used a pre–post study design without a comparison group. Volunteer parents of 3–5-year-old children attending pre-schools were recruited to participate in the intervention. Telephone surveys were conducted with parents approximately 1 week before and 1 week following the intervention.

### Setting and participants

#### Eligibility

Parents were recruited through non-government pre-schools in the Hunter region, New South Wales, Australia. Pre-schools provide programmes for children in the 2 years before starting full-time education and 89% within the state

are operated by non-governmental organisations<sup>(27)</sup>. In all, 64% of 4-year-old children in New South Wales attend pre-school<sup>(27)</sup>. Parents were eligible to participate if they had a child aged 3–5 years attending a participating pre-school, if they resided with that child for at least 4 d/week (in order for the child to be sufficiently exposed to the interventional strategies that the parent may implement) and if they understood English. Parents of children with conditions requiring specialised dietary information or advice, as determined by a dietitian, were excluded.

#### Recruitment

Eight pre-schools were randomly selected from a list of all forty-seven non-government pre-schools in the region, and pre-school supervisors were contacted via mail and telephone to obtain permission to recruit parents. A research assistant visited consenting pre-schools on two occasions to distribute study information and consent forms to parents as they dropped off or picked up their child. The research assistant visited the pre-schools on a third occasion to distribute reminder letters to parents. All parents were encouraged to complete the consent form regardless of their intention to participate. The consent form consisted of three items related to study eligibility: whether the parent resided with their child; the child's age; and allergies or dietary restrictions pertaining to the child. Questions were also included regarding the parents' residential postcode, the child's gender, the child's usual consumption of fruit and vegetables and whether the parents consented to participate in the study. An accredited practising dietitian reviewed the information provided by parents about child allergies and dietary restrictions and determined whether entry into the study was appropriate. All other eligibility items were confirmed by means of telephone before collection of baseline data.

#### Intervention

Intervention development was guided by a family-based interventional model drawing on socio-ecological theory and focusing on introducing new familial norms associated with healthy eating<sup>(28)</sup>. Other interventions based on this model have successfully introduced environmental change in the family home to support healthy eating habits<sup>(29)</sup> and reduce poor eating habits in overweight and obese children<sup>(30)</sup>. The current intervention consisted of four weekly telephone support calls, each of approximately 30 min duration, and a series of instructional resources including a workbook, a cookbook and a pad of meal planners, as well as water bottles for all family members. The support calls were scripted and were delivered by interviewers by means of a computer-assisted telephone interview (CATI)<sup>(31)</sup>. The scripts were used to facilitate structured conversations between interviewers and parents, and the CATI system controls the delivery of the script by requiring the interviewer to enter the participant's response before the next section of the script is displayed on the computer screen.

Scripts were developed in consultation with psychologists, dietitians and health promotion practitioners experienced in parenting, dietary or telephone interventions and were extensively pre-tested. Scripting ensured a common structure and content across each call while multiple scripted pathways facilitated the provision of tailored information on the basis of parents' individual practices and the home food environment. Table 1 provides an overview of the interventional call content, including behavioural change techniques<sup>(32)</sup> on which the script was based and examples of how these techniques were applied<sup>(28,33)</sup>.

Using the script, interviewers helped parents to set goals, identify opportunities to improve family routines or characteristics of the home environment associated with children's healthy eating and identify barriers to change. They also assisted with problem solving and encouraged parents to engage in behavioural change strategies. During the 4-week intervention, participants completed a basic 3 d food diary for their child and were encouraged to try a range of additional activities depending on their existing household routines. During the calls interviewers provided parents with tailored information and strategies to support the implementation of these activities. If parents agreed to attempt any of the suggested activities, the script prompted the interviewer to ask about their attempt in the subsequent call and interviewers provided feedback, highlighted achievements and discussed ideas and strategies for improving future attempts. Activities and information were focused on the following three domains.

1. Availability and accessibility of foods within the home: Parents were encouraged to ensure that fruit and vegetables were available in the home and stored in a form that facilitated their consumption (i.e. washed and chopped)<sup>(34)</sup>. They were also encouraged to reduce the home availability and accessibility of non-core foods such as confectionery<sup>(35)</sup>.
2. Role modelling of fruit and vegetable consumption<sup>(10)</sup>: Parents were encouraged to increase their consumption of fruit and vegetables in front of their child and to display behaviours supportive of fruit and vegetable consumption.
3. Supportive family eating routines: Parents were encouraged to eat meals as a family<sup>(11)</sup>, eat meals without the television on<sup>(11)</sup>, establish and enforce family rules around eating<sup>(10)</sup> and develop boundaries around when and how food should be offered to their child<sup>(33)</sup>.

The intervention was delivered by six interviewers with no formal health qualifications but with experience in conducting health-related telephonic interviews. All interviewers had completed secondary education and vocational training and one had completed a university degree in a non-health field. They were selected on the basis of their competency in undertaking role plays and small group activities, such as answering questions commonly posed by parents, during a 2 d training

workshop delivered by health promotion practitioners, an accredited practising dietitian and a psychologist specialising in parenting. Selected interviewers then completed a further 10 h of self-paced practice including mock intervention calls with members of the research team to ensure that they were adhering to the script and were confident in their delivery. During the period of intervention, members of the research team monitored interviewers for consistency, confidence and ease of script delivery, and two group sessions were held to provide feedback on performance and discuss any issues arising from monitoring.

### **Data collection and measures**

Baseline and follow-up data were collected from parents by means of the CATI approximately 1 week before and 1 week following intervention. For each participant, data collection was conducted by an interviewer who was not involved in intervention delivery. Additional data to assess intervention feasibility were obtained from the CATI system, which automatically recorded information about each interventional call attempt and all responses provided.

### *Demographics*

The baseline survey included demographic items assessing parents' gender, age, education, income and household composition, as well as children's gender and age. Demographic items were sourced from the New South Wales Population Health Survey<sup>(36)</sup>.

### *Intervention efficacy*

Subscales of the children's dietary questionnaire (CDQ) were used to assess children's diet at baseline and follow-up. This parent-reported questionnaire compares children's dietary patterns with Australian recommendations<sup>(37)</sup>, with higher scores indicating a greater variety and/or frequency of foods consumed (hereafter referred to as consumption). The Fruit and Vegetable subscale was used to assess change in children's fruit and vegetable consumption. The scale has established reliability (intra-class correlation coefficient = 0.75) and validity against 7 d food checklists (Spearman's correlation = 0.58) and is sensitive to change in fruit and vegetable consumption at a group level<sup>(37)</sup>. Scores on this subscale can range from 0 to 28, with a score of  $\geq 14$  indicating a pattern of consumption consistent with dietary guidelines<sup>(37)</sup>. A 1-point increase on this subscale equates to, for example, a child consuming on average an additional type of fruit or vegetable each day (variety) or consuming fruit or vegetables at an additional eating occasion each day (frequency). The Non-Core Foods subscale assesses consumption of food items such as potato crisps, soft drinks and confectionery, with scores ranging from 0 to 10 and a score of  $\leq 2$  consistent with dietary guidelines<sup>(37)</sup>. This subscale was included to assess broader changes in the children's diet associated with the intervention.

**Table 1** Overview of intervention content

| Domains                             | Content                                                                                                                                                                     | Behavioural change technique <sup>(32)</sup>                                                                                                                    | Application of behavioural change technique                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Week 1                              | <ul style="list-style-type: none"> <li>● Dietary recommendations and serving sizes</li> <li>● Children's food diary</li> </ul>                                              | <ul style="list-style-type: none"> <li>● Prompt self-monitoring of behaviour</li> </ul>                                                                         | <ul style="list-style-type: none"> <li>● Parents are encouraged to monitor their children's intakes of fruit and vegetables over 3 d</li> </ul>                                                                                                                                                                                                                                                                                                       |
| ● Availability and accessibility    | <ul style="list-style-type: none"> <li>● Ways to provide fruit and vegetables throughout the day</li> <li>● Setting goals</li> </ul>                                        | <ul style="list-style-type: none"> <li>● Prompt specific goal setting</li> </ul>                                                                                | <ul style="list-style-type: none"> <li>● Parents are encouraged to set a programme goal</li> </ul>                                                                                                                                                                                                                                                                                                                                                    |
| Week 2                              | <ul style="list-style-type: none"> <li>● Changing the family routine</li> <li>● Availability and accessibility of food in the home</li> <li>● Mealtime practices</li> </ul> | <ul style="list-style-type: none"> <li>● Prompt intention formation</li> <li>● Provide general encouragement</li> <li>● Teach to use prompts or cues</li> </ul> | <ul style="list-style-type: none"> <li>● Parents decide which activities they will attempt in the coming week</li> <li>● Interviewers provide positive feedback on any helpful practices occurring in the home</li> <li>● Parents learn the HELPS acronym (i.e. try to eat when Hungry, not attempting anything else at the same time (focus on Eating), at an appropriate Location to eat, from a Plate and while Sitting<sup>(28)</sup>)</li> </ul> |
| ● Availability and accessibility    |                                                                                                                                                                             |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| ● Supportive family eating routines | <ul style="list-style-type: none"> <li>● Meal planning</li> <li>● Review of goals</li> </ul>                                                                                | <ul style="list-style-type: none"> <li>● Prompt review of behavioural goals</li> </ul>                                                                          | <ul style="list-style-type: none"> <li>● Parents review the goals they set during the previous calls and evaluate their progress</li> </ul>                                                                                                                                                                                                                                                                                                           |
| Week 3                              | <ul style="list-style-type: none"> <li>● The Ps and Cs division of feeding responsibility</li> <li>● Mealtime strategies to encourage vegetable consumption</li> </ul>      | <ul style="list-style-type: none"> <li>● Teach to use prompts or cues</li> <li>● Prompt intention formation</li> </ul>                                          | <ul style="list-style-type: none"> <li>● Parents learn the Ps and Cs: parents are encouraged to Plan, Prepare and Provide. Children are encouraged to Choose (whether, what and how much to eat)<sup>(33)</sup></li> <li>● Parents decide which activities they will attempt in the coming week</li> </ul>                                                                                                                                            |
| ● Parental role modelling           |                                                                                                                                                                             | <ul style="list-style-type: none"> <li>● Provide general encouragement</li> </ul>                                                                               | <ul style="list-style-type: none"> <li>● Interviewers provide positive feedback about any helpful practices occurring in the home</li> </ul>                                                                                                                                                                                                                                                                                                          |
| ● Supportive family eating routines | <ul style="list-style-type: none"> <li>● Role modelling of fruit and vegetable consumption</li> </ul>                                                                       | <ul style="list-style-type: none"> <li>● Prompt identification as a role model</li> </ul>                                                                       | <ul style="list-style-type: none"> <li>● Parents are provided information about their importance in role modelling fruit and vegetable consumption. Their consumption is compared with national nutrition recommendations. Tailored feedback is provided</li> </ul>                                                                                                                                                                                   |
| Week 4                              | <ul style="list-style-type: none"> <li>● Review of weeks 1–3</li> </ul>                                                                                                     | <ul style="list-style-type: none"> <li>● Provide general encouragement</li> </ul>                                                                               | <ul style="list-style-type: none"> <li>● Interviewers provide positive feedback on any helpful practices occurring in the home</li> </ul>                                                                                                                                                                                                                                                                                                             |
| ● Availability and accessibility    |                                                                                                                                                                             |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| ● Parental role modelling           | <ul style="list-style-type: none"> <li>● Planning for the future and dealing with difficult situations</li> </ul>                                                           | <ul style="list-style-type: none"> <li>● Prompt barrier identification</li> </ul>                                                                               | <ul style="list-style-type: none"> <li>● Parents are encouraged to identify barriers that will prevent them from implementing what they have learnt and generate solutions</li> </ul>                                                                                                                                                                                                                                                                 |
| ● Supportive family eating routines | <ul style="list-style-type: none"> <li>● Review of goals</li> </ul>                                                                                                         | <ul style="list-style-type: none"> <li>● Prompt review of behavioural goals</li> </ul>                                                                          | <ul style="list-style-type: none"> <li>● Parents review their programme goal, evaluate their progress and identify how they can maintain the change</li> </ul>                                                                                                                                                                                                                                                                                        |

*Intervention feasibility and acceptability*

Measures of intervention feasibility included the proportion of participants completing all four calls, and the average call length, the average number of days elapsed between calls and the average number of call attempts. To assess acceptability, the number of participants who agreed to and then attempted interventional activities was calculated from parents' answers to standardised questions asked of parents as part of the scripted telephonic intervention. This information was entered by the interviewer according to predetermined response options and recorded by the CATI system. In addition, the follow-up survey included eight Likert scale items (on a 5-point scale from 'strongly disagree' to 'strongly agree') assessing the acceptability of the number, length, content, format and relevance of the interventional calls, as well as the relevance and ease of understanding of the interventional resources and whether programme participation was worthwhile. Responses of 'strongly agree' and 'agree' to Likert scale items of acceptability were combined and reported as a proportion of all responses.

*Statistical analysis*

Statistical analysis was undertaken using the SAS statistical software package version 9.2 (SAS Institute Inc., Cary, NC, USA). Descriptive statistics were reported as mean, SD and percentage. Median and range were reported for skewed variables. Intervention efficacy was assessed by comparing

baseline and follow-up mean Fruit and Vegetable and Non-Core Foods subscale scores using paired *t* tests ( $\alpha$  set at 0.05, two-tailed test) adjusted for clustering on the basis of pre-school through the use of the Proc Surveymeans command.

**Results**

Four of the eight pre-schools approached (50%) consented to participate in the study and approximately 305 recruitment packs were distributed to families. There were approximately 300 families with children enrolled in the four pre-schools on the days of recruitment. A total of seventy-two parents (24%) returned the consent form, thirty-seven (12%) consented to participate, thirty-five (12%) completed the baseline survey and thirty-four (11% of total families) completed the first interventional call and the follow-up survey. Among those who returned the consent form, those who consented to participate and the thirty-five who did not were similar with regard to children's age, children's fruit and vegetable consumption and the disadvantage level of their suburb of residence<sup>(38)</sup>. However, a higher proportion of parents who consented had boys (65%) compared with those who did not consent (48%). The demographic characteristics of those who started the intervention are presented in Table 2.

The parent sample consisted predominantly of mothers, but the majority of children who were the focus of the intervention were boys. Compared with a survey (with a response rate of 66%) of parents of 2–5-year-old children attending randomly selected childcare centres in the broader study region, the current sample had higher levels of maternal education (44% *v.* 36% with a university education) and household income (44% *v.* 20% with a household income exceeding AUD100 000)<sup>(39)</sup>.

*Intervention efficacy*

There was a significant increase in the mean score on the Fruit and Vegetable subscale and a non-significant decrease in the Non-Core Foods score, as shown in Table 3.

Before the intervention, 32% of the children of participants were not meeting fruit and vegetable dietary guidelines (CDQ scores <14); however, following the intervention this decreased to 18%.

*Intervention feasibility and acceptability*

All participants who started the intervention completed all four calls. The average call length was 30.8 (SD 7.5) min,

**Table 2** Demographic characteristics of the sample

|                            | % or mean | SD  |
|----------------------------|-----------|-----|
| Parent ( <i>n</i> 34)      |           |     |
| Gender (female)            | 97        |     |
| Age (years)*               | 36.3      | 5.2 |
| Household income (AUD)     |           |     |
| 20 000–39 999              | 6         |     |
| 40 000–59 999              | 18        |     |
| 60 000–79 999              | 18        |     |
| 80 000–99 999              | 12        |     |
| ≥100 000                   | 38        |     |
| Do not know                | 9         |     |
| Highest education attained |           |     |
| Year 10                    | 15        |     |
| Year 12                    | 18        |     |
| TAFE/trade qualification   | 24        |     |
| University/tertiary        | 44        |     |
| Children per household*    | 2.0       | 0.8 |
| Child ( <i>n</i> 34)       |           |     |
| Gender (female)            | 32        |     |
| Age (years)*               | 4.5       | 0.8 |

TAFE, technical and further education.

\*Data are presented as mean and SD.

**Table 3** Dietary outcomes pre- and post-intervention

|                                                 | Pre  |     | Post |     | <i>P</i> value |
|-------------------------------------------------|------|-----|------|-----|----------------|
|                                                 | Mean | SD  | Mean | SD  |                |
| CDQ Fruit and Vegetable subscale ( <i>n</i> 34) | 15.5 | 5.1 | 18.1 | 4.1 | 0.027          |
| CDQ Non-core Foods subscale ( <i>n</i> 34)      | 2.7  | 1.4 | 2.2  | 1.0 | 0.203          |

CDQ, children's dietary questionnaire.

**Table 4** Number of parents offered, who agreed to attempt and who actually attempted interventional tasks

| Interventional task                                                        | Call | Number of parents offered* | Percentage of total | Number of parents who agreed to attempt | Percentage of those offered | Number of parents who actually attempted | Percentage of those who agreed |
|----------------------------------------------------------------------------|------|----------------------------|---------------------|-----------------------------------------|-----------------------------|------------------------------------------|--------------------------------|
| Setting programme goal                                                     | 1    | 34                         | 100                 | 34                                      | 100                         | 23                                       | 70‡§                           |
| Completing fruit and vegetable diary in workbook (for 1–3d)                | 1    | 34                         | 100                 | 34                                      | 100                         | 32                                       | 94                             |
| Availability and accessibility                                             |      |                            |                     |                                         |                             |                                          |                                |
| Chopping up fruit and vegetables                                           | 2    | 21                         | 62                  | 17                                      | 81                          | 14                                       | 82                             |
| Moving 'non-core' foods so that the child cannot access them               | 2    | 12                         | 35                  | 9                                       | 75                          | 6                                        | 67                             |
| Making a rule that the child must ask permission to eat 'non-core' foods   | 2    | 4                          | 12                  | 1                                       | 25                          | 1                                        | 100                            |
| Role modelling                                                             |      |                            |                     |                                         |                             |                                          |                                |
| Role modelling healthy eating behaviour                                    | 3    | 29                         | 85                  | 27                                      | 93                          | 26                                       | 96‡                            |
| Supportive family eating routines                                          |      |                            |                     |                                         |                             |                                          |                                |
| Eating dinner as a family without the television (for an additional night) | 2    | 20                         | 59                  | 17                                      | 85                          | 16                                       | 94                             |
| Trying a mealtime strategy to encourage vegetable consumption†             | 3    | 34                         | 100                 | 26                                      | 76                          | 23                                       | 88                             |

\*Participants were offered a task only if they were not already regularly doing it, and if it was relevant to their situation.

†Strategies could include giving verbal praise instead of food rewards, trying a new meal, or serving a sample of vegetable if blending vegetables into a meal.

‡Missing data from one participant.

§Goal attempted and achieved by the week-4 support call.

**Table 5** Intervention acceptability

| Indicator of intervention acceptability              | Agree or strongly agree (n 34) |
|------------------------------------------------------|--------------------------------|
|                                                      | %                              |
| The number of support calls was appropriate          | 97                             |
| Support calls were of appropriate length             | 94                             |
| Calls did not contain too much information           | 91*                            |
| Was able to act on information in support calls      | 97                             |
| Acceptable to talk about these issues over the phone | 97                             |
| The guidebook was easy to understand                 | 100                            |
| Resources were relevant                              | 97                             |
| Participation in the programme was worthwhile        | 97                             |

\*Question inverted. Actual question was 'The calls contained too much information'; 91 % disagreed or strongly disagreed.

the median number of days between calls was seven (range: 2–19) and the median number of attempts to complete each call was two (range: 1–13 attempts). In all, 97% of participants completed the intervention within the 4-week proposed schedule.

Table 4 displays the proportion of participants who agreed to and attempted interventional activities. All participants set a programme goal regarding their children's fruit and vegetable intakes. The most common goals related to increasing the amount (23%) or variety (19%) of vegetables that their child consumed, providing healthier snacks (19%) and being a healthy role model for their child (14%).

Table 5 displays the proportion of participants who agreed or strongly agreed with intervention acceptability items.

## Discussion

The pilot findings show that the variety and/or frequency of children's fruit and vegetable consumption significantly increased following delivery of a parental intervention consisting of four telephone support calls and print resources. The increase in vegetable and fruit consumption also corresponded with a non-significant decrease in the variety and frequency of children's consumption of non-core foods. Furthermore, assessments of intervention feasibility and acceptability indicated that parents actively engaged in interventional tasks, participated in all telephonic contacts and perceived the programme as highly acceptable. Altogether, the findings suggest that the intervention may have considerable public health merit and is worthy of more rigorous evaluation to determine intervention effectiveness in the broader population.

The significant increase in the mean fruit and vegetable score is difficult to contextualise given the lack of research utilising telephone-based parental interventions to target dietary outcomes in young children. The study findings are

in contrast to a telephone-delivered interactive voice recording intervention, which consisted of up to ten contacts for parents of older, school-aged children and failed to show a consistent impact on fruit and vegetable consumption<sup>(40)</sup>. The findings are, however, supported by the results of a randomised controlled trial in which an eight-contact telephone-based parental intervention was efficacious in improving a variety of dietary indices in school-aged children, although fruit and vegetable consumption was not assessed<sup>(41)</sup>. Findings of this pilot study are also consistent with the positive impact of telephone-based nutritional interventions in adults<sup>(20,42–48)</sup>.

The intervention attrition rate was lower than rates previously reported in dietary interventions utilising the Internet<sup>(49,50)</sup> or conducted through face-to-face<sup>(51,52)</sup> support programmes for parents and is consistent with similar telephone-based interventions for adults<sup>(44)</sup>. Such findings indicate that parents are willing to receive and continue with an intervention by means of this delivery format. Encouragingly, process data indicate that, after receiving the four telephone calls, parents engaged in interventional tasks, suggesting that parents perceived the interventional content to be appropriate. Evidence of active parental participation combined with ratings of parental acceptability in excess of 90% suggests that this intervention was well received by parents of pre-school children.

Although the results of the present pilot study are promising, a number of limitations should be acknowledged. First, the absence of a comparison group and a short follow-up period indicate that changes in consumption may not be attributable to the intervention and that suggested efficacy is limited to immediate impact. However, given the significant increase in fruit and vegetable consumption in this small sample, investigation into the longer-term effects in a controlled study is warranted. Second, although the CDQ is a valid and reliable measure of children's dietary patterns and is recommended for interventional research<sup>(37)</sup>, more rigorous assessments of children's dietary intake such as 24 h dietary recalls would represent a more robust measure capable of quantifying actual fruit and vegetable intakes and should be considered for use in future research. Third, most parents in the sample had children whose dietary patterns were already consistent with recommended guidelines for fruit and vegetable intakes. However, a *post hoc* analysis of the eleven participants whose children were not meeting fruit and vegetable dietary guidelines at baseline revealed a significant increase of 5.0 points on the fruit and vegetable score ( $P=0.014$ ), suggesting that the intervention is potentially efficacious among at-risk children. Finally, the response rate of 11% is lower than previous estimates of parental interest in telephone-based support services to encourage children's healthy eating and physical activity (39%)<sup>(53)</sup>. Participants in this sample were more likely to be university educated, to have higher household income and to have children consuming greater quantities of fruit and vegetables compared with random samples of parents in the

study area<sup>(36,39)</sup>. However, subgroup analyses of parents with lower educational levels and lower household income revealed that the intervention significantly increased children's fruit and vegetable scores by 3.8 points ( $P=0.025$ ), suggesting that the intervention might be efficacious among these under-represented participants. Nevertheless, such limitations signify that the generalisability of the intervention findings is restricted to parents and children sharing characteristics of the study sample. Using more comprehensive recruitment strategies<sup>(54)</sup> may improve study participation rates and the external validity of findings from future trials.

Despite these limitations, the results from the present pilot study are encouraging. The public health application of a relatively brief, four-contact intervention, delivered by trained telephone interviewers rather than by health professionals, is likely to be particularly appealing to health services given the limited resources and access to specialist staff. Such interventions may provide feasible healthy eating support within the community. The findings of this trial warrant further investigation in an adequately powered randomised controlled trial with an extended follow-up period, as well as additional research into intervention efficacy in lower-income and less-educated samples.

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