Increasing children's liking for and consumption of vegetables: the effects of exposure, modelling and reward.

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Increasing children's liking for and consumption of vegetables: the effects of exposure and reward

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1. MEDIA SUMMARY

- Children tend not to eat enough vegetables.
- Encouraging children to like vegetables is likely to be the best way to increase consumption. Liking is a learning experience.
- Previous work has suggested that a simple taste exposure strategy can change children's liking of vegetables. Taste exposure means presenting children with a 10cent size piece of vegetable daily for two weeks.
- The current study compared an 'exposure' intervention (Exposure Only) to an 'exposure plus the immediate reward of a sticker' (Exposure + Reward), and a control group.
- The study took place in homes across metropolitan Adelaide, SA involving children aged 4 – 7 years old and their parents.
- Parents identified a vegetable that was neither liked nor greatly disliked as a target for change. A wide range of vegetables were identified.
- In total, 185 parents and their children started the study and 164 finished the study.
- Results are reported on children who tasted the target vegetable 9 times or more (70%).
- Both intervention groups increasing liking (more than control group) after 2 weeks of taste exposure (post-intervention). This was sustained at 3 months.
- At 3 month follow-up, 53% of children in Exposure Only and 58% of children in Exposure + Reward rated their target vegetable as 'yummy', compared with 38% of the children in the control group.
- Consumption increased for the Exposure + Reward group at two weeks, 4 weeks and 3 months. There were also some positive effects on the control group.
- At 3 months there were positive changes by both intervention groups for children's usual vegetable intakes.
- Liking for a target vegetable did not generalise to a liking for other vegetables. This suggests that a variety of vegetables needs to be presented throughout childhood.
- The Exposure + Reward group offered vegetables more often, experienced more tasting and less refusals to taste.
- A repeated exposure of small quantities of a vegetable was new to many parents and greatly appreciated. The interventions also helped parents deal with refusals however this aspect requires further work.
- A reward should be immediate, not food-related and help the child to measure and communicate their achievement of tasting. It should not be a bribe.
- In summary, taste exposure is a simple technique that parents can use at home to increase children's liking and consumption of a vegetable that they did not previously like.

2. EXECUTIVE SUMMARY

- Children's intakes of vegetables tend to be inadequate compared to all recommendations.
- Liking the taste of vegetables is likely to be one of the most important influences upon children's subsequent consumption.
- There is evidence that a simple taste exposure strategy, which involves small daily tastings over 2 weeks, can improve children's liking of vegetables.
- There is conflicting evidence as to whether rewards paired with exposure have negative, neutral or positive effects on liking in the short and medium term.
- It was unknown as to whether Australian parents could implement a taste exposure strategy successfully in the home.
- The current study was a randomised controlled trial designed to evaluate the effectiveness of 2 interventions (one using taste exposure (Exposure Only) and the other using taste exposure plus the immediate reward of a sticker (Exposure + Reward) relative to a control group on increasing children's liking and consumption of vegetables.
- Parents identified six vegetables that were disliked by their child. Based on a taste preference test, a moderately disliked vegetable was selected as a target vegetable for change. In total 22 different vegetables were selected as a target.
- In total, 185 parents and their children (aged 4 – 7 years) participated at baseline. Of these, 92% participated at post-intervention and from baseline to 3 month follow up 87% were retained (164).
- Results are reported on children who tasted the target vegetable 9 times or more (70%) during the 2 week taste exposure period.
- Both intervention groups succeeded in increasing liking above that of the control group. There was no further change over the 3 month follow-up period suggesting that the positive effects were sustained.
- At 3 month follow-up, 53% of children in Exposure Only and 58% of children in Exposure + Reward rated their target vegetable as 'yummy', compared with 38% of the children in the control group.
- The relative preference (ranking relative to another 5 vegetables) was higher in the Exposure + Reward group, compared to the control at post-intervention.
- After a 2 week period of taste exposure, vegetable consumption increased significantly for the Exposure Only and Control group. Changes were evident over the follow-up period for all groups, and there was a trend for the magnitude of change to be greater for the two intervention groups.
- There were positive follow-up changes by both intervention groups for usual vegetable intakes.
- However there was no effect on parents' consumption or liking nor was there a 'transfer effect' of liking for other vegetables.

- The Exposure + Reward group offered vegetables more often, experienced more tasting and less refusals to taste.
- Interviews with parents found positive reactions to the taste exposure strategy.

3. BACKGROUND

3.1 Vegetable consumption in children

The health benefits of vegetable consumption have been widely reported and include contributing to the prevention of nutrient deficiency disorders, cardiovascular disease, stroke, and many cancers (Van Duyn & Pivonka, 2000). Despite the documented benefits, vegetable consumption in Australia (as in most Western countries) falls well below recommended levels for adults and perhaps even more so for children.

In the 1995 National Nutrition Survey, more than 80% of children aged 2-18 years reported inadequate intakes of vegetables on the survey day (Australian Bureau of Statistics, 1998). Data from Australian Children's Vegetable Intake report (HAL report VG07160) analysing the 2007 National Children's Nutrition and Physical Activity Survey (Bowen, Klose, Syrette, & Noakes, 2009), suggests the situation does not appear to have improved. When including all vegetable sources, only one quarter of children aged 2 -8 years met vegetable recommendations of the Australian Guide to Healthy Eating (Diet Model A, higher carbohydrate diet with lower vegetable targets). Only 15% of children aged 9 years and over met this recommendation. As many as one in 4 children ate no major source of vegetable and one in 7 children ate no vegetable whatsoever on the day of the survey. With respect to the Go for 2&5 campaign recommendation of 5 serves of vegetables a day, less than 5% of children ages 13 years or younger and 8% of children aged 14-16 years met this target on the day of the survey (cited in Bowen *et al.*, 2009). On average, younger children consumed a little over 1 vegetable serve on the survey day and the older children approximately 2 serves on the day which represents a large gap compared to recommendations.

When considering explanations for the low levels of children's vegetable consumption, taste preferences are often highlighted as a significant barrier. Indeed, children's liking for vegetables has been shown to be the most significant predictor of their intake (Gibson, Wardle, & Watts, 1998; Resnicow, *et al*., 1997), more so than children's perceptions of the benefit of fruits and vegetables. Labelling foods as 'healthy' has been shown to decrease children's preferences (Wardle & Huon, 2000) because children tend to believe that healthiness and tastiness are mutually exclusive characteristics. Thus, changing children's preferences for vegetables is likely to be the best strategy for increasing vegetable consumption in children's diets.

It is important to encourage children's liking of vegetables early in life as research has shown that food preferences and habits that are formed in childhood tend to be maintained into adulthood. In addition, the Australian Dietary Guidelines (National Health and Medical Research Council, 2003) recommend that good eating practices should be established at an early age to avoid the development of chronic diseases in later life. For young children, parents are both the nutritional gate-keeper and the agent of change for dietary behaviours. The current study aimed to empower parents by providing them with skills in the repeated exposure method and to assess the effectiveness of this method on children's liking and subsequent consumption.

3.2 Using 'exposure' to increase liking and consumption of vegetables

There is an extensive scientific literature that describes how children's food preferences are formed. Food neophobia – defined as the hesitancy or fear to eat novel foods – is common in children and appears to reach a peak between the ages of 2 and 6 years (Pelchat & Pliner, 1995; Pliner, 1994; Pliner & Loewen, 1997). Rejection of many foods, particularly vegetables, is common during this time. Fortunately, there is good evidence that increasing children's 'Exposure' to vegetables has a positive influence on both their *liking* and subsequent *consumption* of vegetables (Birch, Birch, Marlin, & Kramer, 1982; Birch, McPhee, Shoba, Steinberg, & Krehbiel, 1987; Wardle, Cooke, *et al*., 2003; Wardle, Herrera, Cooke, & Gibson, 2003). 'Exposure' involves tasting a small portion of a food a number of times (10 times or more).

Some parents use exposure to encourage consumption but may not offer the food on enough occasions for the exposure to positively influence liking (Carruth, Ziegler, Gordon, & Barr, 2004).

3.3 Benefits of exposure as a strategy

The exposure is simple and low key and is therefore likely to be appealing to parents as a way to encourage consumption of vegetables (as opposed to thinking up ways to make vegetables 'fun and exciting', hiding vegetables in other dishes, or forcing the child to eat 'what's good for them').

Although published after the start of the current study, the exposure strategy is in alignment with some of the concluding remarks from HAL report VG07160 analysing the 2007 National Children's Nutrition and Physical Activity Survey (Bowen *et al.*, 2009) that suggested an 'eat everyday' message should be primary, followed by 'variety', with the current 'quantity' messages (e.g. "Go for 2 & 5") given less emphasis. Regular consumption of small amounts is likely to be a more achievable goal than increased intake. Furthermore, regular consumption of small amounts broadens children's palates, and may encourage good experiences with vegetables, hopefully leading to greater intake with age.

3.4 Using exposure and rewards

There is currently mixed evidence about effectiveness of using rewards to encourage consumption of disliked food. Food and play time rewards for eating target foods have been shown to actually be deleterious to the longer term outcomes (Birch, 1999). However, other forms of rewards, such as 'food dude' labelled products, have shown some success (Horne, *et al*., 2004) particularly when the 'reward' conveys messages about achievement and competence (Lowe, Horne, Tapper, Bowdery, & Egerton, 2004). Given that rewards are an effective reinforcer for behaviour and a highly intuitive response from parents, it may be unrealistic to remove the use of rewards altogether. The current study examines the effect of an Exposure/ Sticker Chart intervention (i.e., a non food based/play time reward) and an Exposure/ No Reward

intervention (i.e., the only form of 'reward' would be parental praise and encouragement). If effective (or at least not harmful) the use of a sticker chart reward would be an interesting and fun way to engage the child in the taste exposure process.

3.5 The importance of early childhood for encouraging food preferences

It is important to encourage children's liking of vegetables early in life as research has shown that food preferences and habits that are formed in childhood tend to be maintained into adulthood. In addition, the Australian Dietary Guidelines (National Health and Medical Research Council, 2003) recommend that good eating practices should be established at an early age to avoid the development of chronic diseases in later life. For young children, parents are both the nutritional gate-keeper and the agent of change for dietary behaviours. The current study aims to empower parents by providing them with skills in the repeated exposure method and to assess the effectiveness of this method on children's liking and subsequent consumption of vegetables.

4. STUDY AIM AND HYPOTHESES

Aim

To evaluate the effectiveness of two interventions based on exposure; one using Exposure/ and No Rewards (Exposure Only) and the other using Exposure/ and Sticker Chart Reward (Exposure + Reward) relative to a control group (Control) in increasing children's liking for a vegetable.

Primary hypotheses

1. Taste exposure to a target vegetable will increase liking of the target vegetable.
2. Taste exposure to a target vegetable will increase consumption of the target vegetable.

Supplementary analyses

3. To investigate if there is any evidence of improvement (or relapse) in liking or consumption of the target vegetable at 4 week follow-up and 3 month follow-up.
4. To investigate whether the intervention groups differ significantly from the control group on vegetable liking and vegetable consumption at the 3 month follow-up.
5. To investigate whether improvements in liking for the target vegetable are associated with improvement in liking for other vegetables (transfer effects).
6. To investigate whether two weeks of taste exposure is associated with an improvement in the child's usual vegetable intake, the parent's usual vegetable intake and the parent's liking of vegetables at follow-up.

5. METHOD

5.1 Participants

Participants were 185 children (110 boys and 75 girls) and their primary caregiver/parent (166 mothers, 13 fathers) in Adelaide, South Australia. The children ranged in age from 3.93 to 7.42 years (M= 5.16, SD=0.84). Demographic information was not available for 6 parents. The remaining 179 parents were aged between 28.06 and 55.80 years (M=39.15, SD=4.91). The educational attainment of the sample was high with 62.6% having completed university, 20.1% having obtained a trade certification or TAFE qualification, and 17.3% having attained a high school certificate or less. See Table 2 and Table 3 in the Results section for a summary of all participant characteristics.

The study was approved by the CSIRO Human Research Ethics Committee. Parents were given a $10 retail voucher to purchase vegetables for the study.

Participants were recruited via newspaper advertisements (local Messenger newspaper, Sunday Mail) and media stories (Messenger, Advertiser, 5AA radio).

5.2 Design

The study was a randomized controlled trial to evaluate the effectiveness of two interventions based on exposure, Exposure Only and Exposure + Reward, relative to a Control group, in increasing children's liking for a vegetable.

5.3 Procedure

5.3.1 Vegetable selection

Parents/caregivers were asked to identify six vegetables that their child did not currently like to eat. Parents were asked to avoid choosing a vegetable that their child has had a particularly strong negative response. Based on the results of the baseline assessment (discussed below) one of these vegetables was picked as the 'target' vegetable for the intervention. See Table 6 for the range of vegetables chosen as targets.

5.3.2 Baseline assessment

At the baseline assessment children's understanding of a visual rating scale was established so that they could reliably indicate dislike, like or neutral response to each vegetable. Children were then offered a small piece of each vegetable to taste. Once the child tasted the vegetable they placed an additional piece of the vegetable on a visual liking scale that corresponded to their response. Once all vegetables had been rated for liking the children ranked them in order of preference. Once all vegetables were ranked the fourth vegetable became the 'target'. Following this rating and ranking

process, the child was then presented with half a cup of the target vegetable and asked to eat as much as they would like.

All taste testing assessments took place in the home and were carried out by a trained fieldworker. The same procedure was followed at post-intervention, 4 week follow-up, and 3 month intervention.

5.4 Measures

5.4.1 Vegetable liking rating

Following the approach developed by Birch and Sullivan (1991) and used by Wardle *et al*. (2003, 2003a), a three point hedonic ratings scale of vegetables (hedonic scale) was used. Children were shown three faces - smiling, frowning and neutral. Importantly, these were described to the child as

1) **"yummy"**: "this is the face that you might make when you taste something really nice and delicious; it's a yummy face"

2) **"yucky"**: "this is the face that you might make when you taste something you really don't like; it's a yucky face"

3) **"just ok"**: "this is the face that you might make when you eat something that doesn't taste really yummy, but that doesn't taste really yucky; it just tastes ok".

Liking scores were coded such that 1 = yummy), 0 = just ok, -1 = yucky, and -2 = refused to taste.

5.4.2 Vegetable preference ranking

Relative preferences of the six vegetables was obtained using force choice elimination ranking in which vegetables were ranked from 1 (most preferred) to 6 (least preferred).

5.4.3 Vegetable consumption at taste testing

Vegetable consumption at the taste testing was measured in grams by weighing the amount of target vegetable in the bowl pre- and post-consumption. A Propert electronic kitchen scale was used with 1g graduation.

5.4.4 Other measures

Parents also completed a questionnaire at baseline that included the following measures:

Demographics

Demographic information was collected to describe the characteristics of the sample. For the child this included age, gender, number of siblings, and position in family

(oldest, middle or youngest child). For the study parent[1] this included age, gender, highest level of education completed, and breastfeeding duration. The second parent's age, gender and highest level of education completed was also obtained.

Food neophobia and parenting style

Food neophobia, was measured using the Food Neophobia Scale (FNS), a 10 item self-report scale that assesses the fear of trying new foods (Pliner, 1994; Pliner & Hobden, 1992). Both the adult and child version of the FNS were completed by the study parent. Scores could range from 0 to 70 with higher scores indicating greater neophobia.

Parenting style was measured using the Parenting Practices Questionnaire (Robinson, Mandleco, Olsen, & Hart, 1995), a 62 item self-report questionnaire that assesses parenting style with respect to three typologies: Authoritarian (15), Authoritative (26 items) and Permissive (14) parenting styles. For ethical reasons, the version of the questionnaire used in the current study removed 6 items pertaining to physical punishment, and 1 item was omitted due to a clerical error. Parents responded to statements using a 5 point scale anchored by never (1) to always (5). Item scores for each typology were summed and averaged so that total scores could range from 1 to 5 with higher scores indicating that the parent exhibited more of the parenting style.

Child usual vegetable intake

Child usual vegetable intake was measured with the Children's Dietary Questionnaire, a self-report measure that assesses the patterns of children's food intake (Magarey, Golley, Spurrier, Goodwin, & Ong, 2009). The questionnaire was adapted from the original, which groups fruit and vegetables together, to focus exclusively on patterns of vegetable intake. Parents indicated which vegetables (from a list of 23) the child had consumed in the past week. A vegetable variety score was calculated by summing the number of vegetables and dividing by seven. Parents also indicated how often the child consumed vegetables on the previous day, with responses (and scores) ranging from nil (0) to 4 times (4). The vegetable variety score and the previous day consumption score were summed to create a total score.

Parent vegetable intake and liking

Parent vegetable intake was measured with a vegetable food frequency questionnaire adapted from the vegetable component of the Anti-Cancer Council Food Frequency Questionnaire (Hodge, Giles, Patterson, Brown, & Ireland, 2003). Parents indicated how often they had consumed 23 vegetables over the previous 3 months, with the option of responding in 'times per day', 'time per week', 'times per month' or never. Responses were then converted into daily frequencies which were summed and averaged, with higher scores indicating higher frequency of consumption. Although quantity was not measured, and therefore absolute consumption could not be calculated, higher frequency of vegetable consumption has been associated with greater absolute consumption of vegetables (Hodge, *et al*., 2003; Hunter, *et al*., 1988;

[1] The study parent is the parent who completed the questionnaires.

Ireland, Jolley, & Giles, 1994). Therefore, the combined frequency score is only a marker of vegetable intake.

Parent vegetable liking was measured with a 23 item vegetable checklist. For each vegetable parents indicated whether the vegetable was 'liked (1)', neutral (0), or disliked (-1). Responses were summed to create a total score, which could range from 23 (all vegetables disliked) to 23 (all vegetables liked).

A summary of all the vegetable intake and liking measures collected in this study is provided in Table 1.

Table 1. Summary of vegetable liking and consumption measures

Measures	**Visit number (time)**			
	Baseline	*Post-intervention (2 wks)*	*Follow-up (4 wks)*	*Follow-up (3 mth)*
Taste testing (fieldworker)				
Vegetable liking rating	✓	✓	✓	✓
Vegetable preference ranking	✓	✓	✓	✓
Vegetable consumption	✓	✓	✓	✓
Parented reported				
Child's usual vegetable intake	✓		✓	✓
Parent's vegetable intake	✓			✓
Parent's vegetable liking	✓			✓

Note. Tick marks indicate at which time points the measure was obtained.

5.4.5 Qualitative assessment

Immediately following the 2 week intervention structured interviews were conducted with a random subsample of parents. Forty participants were interviewed; 14 from the exposure and sticker condition, 16 from the exposure and no-reward condition, and 10 from the control group.

The purpose of the interviews with the intervention participants was to determine their satisfaction with the information provided to support them to carry out the 2 week taste test intervention. For example

- Which strategies or information was most useful to encourage children to eat vegetables?
- Which strategies or information was most useful to manage children's refusal of vegetables.
- Were the logistical requirements of the interventions achievable? (i.e., 10 tastes, consistent presentation time, and consistent vegetable preparation method)
- How useful was the sticker chart?
- Did the parent notice a change in child's eating behaviour?
- Did the experience influence how many or what types of vegetables preparation or purchasing practices?
- Do parents intend to continue using the intervention strategies?

The purpose of the interviews conducted with participants from the control group was to find out whether they had made any changes to their feeding practices over the 2 week period or had noticed any changes in the child's vegetable consumption. Specifically participants were asked whether they thought their child's behaviour (changes in the child's eating) or their own behaviour (changes in their approach) towards vegetables had changed through involvement in the study.

The interviews were conducted by telephone and were approximately 10 minutes long. Each interview was recorded and transcribed. A coding framework was developed to analyse the transcripts. The coding framework was developed by one researcher by examining responses to a subset of interviews and assigning codes to common responses. For questions relating to the strategies that parents identified to be useful to encourage vegetable intake and to manage refusal, content analysis was used whereby two researchers independently identified the strategies, discussed them, and developed category codes. Each researcher then coded all transcripts and the level of agreement in coding was calculated. Discrepancies were resolved through discussion with a third researcher.

5.5 Intervention

The intervention and all data collection occurred within the home. The parent was required to present a 10c sized piece of the target vegetable to the child to taste once a day, every day for two weeks. The parent was asked to prepare the vegetable in any way they normally would but keep this consistent throughout the intervention. To qualify as an instance of exposure, the minimum requirement was that the vegetable must be tasted (i.e. the child must place the vegetable in their mouth, but they were allowed to spit it out if they really did not like it).

The aim was to present the target vegetable in an unmasked form, meaning it could not be offered as part of a mixed dish or with a sauce. All intervention groups were given detailed instructions on how to carry out the exposure.

5.5.1 Intervention conditions

Exposure Only

No rewards provided to the child, except for parental praise and encouragement. Guidelines were provided in the intervention booklet to assist parents with their use of praise. For example, limiting feedback to 'Well done! You're eating really well today' or 'It's great that you're being adventurous'.

Exposure + Rewards

The family was provided with a colourful chart listing each day of the 14 day test period. We provided a sheet of stickers with 'yummy', 'yucky' and 'just okay' faces.

Every day the child tasted the target vegetable they could choose a sticker and place it on the chart.

Control

The control group was asked to maintain their normal feeding behaviours for the course of the study. At the end of the study (three months) they were fully briefed about the intervention, how to perform it and given examples of the materials used.

5.5.2 Assessing compliance with the intervention

The primary purpose of the current study was to assess whether Exposure Only or Exposure + Reward would be effective in changing liking and consumption of vegetables, hence only participants who complied with the taste exposure protocol were included in the analyses. Compliance with the intervention was defined as at least 9 taste exposures over the 2 week intervention period. Parents recorded their progress in a diary that was handed in to the fieldworker at post-intervention.

5.6 Statistical analyses

5.6.1 Analyses to address primary hypotheses

To determine the effectiveness of the intervention on the primary outcome measures (vegetable liking rating, vegetable preference ranking, and vegetable consumption) from baseline to post-intervention, the following analyses were conducted.

For liking ratings, a repeated measures linear mixed effects model was run with 2 factors: treatment Group (Exposure Only, Exposure + Reward, Control) as the between subjects factor and Time (baseline, post-intervention, 4 week follow-up, 3 month follow-up) as the within subjects factor.

For vegetable preference ranking, baseline mean ranking scores were identical for each treatment group (i.e., target vegetable was 4th ranked vegetable), therefore an ANOVA was run on post-intervention scores.

For vegetable consumption, a negative binomial generalised linear model was run (in preference to the linear mixed effect model) to accommodate a positively skewed distribution containing a high percentage of ‘0’ scores.

If a significant interaction was found between Time and treatment Group, post hoc comparisons were conducted to determine for which treatment groups significant changes occurred.

Participants who achieved fewer than 9 taste exposures or who did not complete the post-intervention taste test were excluded from the analyses.

5.6.2 Supplementary analyses

To investigate if there is any further improvement (or relapse) in liking or consumption of the target vegetable at over the follow-up period, a repeated measures linear mixed effects model was run on post-intervention and follow-up scores. In this model, treatment Group (Exposure Only, Exposure + Reward, Control) was the between subjects factor and Time (post-intervention, 4 week follow-up, 3 month follow-up) was the within subjects factor. If a significant interaction was found, post hoc comparisons were conducted to determine for which treatment groups significant changes occurred.

To investigate whether the intervention groups differ significantly from the control group on vegetable liking and vegetable consumption at the 3 month follow-up, a one-way between groups ANOVA was conducted.

A repeated measures linear mixed effects model was run to examine changes in liking for non-target vegetables (liking transfer effects) and to examine improvement in the child's usual vegetable intake, the parent's usual vegetable intake and the parent's liking of vegetables.

5.6.3 Data screening and preliminary analyses

Multivariate outliers were examined by calculating the z-scores of the residuals from the analyses. The distribution of the residuals was found to be acceptable and the z-scores of the residuals were within or close to the acceptable range (cases with z-scores between -3.29 and 3.29).

A Chi-square and ANOVA were conducted to determine if the composition of groups differed with regard to the child's gender, age, food neophobia score and vegetable intake score. A Chi-square test for independence indicated no significant difference in the gender composition of the groups χ^2 (2, n = 138) = 4.88, p > .05. Importantly, no significant differences were found between the groups for child food neophobia score, F(2, 132) = 1.50, p > .05, or vegetable intake score, F(2, 132) = 3.68, p > .05.

ANOVA indicated a statistically significant difference in age for the three groups, F(2, 134) = 3.68, p < .05. Post-hoc comparisons using the Tukey HSD test indicated that children in the control group (M = 5.36, SD = 0.90) were older than the children in the Exposure Only group (M = 4.88, SD = 0.69). The age of the children in Exposure + Reward group (M = 5.10, SD = 0.86) did not differ from either the control group or the Exposure Only group. Age was therefore included as a covariate in all analyses.

6. RESULTS

6.1 Preliminary descriptive information

6.1.1 Sample characteristics

The participant sample characteristics are shown in Table 2 and Table 3. In regards to the children, there were slightly more males in the study, however, the family characteristics were varied. Food neophobia for the children only was high, indicating that the children were generally unwilling to try novel foods. The study parent was mostly female with a high level of education. Average breastfeeding duration exceeded current recommendations. Parents scored high on the Authoritative parenting, the style on which contemporary parenting advice is based.

Table 2. Sample characteristics of the children in the study (full sample).

Demographic and measure	*n*	**%**
Gender		
Male	110	60
Female	75	40
Position in family		
Oldest	77	42
Middle	23	12
Youngest	43	23
Number of siblings		
Only child	36	20
One sibling	89	48
Two or more siblings	55	30
	M	SD
Age (in years)	5.16	0.84
Food neophobia[a]	51.82	13.49

Note. Percentages do not equal 100 due to missing data in the questionnaires.

[a] Neophobia scores can range from 0 to 70 with higher scores indicating greater food neophobia.

Table 3. Sample characteristics for the parents in the study (full sample).

Demographic measure	***Study parent***		**2nd Parent**	
	n	%	n	%
Gender				
Male	13	7	152	82
Female	167	90	14	8
Highest level of education completed				
High school or less	31	17	32	17
Tech, trade or TAFE	36	20	51	28
University	113	61	83	45
	Mean	SD	Mean	SD
Age (years)	39.15	4.91	43.07	5.66
Breastfeeding duration (months)	9.70	8.25	-	-
Food neophobia[a]	23.44	10.11	-	-
Parenting style[b]				
Authoritative	4.03	0.36	-	-
Authoritarian	2.08	0.37	-	-
Permissive	3.21	2.05	-	-

Note. Percentages do not equal 100 due to missing data in the questionnaires.

[a] Neophobia scores can range from 0 to 70 with higher scores indicating greater neophobia.

[b] Authoritative (high demandingness, high responsiveness), Authoritarian (high demandingness, low responsiveness), Permissive (low demandingness, high responsiveness), Scores can range from 1 to 5 with higher scores indicating that the parent exhibited more of the parenting style.

6.1.2 Participant retention

The number of participants who completed baseline and post-intervention assessment, and 4 week and 3 month follow-up assessments are shown in Table 4. The retention rate from baseline to post-intervention was 92%, and from baseline to 3 month follow

up was 87%. Nine participants withdrew from the study after the baseline assessment; 2 from the Control group, 4 from the Exposure Only group, and 3 from the Exposure + Sticker group, and are not included in the analyses. Five participants failed to complete the post-intervention assessment but completed at least one follow-up assessment.

Table 4. Number of participants at each assessment time point.

Assessment	***Control***	***Exposure Only***	***Exposure + Reward***	***Total***
Baseline	64	62	59	185
Post-intervention	61	55	55	171
4 week follow-up	55	55	50	160
3 month follow-up	57	55	52	164

6.1.3 Intervention compliance

The majority of parents (86%) offered the target vegetable on a least 10 occasions over the 2 week intervention period. Just over half of the children (56%) achieved the desired 10 taste exposures and 70% of children achieved at least 9 taste exposures. The reason for failing to achieve the daily taste exposures was due mainly to the child refusing to taste the vegetable rather than the parent failing to offer the vegetable.

Table 5 shows the mean number of days that parents were able to offer the target vegetable, mean number of days that taste exposure was achieved and mean number of days the child refused to taste the vegetable. Independent-samples t-tests revealed that the Exposure + Reward group was able to offer the vegetable more often, $t(113) = -2.22$, $p<.05$, achieve more days of taste exposure, $t(113) = -3.78$, $p<.05$, and fewer refusals from the child, $t(113) = 3.18$, $p<.05$, compared with the Exposure Only group.

Table 5. Mean and standard deviation for days of compliance with intervention.

	Exposure Only (n = 58)		*Exposure + Reward (n=57)*	
Compliance	*M*	*SD*	*M*	*SD*
Days vegetable offered	10.79	2.53	11.77	2.20
Days of taste exposure	8.31	3.60	10.77	3.38
Days vegetable refused	2.48	2.89	1.00	2.03

6.1.4 Intervention target vegetables

Twenty-two different vegetables were selected as the target vegetable as shown in Table 6. Parents also indicated how they prepared this vegetable for the taste test. Some vegetables were typically served raw with few exceptions (cucumber, capsicum, celery, lettuce, tomato, snow peas). Steaming was common method for the remaining vegetables, followed by boiling, and grilling/frying/roasting. Very few canned vegetables were used.

Table 6. Vegetables selected as target vegetable and preparation method for each vegetable.

Target vegetable	*N*	*%*	*Raw (n)*	*Canned (n)*	*Steamed (n)*	*Boiled (n)*	*Fried, roasted or grilled (n)*
Carrot	20	10.8	3		14	1	2
Cauliflower	17	9.2			15	2	
Cucumber	17	9.2	16				1
Broccoli	16	8.6			12	4	
Peas	12	6.5	2		7	3	
Capsicum	11	5.9	11				1
Celery	10	5.4	10				
Lettuce	10	5.4	10				
Potato	9	4.9			1	7	1
Tomato	9	4.9	9				
Beans	8	4.3			7	1	
Corn	7	3.8		2	3	2	
Pumpkin	6	3.2			6		
Sweet potato	6	3.2			3	2	1
Mushroom	5	2.7	2				3
Spinach (includes baby spinach)	5	2.2	2		2		1
Zucchini	4	2.2			3		1
Snow peas	4	2.2	4				
Legumes	3	1.6		3			
Cabbage	3	1.6			1	1	
Beetroot	2	1.1	1	1			
Brussels sprouts	1	.5			1		

6.1.5 Baseline liking for target vegetable

The number of children who rated their target vegetable as yummy, just okay, yucky, and refused to taste it at baseline are shown in Table 7 and Table 8. Table 7 includes all participants who completed the baseline assessment. Table 8 includes only the participants who adhered to the protocol (9 or more taste exposure) and were therefore included in the analyses to test the effectiveness of the intervention. Despite parents choosing vegetables that their child disliked, approximately 20 percent of children began the study with a target vegetable that was rated 'yummy'. The 'yummy' ratings are likely to be explained by demand effects, such as trying to please the fieldworker, rather than a genuine liking of the vegetable. Given that these cases are evenly distributed across the groups, they are retained in all analyses.

Table 7. Baseline liking ratings for the complete sample (all participants who completed the baseline taste test assessment).

Liking rating	*Control (n = 64)*		*Exposure Only (n = 62)*		*Exposure + Reward (n = 59)*	
	n	%	n	%	n	%
Yummy	16	25	9	15	13	22
Neutral	20	31	28	45	21	36
Yucky	23	36	17	27	22	37
Refused to taste	5	8	8	13	3	5

Table 8. Baseline target vegetable liking ratings for the analysis sample (participants who completed 9 or more taste exposures and therefore included in analyses).

Liking rating	*Control (n = 61)*		*Exposure Only (n = 34)*		*Exposure + Reward (n = 43)*	
	n	%	n	%	n	%
Yummy	15	25	6	18	7	16
Neutral	20	33	17	50	18	42
Yucky	22	36	10	29	17	40
Refused to taste	4	7	1	3	1	2

6.2 Liking and consumption

6.2.1 Effectiveness of the intervention on children's liking ratings

Does liking increase from baseline to post intervention (hypothesis 1)?

There was a significant group by time interaction F (1, 134) = 4.15, p < .05, which indicated that liking increased significantly for both the Exposure Only group (Δ = .49, SE = .15, p < .01) and the Exposure + Reward group (Δ = .61, SE = .13, p < .001) but not for the Control group. The increase in mean target vegetable liking rating is shown graphically in Figure 1. Liking ratings above the '0' point represent 'yummy' and bars below represent 'yucky'.

Post-hoc analyses revealed that liking ratings for Exposure Only and Exposure + Reward were both significantly higher than the Control group but not significantly different from each other at post-intervention (p > .05).

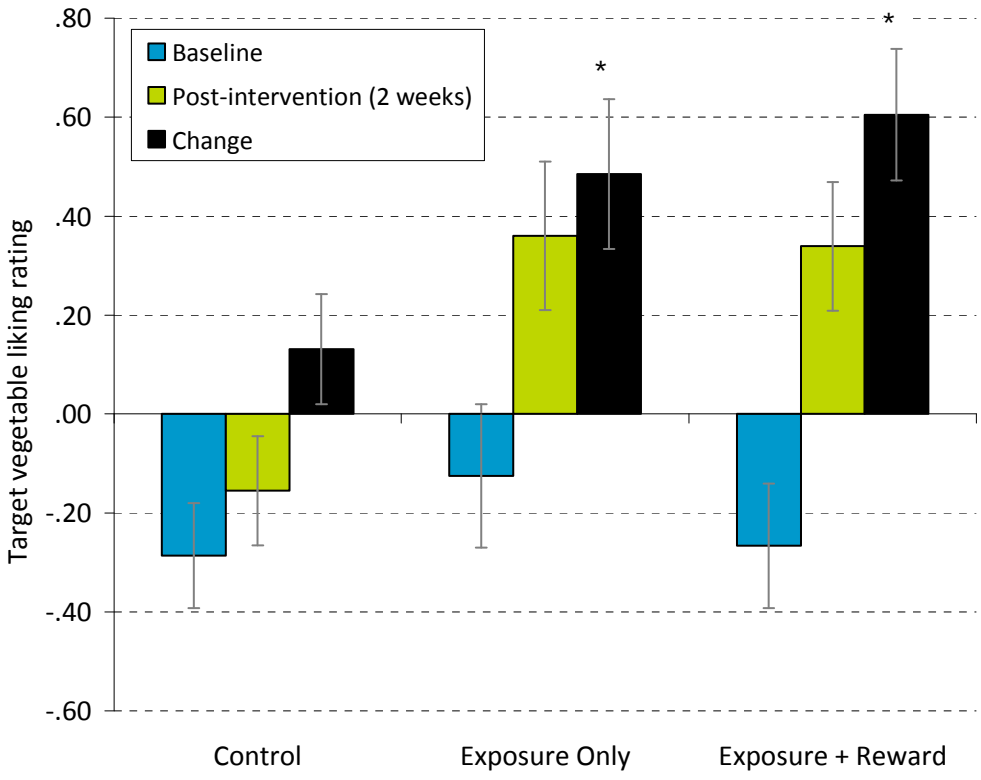

Figure 1. Mean (SE) target vegetable liking ratings for the target vegetable at baseline and post-intervention. Significant changes in liking from baseline are indicated by asterisks. Scores can range from -2.00 (not tasted) to +1.00 ('yummy').

Does liking change over the follow-up period?

There was no significant group by time interaction, $F(4, 126) = .73$, p>.05, and no overall change in liking from post-intervention to 4 week follow-up and 3 month follow-up, $F(2, 125) = .37$, $p > .05$. This indicates that liking did not change significantly for any of the groups from post-intervention. The mean liking ratings from post-intervention to follow-up is shown in Figure 2.

Do the intervention groups differ significantly from the control group on vegetable liking at 3 month follow-up?

There was no statistically significant difference in mean target vegetable liking scores at 3 months follow-up, $F(2, 127) = 1.70$, $p > .05$.

An additional analysis was run comparing 3 month follow-up liking ratings with baseline liking ratings. The findings indicated that liking at 3 months was significantly higher than baseline for all groups, including the control group ($p < .05$).

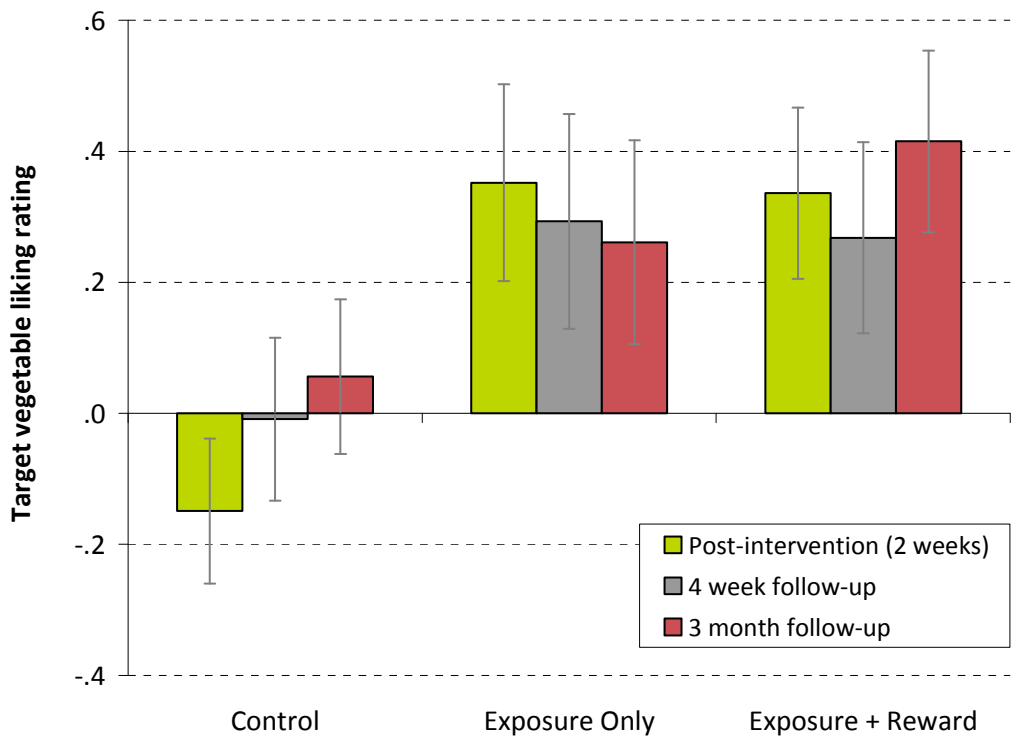

Figure 2. Mean (SE) vegetable liking ratings at post-intervention, 4 week follow-up and 3 month follow-up. Liking responses can range from -2.00 to +1.00.

Summary

After a 2 week period of taste exposure, **liking** for the target vegetable **increased** significantly **for the Exposure Only group and the Exposure + Reward group** but not for the control group. These changes were sustained over the follow-up period.

At 3 month follow-up, 53% of children in Exposure Only and 58% of children in Exposure + Reward rated their target vegetable as 'yummy', compared with 38% of the children in the control group .

6.2.2 Effectiveness of the intervention on children's preference ranking

Are vegetable preference rankings different between groups at post-intervention?

As the 4th ranked vegetable (of six vegetables) was selected as the target vegetable for all participants, baseline ranking was identical across groups. A one-way ANOVA exploring the impact of treatment group on vegetable preference ranking scores at post-intervention indicated there was a significant difference in scores between the groups, F (2, 127) = 3.45, $p < .05$. Post-hoc comparisons using Tukey HSD test indicated that the mean ranking score for the Exposure + Rewards group (M = 2.81, SD = 1.44) was significantly lower than the Control group (M = 3.64, SD = 1.65). The Exposure Only group (M = 3.22, SD = 2.81) did not differ significantly from either the Exposure + Reward group or the Control group. The post-intervention vegetable preference rankings at post-intervention are shown in Figure 3 whereby a lower ranking equates to a higher preference.

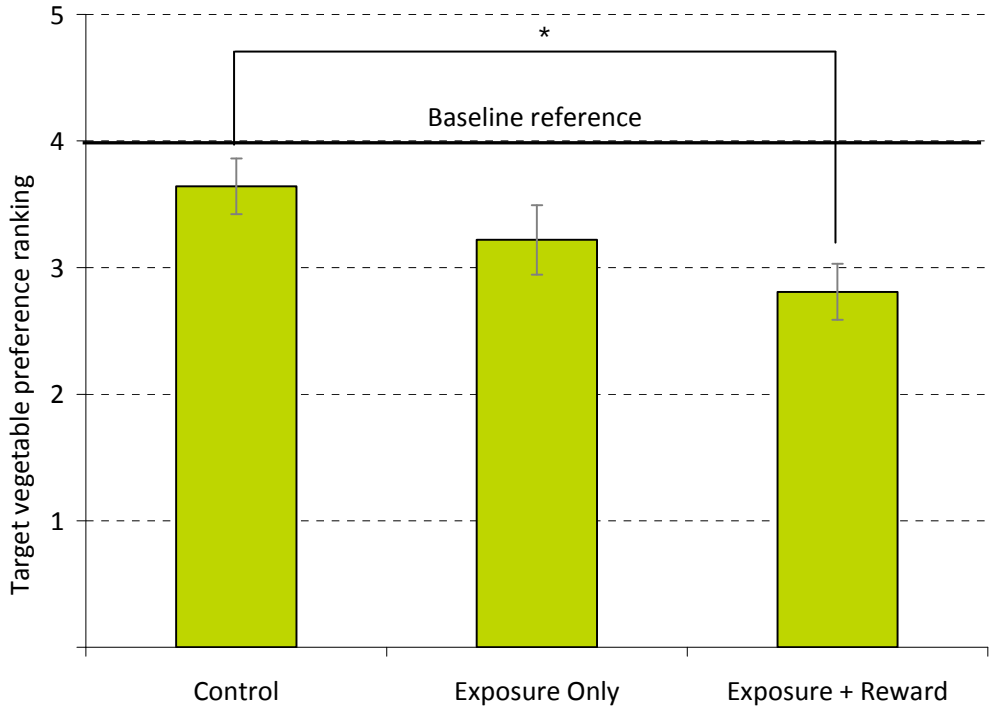

Figure 3. Mean (SE) target vegetable preference rankings at baseline and post-intervention.

Do vegetable preference rankings change over the follow-up period?

There was no significant group by time interaction, $F(4, 117) = 0.51$, $p > .05$, and no significant overall change in liking from post-intervention to 4 week follow-up and 3 month follow-up, $F(2, 116) = 1.29$, $p > .05$., indicating that ranking did not change significantly for any of the groups over the follow-up period. The estimated means for vegetable preference rankings are shown in Figure 4.

Do the intervention groups differ significantly from the control group on vegetable preference rankings at 3 month follow-up?

There was no statistically significant difference in mean vegetable preference rankings at 3 months follow-up, $F(2, 117) = 1.47$, $p > .05$.

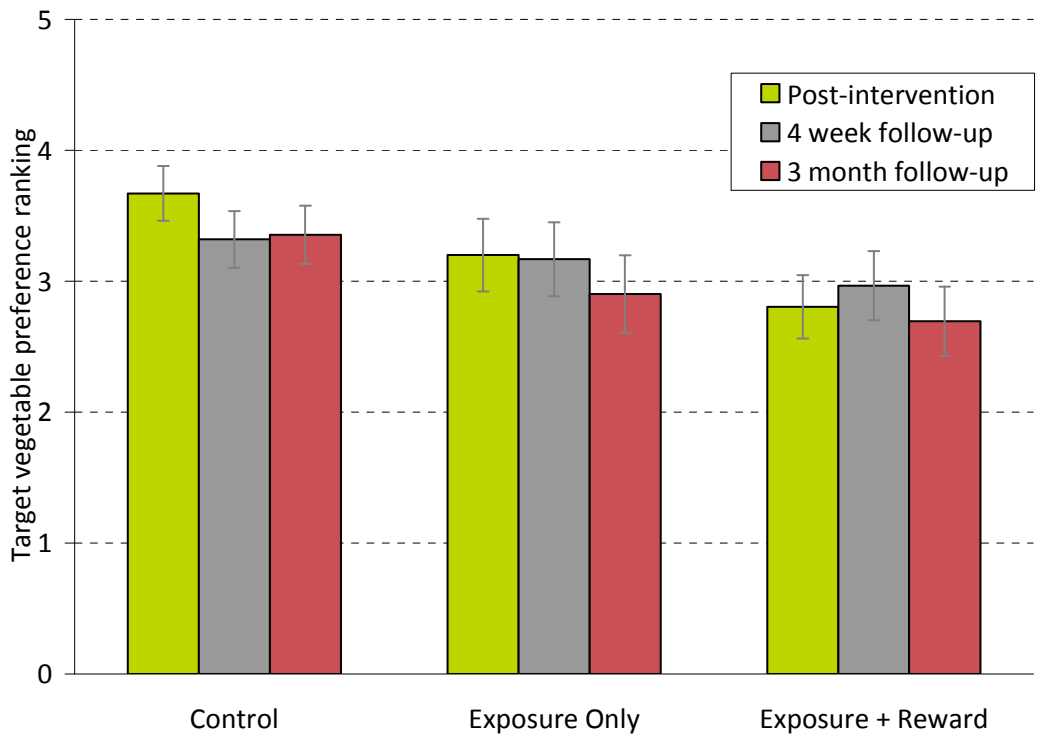

Figure 4. Mean (SE) vegetable preference rankings at baseline, post-intervention, 4 week and 3 month follow-up.

Summary

After a 2 week period of taste exposure, vegetable preference was higher (lower ranking) in the Exposure + Reward group compared with control. This change was stable over the follow-up period.

6.2.3 Effectiveness of the intervention on children's vegetable consumption measured at taste testing

Does vegetable consumption increase at post-intervention (hypothesis 2)?

There was a significant group by time interaction χ^2 (2) = 6.08, p < .05, which indicated that consumption increased significantly for both the Control group (Δ = 2.80, SE = 1.05, p < .01) and the Exposure + Reward group (Δ = 7.07, SE = 2.78, p < .01) but not for the Exposure Only group. It should be noted that the low baseline consumption and less variability amongst the exposure + reward group may account for the significant change. The increase in liking is shown graphically in Figure 5.

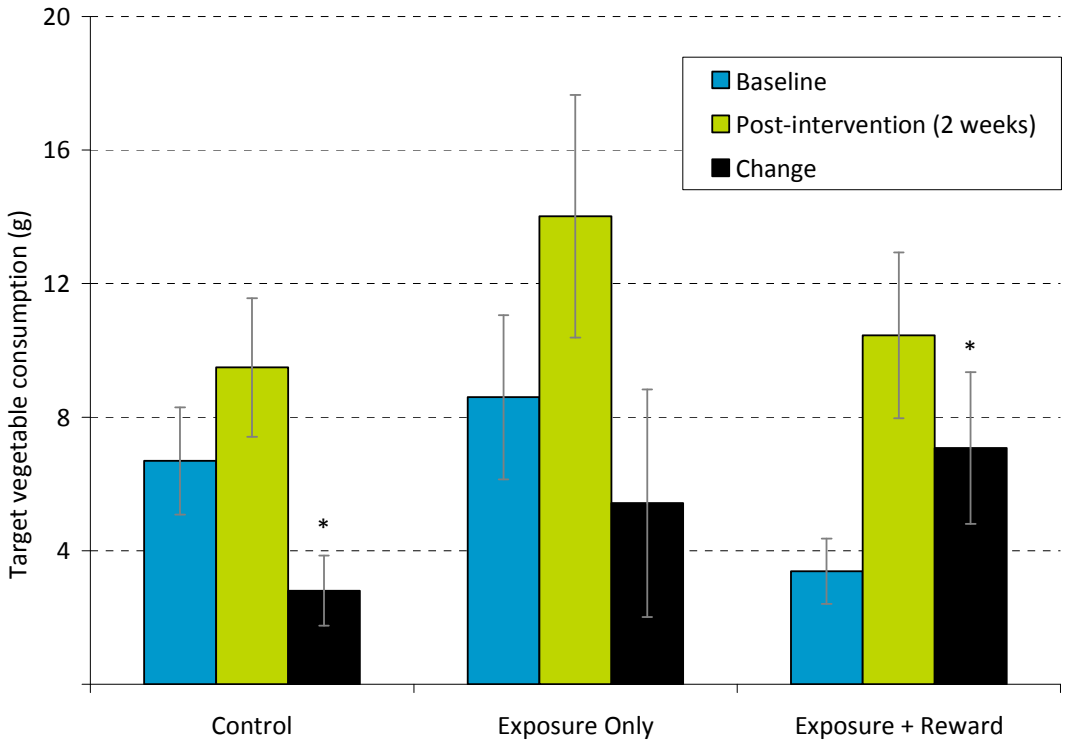

Figure 5. Mean (SE) target vegetable consumption (g) at baseline, post-intervention, and magnitude of change in consumption from baseline to post-intervention.

Does vegetable consumption measured at taste testing change over the follow-up period?

There was a significant group by time interaction χ^2 (4) = 16.72, p < .05. For the Exposure + Rewards group, consumption increased significantly from post-intervention to 3 months (Δ = 5.57, SE = 2.13, p < .05) and increased significantly from 4 weeks to 3 months (Δ = 6.78, SE = 1.46, p < .001). For the Control group consumption increased significantly between post-intervention and 3 month follow-up (Δ = 3.27, SE = 1.21, p < .05). Changes in mean consumption over the follow-up period are shown in Figure 6.

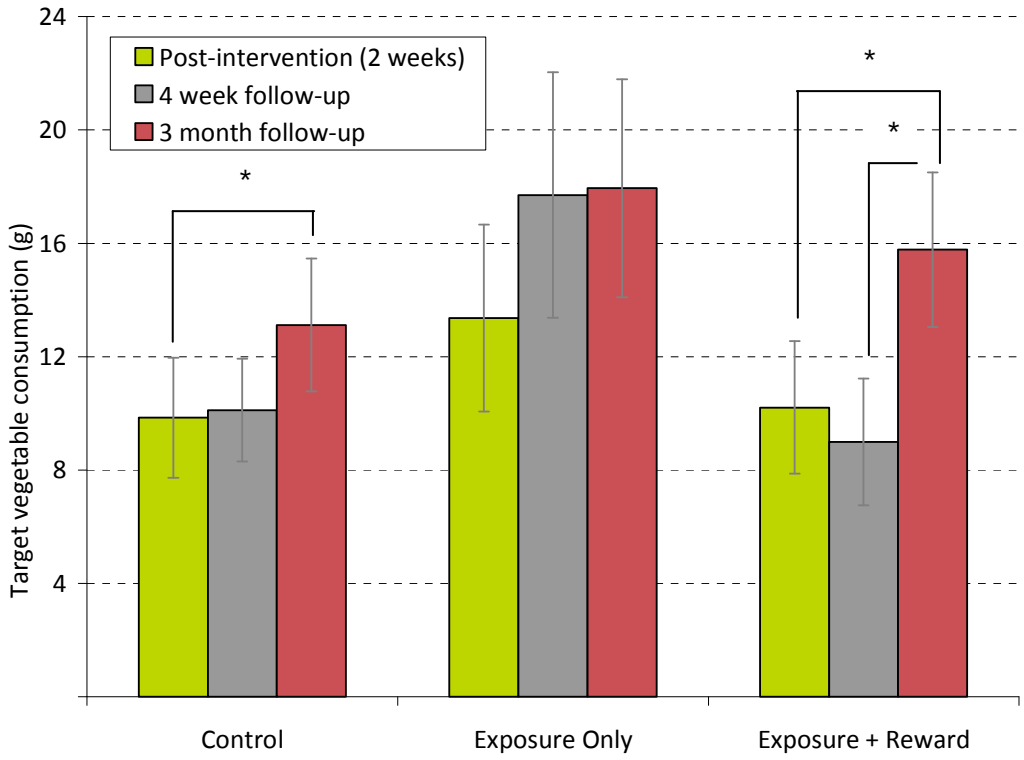

Figure 6. Mean (SE) target vegetable consumption (g) at post-intervention, 4 week follow-up and 3 month follow-up.

Do the intervention groups consume more of the target vegetable at 3 month follow-up compared with the control group?

Post-hoc tests indicated that there was no statistically significant difference in mean vegetable consumption between either of the intervention groups and the control group at 3 months follow-up ($p > .05$).

An additional analysis was run comparing consumption at 3 month follow-up with consumption at baseline. The findings indicated that liking at 3 months was significantly higher than baseline for all groups, including the control group ($p < .05$).

Summary

After a 2 week period of taste exposure, vegetable consumption increased significantly for the Exposure and Control group. Changes were evident over the follow-up period for all groups, including the control group.

6.2.4 Effects on liking for non-target vegetables measured at taste testing

Can taste exposure for a target vegetable result in improvement in liking for other vegetables?

The group by time interaction was not significant, F (2, 134) = 0.65, p > .05, and liking for the non target vegetables did not change significantly over time, F(1, 134) = 0.19, p > .05. Furthermore, no group by time interaction, F(4, 127) = 0.55, p > .05, or change in liking over time was evident over the follow-up period, F(2, 126) = 1.33, p > .05.

6.2.5 Effects on child and parent eating behaviours

Is taste exposure associated with an improvement in the child's usual vegetable intake?

There was a significant group by time interaction F (4, 123) = 2.75, p < .05. For the Exposure Only group, there was a significant increase in child's usual vegetable intake score from baseline to 3 month follow-up (Δ = .56, SE = .19, p < .05). For the Exposure + Reward group, there was a significant increase in child's vegetable intake score from baseline to 4 week follow-up (Δ = .50, SE = .15, p < .01) and from baseline to 3 month follow-up (Δ = .45, SE = .17, p < .01). No changes were found for the control group. The improvement in mean usual vegetable intake scores is shown in Figure 7.

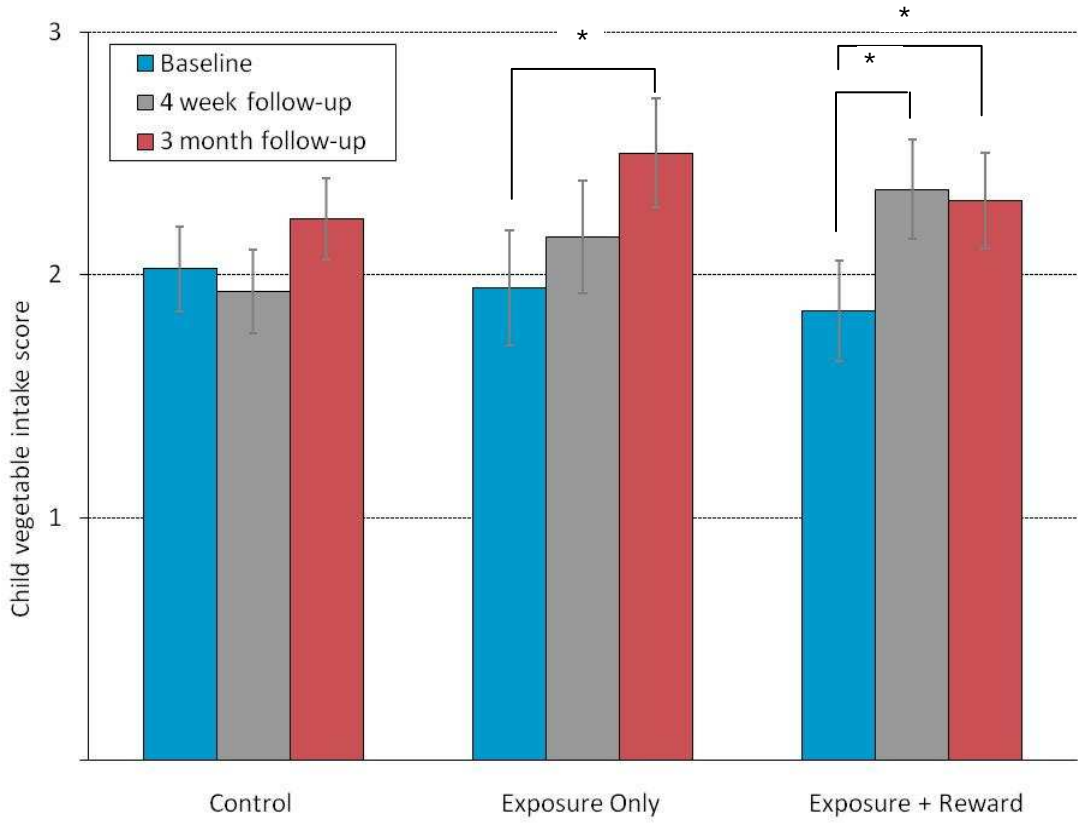

Figure 7. Mean (SE) child's usual vegetable intake score at baseline, 4 week follow-up and 3 month follow-up.

Is taste exposure associated with an improvement in the parent's usual vegetable intake?

The group by time interaction was not significant, F (2, 124) = 0.66, p > .05, and frequency of vegetable consumption did not change significantly over time, F(1, 123) = 0.91, p > .05. Mean scores at baseline and 3 month follow-up are shown in Figure 8.

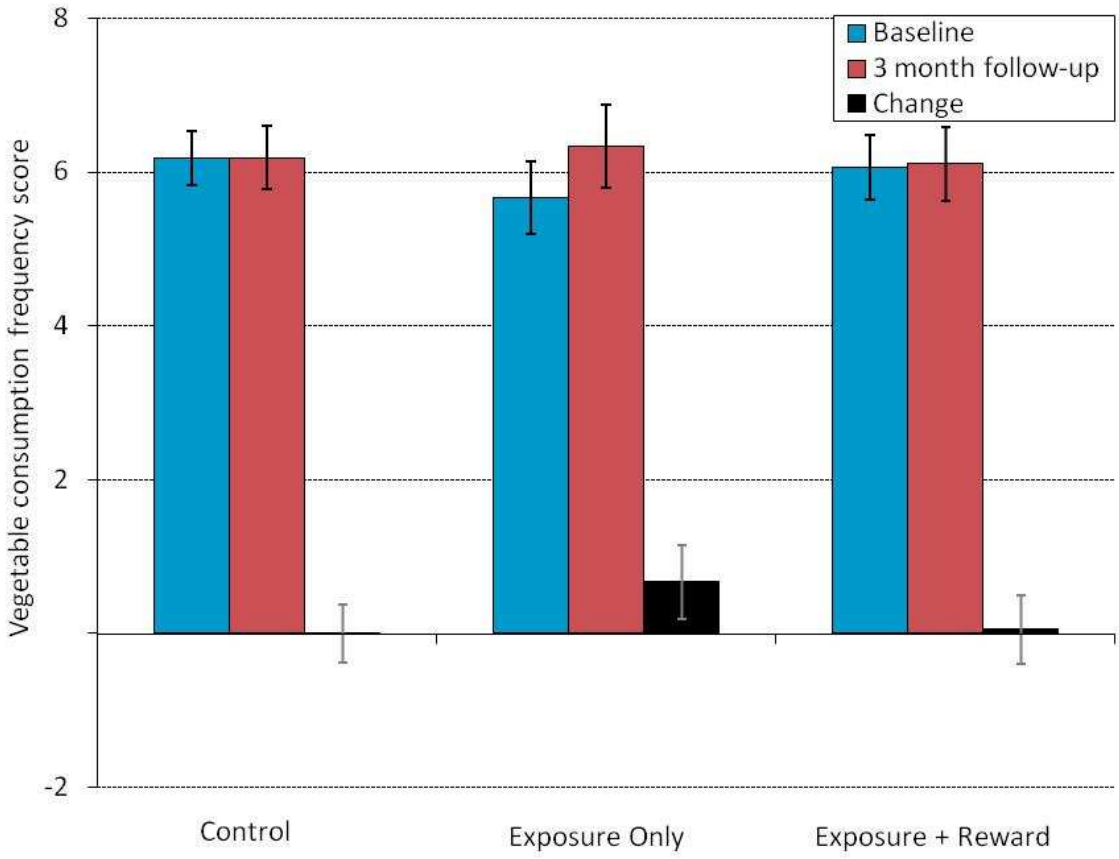

Figure 8. Mean (SE) parent vegetable consumption frequency score at baseline and 3 month intervention, with the magnitude of change from baseline to 3 month follow-up also shown.

Is taste exposure associated with an improvement in the parent's vegetable liking?

The group by time interaction was not significant, F (2, 124) = 1.23, p > .05, and liking scores did not change significantly over time, F (1, 124) = 3.16, p > .05. Mean (SE) parent vegetable liking score at baseline and 3 month follow-up is shown in Figure 9.

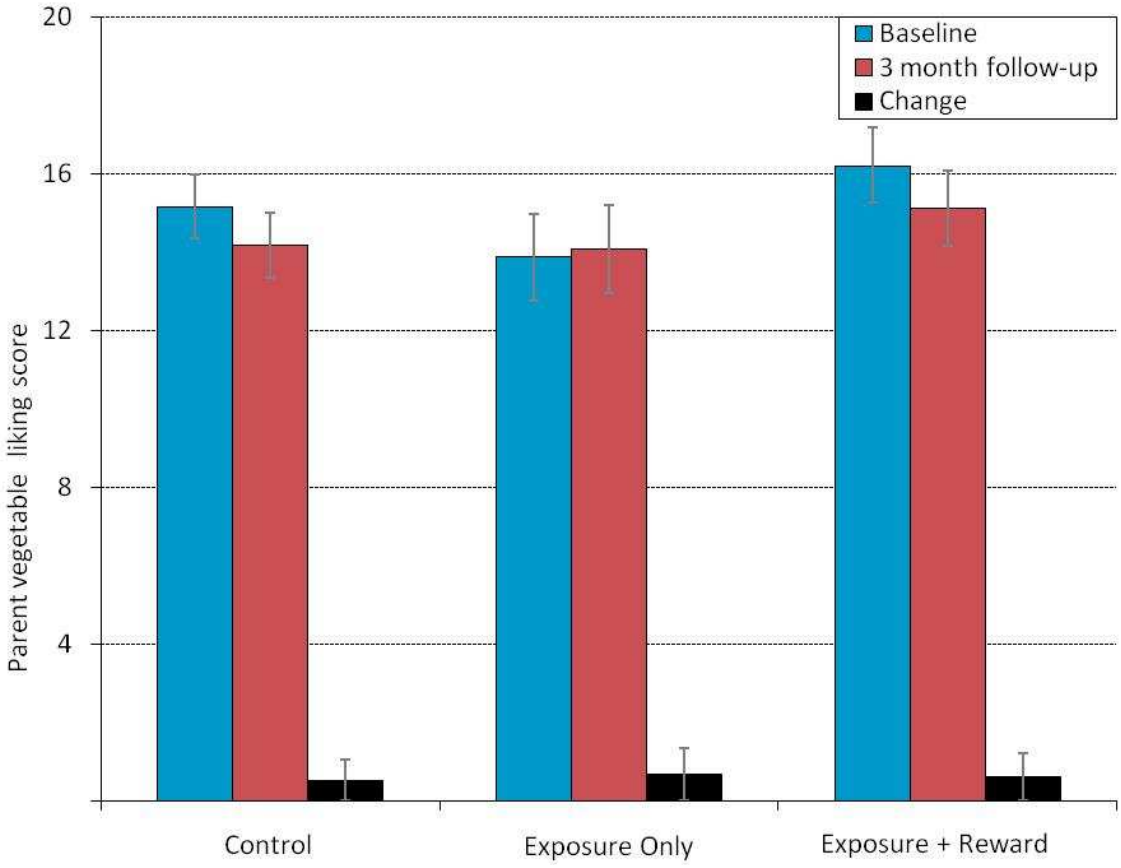

Figure 9. Mean (SE) parent vegetable liking score at baseline and 3 month follow-up, with the magnitude of change also shown.

Summary

There were positive follow-up changes by both intervention groups for the child's usual vegetable intake. There was no effect on parents' consumption or liking.

6.2.6 Summary of liking and consumption changes

After a 2 week period of taste exposure, **liking** for the target vegetable **increased** significantly **for both the Exposure Only group and the Exposure + Reward group** but not for the Control group. These changes were sustained over the follow-up period.

At 3 month follow-up, **53% of children in Exposure Only and 58% of children in Exposure + Reward rated their target vegetable as 'yummy'**, compared with 38% of the children in the control group.

After a 2 week period of taste exposure, vegetable preference was higher (lower ranking) in the Exposure + Reward group compared with the Control group.

After a 2 week period of taste exposure, **vegetable consumption increased significantly for both the Exposure + Reward and Control group** but consumption in the Exposure Only group did not increase. Changes were evident over the follow-up

period for the Exposure + Reward group and the Control group but not for the Exposure Only group.

There was no evidence that the addition of reward has a negative effect upon the exposure mechanism and a suggestion that reward may have a beneficial effect on some outcome measures.

The study also provided evidence that the exposure technique was associated with an improvement in children's usual intake of vegetables. How much this finding is driven by the increase in consumption of the target vegetable versus other vegetables cannot be determined but the findings are encouraging nonetheless.

There was no evidence that parents' usual intake of vegetables increased but this is not surprising given that parents self-reported vegetable intake was high to begin with.

6.3 Parent feedback on the intervention process

Forty participants were interviewed; fourteen from the Exposure + Reward group, sixteen from the Exposure Only group, and ten from the Control group. All parents who were contacted for an interview agreed to participate.

6.3.1 Reported compliance with intervention instructions

The intervention required parents to offer their target vegetable daily for two weeks, prepared in the same way and offered at around the same time each day. Only two participants indicated that they offered their target vegetable on fewer than 10 occasions over the 2 week intervention period. One participant indicated that their target vegetable (baby spinach) was an inconvenient target vegetable as it was not possible to purchase a small amount and was therefore expensive to have on hand for 2 weeks. One participant changed the way they prepared the target vegetable by serving the vegetable warm. Six participants varied the time of day at which they offered the vegetable. The most common reason was ease of fit with family routines.

6.3.2 Strategies to encourage consumption of the vegetable

Parents were asked to indicate which aspects of the instruction booklet they found to be the most useful in encouraging their child to eat the vegetable. Nine strategies were identified and they are shown in Table 9. The 3 most commonly mentioned were Size of Vegetable, Low Key Approach, and Instructions. Parents indicated that presenting a small amount or piece of the vegetable was helpful in encouraging the child to taste the vegetable. Keeping the process low key was helpful to both the parent and the child. The instructions (which included the flow chart along with general tips) made it easier for the parent to know how to encourage the child to taste the vegetable and manage different situations. The Repeated Exposure message (the intervention focus) was

also identified as a helpful concept in reminding the parent about the importance of persistence and the value of even ‘small tastings’ in encouraging liking of vegetables.

Table 9. Strategies in the information booklet that parents identified as useful (n = 30).

Strategy	*n (%) of participants*	*Example Comments*
Small pieces/portions	*18 (60)*	*"Having the small pieces was certainly helpful for him"* *"Oh yes, definitely, the whole idea of offering a smaller amount did - he was more likely to do that than he would have if I put a whole plate in front of him and that's something I haven't tried."*
Low Key	*17 (57)*	*"Not forcing her to actually try it or to put pressure on her to try it, to let her know that it's okay and she can have them, or she can spit out and that's still a good attempt." (180)* *"Ways of encouraging without putting too much pressure on the child" (194)* *"I'm not going to bribe him any more" (194)* *"So yeah it's just the way, we sort of kept it low key if you like. It wasn't a big issue and it wasn't a big story."*
Instructions	*14 (47)*	*"It was helpful to have the guide to say what to do next" (182)* *"I thought the diagram was there about the - if this happens, do this; if that happens, try that - was very clear and helpful." (125)* *"What I found useful about that information was the don'ts, what don't to do, like don't get cross with them if don't eat it, don't try and bribe them to eat it, that sort of thing." (149)*
Repeated exposure	*9 (30)*	*"Not to be deterred by continually presenting these things. So it's probably given me more confidence and patience to keep trying." (165)* *"Being consistent; I bring it to her every day whereas I had actually given up in the past" (180)* *"And also the fact that you offer every day and just sort of make it part of your routine." (129)*

Strategy	*n (%) of participants*	*Example Comments*
Stickers	*8 (27)*	*"I thought it was good with stickers, I think that was re-enforcing it in itself, gave him more motivation to actually eat the beans, then we'd put the sticker on, and then my daughter usually would get to put a sticker on regardless."* *"Even after the study, he still wanted to do like the sticker thing, I think that was a good thing" (138)*
Role modelling	*7 (23)*	*"And her sister did most of it with her as well. …So it became, it wasn't like she was being singled out either." (126)* *"And having his one-on-one attention and showing him that I'm eating it, I'm not dying - which he thinks you do when you eat carrots." (143)* *"...going onto actually trying a piece myself, as I guess leading by example" (165)*
Talking	*4 (10)*	*"I think just talking about the food as well, like we talked about what colour it was and that sort of thing, and what it tasted like." (164)* *"...and rather than focus on getting her to eat them, focus on getting her to taste them and talk about them" (174)*
Spitting out	*3 (13)*	*"I did try the "just take a bite", "just taste it, you can spit it out"." (131)* *"...to let her know that it's okay and she can have them, or she can spit out and that's still a good attempt." (180)*
Child involvement in cooking/preparation	*2 (7)*	*"I definitely like the idea of getting them to cook with me" (114)* *"She helped me to cook it but didn't want it." (137)*

6.3.3 Perception of the sticker chart

When specifically prompted about their child's perceptions of the sticker chart, most participants reported that their child had found the use of stickers to be positive (n=11). Remaining comments were more related to indifference to the sticker chart (n=3) rather than a negative response. Three participants had used a sticker system previously with eating.

Comments indicative of positive responses were:

> "She was quite happy with it. She found it quite entertaining [and] is looking forward to it all the time"
>
> "I would say it was very positive and … it was really important that she could let [us know] what she thought each day"
>
> "He loved it because you know he's quite a visual child and so to actually see that he can make a choice about what he wants and actually peel the sticker off and put it in the book, I thought was just a real key and you know I think if you're going to keep anything going, if you're going to do the study again or whatever, it's very much kids having visual prompts is really important."
>
> "Yep, he thought that was quite good. And he kept asking can he do his apple, yeah, and then he was very upset that the apple had gone but luckily we've got another one anyway, we've got a star chart on the fridge door that the dietician had given us - which is magnetic."
>
> "She was quite happy with it. She found it quite entertaining is looking forward to it all the time"
>
> "I would say it was very positive and … it was really important that she could let [us know] what she thought each day"

6.3.4 Strategies to manage a refusal of the vegetable

Sixty-six percent of parents in the intervention group reported that their child refused the vegetable on at least one occasion. Of these parents, most (75%) indicated that the information in the booklet regarding strategies to manage refusal was helpful. Table 10 lists the strategies that were identified.

Interestingly, participants in the sticker chart condition reported fewer instances of managing a refusal (n=4, 28%) than that of participants in the no sticker chart condition (n=12, 75%). Of the participants who discussed refusals, seventy-five per cent found the intervention strategies to be helpful with regards to refusals.

Table 10. Strategies in the information booklet that parents identified as useful for managing refusal of the vegetable.

Strategy	*n (%) of participants*	*Example Comments*
Low Key	*9 (30)*	*"Not to make a fuss about it." (162)* *"Yeah, the hiding, the emotions and not letting it worry you one way or the other." (131)* *"Not bribing her or telling her off for not eating the vegetable." (130)*
Role modelling	*6 (20)*	*"Tasting it with the child, and my husband tasting it, my other little girl tasting it with her" (164)* *"I tried a few times, not always, but I tried to eat myself to show her that it's Okay to eat it. So I can try it, I can eat it so you can try it." (137)* *""I'll have a bit and then you can have a try and see how it tastes and you can tell me how it tastes", like she would put it in her mouth and do that with me." (149)*
Small pieces/portions	*5 (17)*	*"We tried cutting it up into smaller pieces. She's getting more receptive about it as we go along."* *"I told her that she only had to eat a little bit"* *"If they say no, then try and get them to eat a bit and I tried a bit – "See, look I'm eating it, it's fine" and I did that but mostly it didn't work."*
Talking	*3 (10)*	*"I think just talking about the food as well, like we talked about what colour it was and that sort of thing, and what it tasted like" (164)* *"It's really nice. It's crunchy, it's juicy. It's tasty." (194)* *"I asked him why doesn't he like it, just went into that I guess" (143)*

Strategy	*n (%) of participants*	*Example Comments*
Repeated exposure	*3 (10)*	*"Just offer it to him and if he doesn't, that's fine." (179)* *"I just said that's okay, that we'll try again the following day and as each day has progressed; her confidence to try the beans has increased." (180)* *"I think what it said that you need to be consistent so that it doesn't really matter if the child refuses you still need to offer it again so I just offered her again even after she refused it." (137)*
Spitting out	*3 (10)*	*"If she didn't like it she could spit it out." (174)* *"I said to him you can just bit it and spit it out and he did it and spat it out so he didn't really try it but he got it in his mouth, which was better than any of the other days." (182)* *"He was the same every single day as far as he put it in his mouth and then he spat it out" (132)*
Child involvement in cooking/preparation	*1 (3)*	*"She helped me to prepare it" (137)*

6.3.5 Reported changes in feeding practices

When asked if they had changed their approach to getting their child to eat vegetables, participants mostly responded in the affirmative (n=26). Responses indicated many changes such as adjustments to size and portion quantity (n=7), a shift from an aggressive to a more low-key approach from parents (n=5) and more consistent exposure to vegetables (n=5).

Responses suggesting changes to feeding practices were:

> "I've maintained the approach a bit in terms of just putting a tiny bit … I think also it took away that fear of "Oh my god I have to have my child eating enormous amounts of vegetables or he'll die of malnutrition"."

> "Not forcing her to actually try it or to put pressure on her to try it, to let her know that it's okay and she can have them, or she can spit them out and that's still a good attempt."

Participants in the sticker chart condition were slightly more likely to report an increase in willingness to try new vegetables (n=9/14, 64%) over the course of the study, in comparison to those involved in the Exposure Only condition (6/16, 37%)

> "he's less fearful of them and I've maintained the approach a bit in terms of just putting a tiny bit"

In regards to changes in eating patterns of other family members over the course of the trial, the majority of the participants reported no change to vegetable consumption (n=24/28, 85%).

6.3.6 Reported changes to the way vegetables are served

The majority of participants reported that they plan to change how they cook or serve vegetables to their children (n=23/30, 76%). In responding to this question, the answers were similar to what was described in changes to feeding practices (5.9.4). Common themes were: persisting with the presentation of vegetables to their child (n=7), adjusting the size or portion quantity (n=9) and having a wider variety of vegetables (n=9).

Responses indicative of changes to the serving of vegetables were:

> "I'd probably offer smaller amounts and rather than focus on getting her to eat them, focus on getting her to taste them and talk about them."

> "Sometimes you just give up and just give her what she wants and I think I've just got to make sure that you put it in front of her and get her to try it. And just carry on with that repetition that she then gets used to it being there."

> "I started to think about other things as well, not just vegetables, can I say, what's the right word, atmosphere, I started to pay more attention to this as well, atmosphere."

> "What we've done before was just give up. We hadn't bothered. We used to make ourselves ill over trying to get him to eat and now we just - everyone keeps saying "Don't stress over it. He will eat when he's ready, even if it's when he's 15". So now at least I know if you cut your vegetables small enough, then he might have a tiny taste of it, even though he's not actually eating it and he's sometimes not even swallowing it, at least he's putting it in his mouth and that's certainly a good step."

However, only a minority of participants reported that they would change the types of vegetables purchased or presented to their children (n=6/30, 20%). This was commonly explained by participants as being due to already having a diverse range of vegetables (n=11) or that the vegetables served to children were along family preferences (n=5).

6.3.7 Use of intervention strategies following the trial

All but one of the participants predicted that they would find the instruction booklet to be useful in the future (n=29, 1 missing). With regards to the booklet, an emerging theme was that the participants would use the parent diary as a reminder of the strategies that they had found useful (n=6).

Comments regarding future use of the booklet were:

> "I feel I've got a good grasp of it now going through, but if maybe in a few months time found that I'd fallen into bad habits, I think it would be a really good self guide to go back to."

> "Definitely and I would definitely talk about it with other friends I have who have similar problems I think. I thought the information was really fantastic, both in terms of preparing me for the intervention itself, so that I knew what was going on, also in terms of those strategies and things, it was really, really well written."

The majority of participants also indicated that they planned on continuing with parts of the trial (n=26/29, 89%). The most commonly mentioned intervention strategies were continual exposure (n=8), smaller portions and pieces (n=14), and the sticker chart (n=7).

Comments indicative of future use of intervention strategies were:

> "I would continue to offer small serves on a regular basis."

> "Yea I guess just continually presenting things, that's probably the main thing, and do it in smaller pieces actually, that's the other thing. So she feels she has some control over the tasting."

> "Yeah well I'm certainly interested in trying the sticker approach."

> "I think definitely the sticker books have a really good impact with her … So I will definitely continue using something like that."

6.3.8 Summary of the control group responses

Ten participants from within the control group were interviewed. Half of those interviewed thought their child was more willing to eat vegetables, 4 reported no change and only one reported a negative change associated with study involvement.

Nine out of ten reported that their own behaviour (changes in their approach) towards presenting vegetables to their children had not changed through involvement in the study.

7. DISCUSSION

7.1 Comparison to previous studies

We have confirmed the effectiveness of the strategy of exposure and the positive effects of exposure plus reward. Importantly we have demonstrated effects that could, potentially be reproduced by parents at home if provided with simple information. The design of the current study was similar to that conducted by Wardle *et al*. (2003). In contrast to the Wardle *et al*. (2003) study, we compared a mere exposure group with an exposure + reward group. Wardle's 'exposure' group was similar to our exposure + reward group and was also found to be effective. The nature of reward needs very careful handling. Further work by Wardle (Wardle *et al*, 2003a) tested exposure only against exposure + reward and found that reward reduced the positive effects of exposure on one target vegetable (red capsicum). However in that study the children in the reward group were presented with an "if you taste then you get a reward" (a sticker). The important aspect of the current study is that the reward was presented as a self monitoring exercise, facilitating acknowledgement and recognition of achievement of tasting. The use of stickers as a self monitoring exercise has been shown to be effective in other studies (Horne, Lowe, Bowdery, & Egerton, 1998; Lowe, *et al*., 2004) and is generally well established as a facilitator in behaviour change. Similarly having achievement publically acknowledged is also generally widely recognised as helpful in maintaining behaviour change.

7.2 Compliance with the intervention

Overall participating parents were generally compliant (86%) in that they attempted to expose their children to the target vegetables; however, lack of compliance was a result of the children refusing to taste the vegetable. Dealing with refusals and furthering parents' confidence and ability to sustain the exposure technique, in the face of refusals, requires further work. Nine or more tastings was taken as compliance in the current study (70% of participants) which differs from the UK study (Wardle *et al*, 2003) and other studies which suggest 10 or more tastings are 'necessary'. Hence the positive results in the current study suggest a smaller number of exposures can be effective. On the other hand, if parents can be shown how to deal with refusals and the number of exposures increases then effects may be stronger.

7.3 Impact on liking

The positive effects upon liking were similar to the Wardle *et al* (2003) study with the exposure + sticker group showing the most positive change. At 3 month follow-up, 53% of children in Exposure Only (18/34) and 58% of children in Exposure + Reward (25/43) rated their target vegetable as 'yummy', compared with 38% of the children in the control group (23/61). The immediate reward of the sticker was positive and is recommended as a future strategy.

In contrast to previous studies, parents chose the target vegetables resulting in a wide range of vegetables (Table 6). Wardle *et al* (2003) chose six vegetables (that also

were chosen by our parents) however there is value in allowing the parents to choose the target vegetables because the target is tailored to the individual child. A much larger range of vegetables was targeted hence the strategy employed in the current study has the potential to benefit a wide range of vegetable growers.

7.4 Impact upon consumption

The interventions also had positive effects on consumption. Whilst these were modest in quantity and only proxy measures for potential dietary intake changes they are nevertheless encouraging. Further studies should focus more on the change in consumption by measuring intakes in more detail. Such a measure was beyond the resources in the current study.

We did not find any transfer effect upon vegetable liking which suggests that exposure to a variety of vegetables would be needed to increase vegetable consumption generally. Meier and colleagues (Maier, Chabanet, Schaal, Issanchou, & Leathwood, 2007; Maier, Chabanet, Schaal, Leathwood, & Issanchou, 2008), working with younger children (infants), found that exposure to variety led to acceptance of new foods and that frequency of change was the most effective strategy.

Larger studies may reveal transfer effects to similar vegetables (for example, green and red capsicum, or brassicas in general) however the small sample and wide variety of target vegetables chosen in the current study negates such analysis in the current data set. Larger studies should further investigate potential transfer effects.

Despite the parents participation as role models we did not find any effects upon parents liking or consumption. The parents that chose to participate may have already been positive towards vegetables and hence there was little room for improvement. Again a larger sample with greater variation in current vegetable intake may identify an effect upon parents and other family members.

7.5 Liking and consumption over the 3 month follow-up period

There was evidence of sustained effects upon both liking and consumption, that is, there was no evidence that scores changed over the follow-up period. The sustained influence of the interventions, particularly the exposure + reward intervention is very encouraging. Previous work (Wardle *et al.*, 2003; Wardle *et al.*, 2003a) has criticised the use of rewards because once the reward stops so does the target behaviour change. This was not the case in the current study and is again supported by other findings, from the UK, that used the 'reward' as a self monitoring aid (Horne, *et al*., 1998). In other words, the evidence suggests that the children were not motivated by the reward but appear to have developed a genuine increased liking for the target vegetable.

7.6 Feedback on the intervention and study (control group) involvement.

There was generally a positive reaction to the interventions and, for most parents, the frequent presentation of small quantities of vegetables was a novel and welcome approach that they thought worthwhile continuing. It is notable that the sticker condition also received much appreciation with no negative impact. This is in contrast to some of the previous literature (Birch, 1999; Wardle *et al*, 2003a) but consistent with others, notably Lowe's work in the UK (Horne, *et al*., 2004). Not only did the sticker condition not have any detrimental effect (see main results on liking) but, notably the sticker condition appeared to reduce the frequency of refusal to comply and encouraged children's participation (compared to the exposure only condition). This is important and the immediate 'reward' (Horne, *et al*., 2004), 'self monitoring', and 'asking skills' (Blanchette & Brug, 2005) facilitated by these well liked, simple, and inexpensive materials, should be used in the future.

The majority of those interviewed encountered refusal to comply however most reported that the information provided to deal with this was helpful. Some caution is required in interpreting these responses because almost all of this sub-set of participants reported compliance with 10 exposures; however, this was not true for all participants. There is a suggestion of a need to further address refusal scenarios and coping strategies to manage a child's refusal to taste the vegetable.

Participation in the control group did appear to influence some children's behaviour towards vegetables although most parents stated that they did not change their approach. It is reasonable to conclude that there was some contamination of the control group which is likely to have weakened the intervention effects. Recruiting and sustaining control groups, particularly within a free living community setting, is often challenging. One alternative would be that future research should recruit a control group that is presented with an intervention unrelated to the vegetable intervention focus.

7.7 Strengths of the study

The major strength of the current study is the simplicity of the technique and it's popularity amongst both parents and children. Whilst the current study was intensively administered with home visits by fieldworkers, the technique lends itself to less intensive administration (e.g. electronically) because of its simplicity.

We have demonstrated the effectiveness of exposure and the positive and sustained effects of a 'reward' beyond the original intervention period.

7.8 Limitations of the study

There are always difficulties in recruiting control groups in interventions which are not (double) blinded such as the dietary intervention in the current study. There is no doubt that there was some 'contamination' of the control group by contact with

fieldworkers, a focus on vegetables, and participating in tasting small portions of vegetables. Hence positive effects within the control group weaken the effect of the interventions. In this respect the significant effects of the interventions are all the more remarkable. Future studies should use a true control with no focus on the target behaviour.

It was not the aim of the current study to recruit a sample representative of the (South Australian) population of parents because the study was aimed at attracting a motivated group of parents. We sought parents who were motivated to increase their children's consumption of vegetables, although this was not formally measured. There was no reason to expect that the efficacy of the exposure technique itself will vary by participant demographics such as socioeconomic status (SES) or cultural background. On the other hand, it is possible that parents' ability to carry out the technique may vary across different groups (e.g., low SES versus high SES) and this warrants further research. The current research is a 'proof of principle' study and future work will need to be carried out with specific groups.

7.9 Further research

In this project we established the efficacy of the vegetable exposure technique in raising liking of vegetables amongst 4-7 year old children using an intensive fieldworker-based-home-intervention. There is clearly a need to achieve wider community impact and, secondly, address barriers to success (identified here).

Future studies could use on-line measurements and electronic communications media to achieve a large scale community impact. However the project identified that parental ability to deliver the exposure technique was a barrier to success. Therefore the future work should raise parents' confidence and ability to undertake the strategies defined by a refined 'exposure, modelling and self monitoring' technique to increase children's consumption of target vegetables. This differs from the study reported above by no longer focusing on the child, as it is thought that the technique itself is proven, but the problem lies with the parents' ability to deliver it, sustain it and deal with problems such as refusals. A controlled trial (Intervention group vs. Control group) should be undertaken on a nationwide sample of children and their parents to test the efficacy of boosting parents self confidence and ability to implement the exposure + reward technique.

7.10 Conclusion

The exposure + reward intervention was particularly effective in increasing liking and consumption of a target vegetable in the medium term. Further study is required to improve parents' ability to handle refusals in a larger sample using less intensive administration. Once a low cost effective intervention is demonstrated then the vegetable industry, retailers and health and parental guidance professionals could promote the technique. This, in turn, should increase the demand and consumption of vegetables.

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APPENDIX A – BASELINE QUESTIONNAIRE

FAMILY ID | | | |

GROUP | | |

INCREASING CHILDREN'S LIKING FOR AND CONSUMPTION OF VEGETABLES

VISIT 1

The following questions are about how you interact with your child, your vegetable eating habits and your child's vegetable eating habits.

Please answer ALL questions as honestly as possible.

Q1. Please think about how often YOU exhibit this behaviour with your child. Answer with the following responses:

1 = Never 2 = Once in a while 3 = About half the time 4 = Very often 5 = Always

PLEASE CIRCLE ONE RESPONSE PER ROW.

	Never	Once in a while	About half the time	Very Often	Always
1 Encourage our child to talk about the child's troubles.	1	2	3	4	5
2 Guide our child by punishment more than by reason.	1	2	3	4	5
3 Know the names of our child's friends.	1	2	3	4	5
4 Give praise when our child is good.	1	2	3	4	5
5 Play and joke with our child.	1	2	3	4	5
6 Withhold telling off or criticism even when our child acts against our wishes.	1	2	3	4	5
7 Show sympathy when our child is hurt or frustrated.	1	2	3	4	5
8 Punish by taking privileges away from our child with little if any explanation.	1	2	3	4	5
9 Spoil our child.	1	2	3	4	5
10 Give comfort and understanding when our child is upset.	1	2	3	4	5
11 Yells or shouts when our child misbehaves.	1	2	3	4	5
12 Am easy going and relaxed with our child.	1	2	3	4	5
13 Allow our child to annoy someone else.	1	2	3	4	5
14 Tell our child our expectations regarding behaviour before the child engages in an activity.	1	2	3	4	5
15 Scolds and criticises to make our child improve.	1	2	3	4	5
16 Show patience with our child.	1	2	3	4	5
17 Grab our child when being disobedient.	1	2	3	4	5
18 State punishments to our child and do not actually do them.	1	2	3	4	5
19 Am responsive to our child's feedings or needs.	1	2	3	4	5
20 Allow our child to give input into family rules.	1	2	3	4	5
21 Argue with our child.	1	2	3	4	5
22 Appear confident about parenting abilities.	1	2	3	4	5
23 Give our child reasons why rules should be obeyed.	1	2	3	4	5

Q2. USING THE SAME SCALE, Please respond to the following statements.

PLEASE CIRCLE ONE RESPONSE PER ROW.

		Never	Once in a while	About half the time	Very Often	Always
1	I appear to be more concerned with own feelings than with our child's feelings.	1	2	3	4	5
2	I tell our child that we appreciate what the child tries or accomplishes.	1	2	3	4	5
3	I punish by putting our child off somewhere alone with little if any explanation.	1	2	3	4	5
4	I help our child to understand the impact of behaviour by encouraging our child to talk about the consequences of their own actions.	1	2	3	4	5
5	I am afraid that disciplining our child for misbehaviour will cause the child to not like their parents.	1	2	3	4	5
6	I am aware of problems or concerns about our child in school.	1	2	3	4	5
7	I threaten our child with punishment more often than actually giving it.	1	2	3	4	5
8	I express affection by hugging, kissing, and holding our child.	1	2	3	4	5
9	I ignore our child's misbehaviour.	1	2	3	4	5
10	I carry out discipline after our child misbehaves.	1	2	3	4	5
11	I apologise to our child when making a mistake in parenting.	1	2	3	4	5
12	I tell our child what to do.	1	2	3	4	5
13	I give into our child when the child causes a commotion about something.	1	2	3	4	5
14	I talk it over and reason with our child when the child misbehaves.	1	2	3	4	5
15	I disagree with our child.	1	2	3	4	5
16	I allow our child to interrupt others.	1	2	3	4	5
17	I have warm and intimate times together with our child.	1	2	3	4	5
18	When two children are fighting, I discipline the children first and ask questions later.	1	2	3	4	5
19	I encourage our child to freely express themselves even when disagreeing with parents.	1	2	3	4	5
20	I bribe our child with rewards to bring about compliance.	1	2	3	4	5
21	I scold or criticise when our child's behaviour doesn't meet our expectations.	1	2	3	4	5
22	I show respect for our child's opinions by encouraging our child to express them.	1	2	3	4	5

		Never	Once in a while	About half the time	Very Often	Always
23	I set strict well established rules for our child.	1	2	3	4	5
24	I explain to our child how we feel about the child's good and bad behaviour.	1	2	3	4	5
25	I use threats as punishment with little or no justification.	1	2	3	4	5

Q3. Please respond to the following statements.

PLEASE CIRCLE ONE RESPONSE PER ROW.

		Never	Once in a while	About half the time	Very Often	Always
1.	I take into account our child's preferences in making plans for the family.	1	2	3	4	5
2.	When our child asks why they have to conform, I state: because I said so, or I am your parent and I want you to.	1	2	3	4	5
3.	I appear unsure on how to solve our child's misbehaviour.	1	2	3	4	5
4.	I explain the consequences of the child's behaviour.	1	2	3	4	5
5.	I demand that our child does/do things.	1	2	3	4	5
6.	I channel our child's misbehaviour into a more acceptable activity.	1	2	3	4	5
7.	I emphasise the reasons for rules.	1	2	3	4	5

Q4. Please indicate your agreement with the following statements. Please circle the appropriate response from 1 to 7, where 1 is Disagree Strongly and 7 is Agree Strongly.

CIRCLE ONE RESPONSE PER ROW.

		Disagree strongly	Disagree moderately	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree moderately	Agree strongly
1.	I am constantly sampling new and different foods.	1	2	3	4	5	6	7
2.	I don't trust new foods.	1	2	3	4	5	6	7
3.	If I don't know what a food is I won't try it.	1	2	3	4	5	6	7
4.	I like foods from different countries.	1	2	3	4	5	6	7
5.	Ethnic food looks too weird to eat.	1	2	3	4	5	6	7
6.	At dinner parties, I will try a new food.	1	2	3	4	5	6	7

7. I am afraid to eat things I have never had before.	1	2	3	4	5	6	7
8. I am very particular about the foods I will eat.	1	2	3	4	5	6	7
9. I will eat almost anything.	1	2	3	4	5	6	7
10. I like to try new ethnic restaurants.	1	2	3	4	5	6	7

Q5. The next section is about the kinds of vegetables YOU eat and like to eat. Read through the following list of vegetables and record <u>how much you like them</u>.

CIRCLE THE APPROPRIATE RESPONSE – ONE RESPONSE PER ROW.

	Dislike	Neutral	Like
1. Pumpkin	1	2	3
2. Cauliflower	1	2	3
3. Potato (not hot chips)	1	2	3
4. Peas & Beans	1	2	3
5. Lettuce	1	2	3
6. Celery	1	2	3
7. Eggplant	1	2	3
8. Carrot	1	2	3
9. Broccoli	1	2	3
10. Corn	1	2	3
11. Tomato	1	2	3
12. Capsicum	1	2	3
13. Zucchini	1	2	3
14. Cabbage	1	2	3
15. Brussel sprouts	1	2	3
16. Sweet potato	1	2	3
17. Spinach	1	2	3
18. Cucumber	1	2	3
19. Mushroom	1	2	3
20. Squash	1	2	3
21. Legumes (Baked beans, chickpeas, lentils, kidney beans)	1	2	3
22. Mixed frozen vegetables	1	2	3
23. Vegetables in mixed dishes (soups, stews & stir fries)	1	2	3

We realise that your food intake and food purchasing can vary from time to time, so we are trying to get an overall picture for the last 3 months. Please think about the last <u>3 months</u> and record how often you usually eat the listed foods.

Q6. How often in the <u>past 3 months</u> have you eaten the following vegetables? You can tell us as the number of times per day, week or month. Whichever is easiest.

INTERVIEWER NOTE: SINGLE RESPONSE ONLY, ENTER DAYS <u>OR</u> WEEKS <u>OR</u> MONTHS <u>OR</u> NEVER

	Times per day	Times per week	Times per month	Never
1. Pumpkin				
2. Cauliflower				
3. Potato (not hot chips)				
4. Peas & Beans				
5. Lettuce				
6. Celery				
7. Eggplant				
8. Carrot				
9. Broccoli				
10. Corn				
11. Tomato				
12. Capsicum				
13. Zucchini				
14. Cabbage				
15. Brussel sprouts				
16. Sweet potato				
17. Spinach				
18. Cucumber				
19. Mushroom				
20. Squash				
21. Legumes (Baked beans, chickpeas, lentils, kidney beans)				
22. Mixed frozen vegetables				
23. Vegetables in mixed dishes (soups, stews & stir fries)				

The next section is about YOUR CHILD and their eating behaviours.

Q7. Please think about the kinds of vegetables YOUR CHILD usually eats. In the past week, please tick all the listed foods <u>your child</u> has eaten.

☐ 1. Pumpkin	☐ 9. Carrot	☐ 17. Cabbage
☐ 2. Cauliflower	☐ 10. Broccoli	☐ 18. Brussel sprouts
☐ 3. Potato (not hot chips)	☐ 11. Corn	☐ 19. Sweet potato
☐ 4. Peas & Beans	☐ 12. Tomato	☐ 20. Spinach
☐ 5. Lettuce	☐ 13. Capsicum	☐ 21. Cucumber
☐ 6. Celery	☐ 14. Zucchini	☐ 22. Mushroom
☐ 7. Eggplant	☐ 15. Mixed frozen vegetables	☐ 23. Squash
☐ 8. Vegetables in mixed dishes (stews & stir fries)	☐ 16. Legumes (Baked beans, chickpeas, lentils, kidney beans)	☐ 24. Other (eg olives or beetroot)

Q8. Please indicate your agreement with the following statements. Please circle the appropriate response from 1 to 7, where 1 is Disagree Strongly and 7 is Agree Strongly.

CIRCLE THE APPROPRIATE RESPONSE – ONE RESPONSE PER ROW.

	Disagree strongly	Disagree moderately	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree moderately	Agree strongly
1. My child is constantly sampling new and different foods.	1	2	3	4	5	6	7
2. My child does not trust new foods.	1	2	3	4	5	6	7
3. If my child does not know what is in a food, he/she won't try it.	1	2	3	4	5	6	7
4. My child likes foods from different cultures.	1	2	3	4	5	6	7
5. For my child, food from cultures	1	2	3	4	5	6	7

		Disagree strongly	Disagree moderately	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree moderately	Agree strongly
	different to his/her own looks too weird for him/her to eat.							
6.	At social gatherings, my child will try a new food.	1	2	3	4	5	6	7
7.	My child is afraid to eat things he/she has never had before.	1	2	3	4	5	6	7
8.	My child is very particular about the foods he/she will eat.	1	2	3	4	5	6	7
9.	My child will eat almost anything.	1	2	3	4	5	6	7
10.	My child likes going places serving foods from cultures different to his/her own.	1	2	3	4	5	6	7

And finally, please think about you and your child's vegetable intake <u>yesterday</u>.

Q9. Please circle how often YOU had vegetables (raw and cooked) yesterday. For example salad in a sandwich and vegetables with your evening meal = twice. TICK ONE RESPONSE ONLY.

- € Nil
- € Once
- € Twice
- € 3 times
- € 4 times

Q9a. How many different vegetables do YOU usually eat per day? (include fresh, frozen or tinned)

- € Less than one vegetable per day
- € 1 vegetable per day
- € 2 vegetables per day
- € 3 vegetables per day
- € 4 vegetables per day
- € 5 vegetables per day
- € 6 vegetables per day

Q10. Please circle how often YOUR CHILD had vegetables (raw and cooked) yesterday. TICK ONE RESPONSE ONLY.

- € Nil
- € Once
- € Twice
- € 3 times
- € 4 times

Your Background

Parent 1	Parent 2
Q11. Gender ☐Female ☐Male Q12. Date of Birth ____/____/_____ Q13. Highest level of education completed ☐ 1. Some high school ☐ 2. Completed high school ☐ 3. Tech, Trade or TAFE qualification ☐ 4. University ☐ 5. Post graduate studies	14. Gender ☐Female ☐Male 15. Date of Birth ____/____/_____ 16. Highest level of education completed ☐ 1. Some high school ☐ 2. Completed high school ☐ 3. Tech, Trade or TAFE qualification ☐ 4. University ☐ 5. Post graduate studies

Your Child and Your Family

Q17. Child's Gender
1. Male ☐
2. Female☐

Q18. Child's Date of Birth ____/____/_____

Q19. Duration of Breastfeeding _[SINGLE RESPONSE ONLY]
Days ____
Or
Weeks ____
Or
Months ____
Or
Years ____
☐ I did not breastfeed (tick if applicable)

Q20. Does your child have siblings?
1. No, only child ☐ THANK AND CLOSE
2. 1 sibling ☐
3. 2 or more siblings ☐

Q21 And is the child included in this study the……READ OUT:
1. The youngest ☐ THANK AND CLOSE
2. Middle ☐
3. The oldest ☐

THANK YOU FOR YOUR TIME
ANY COMMENTS

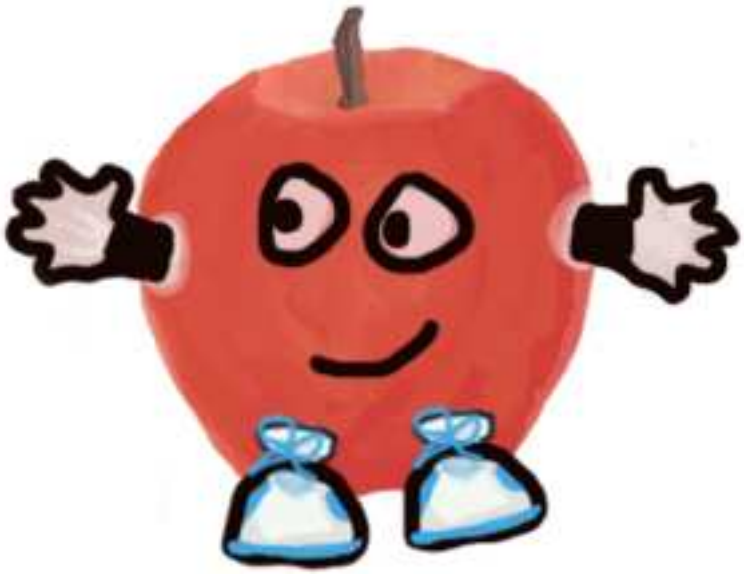
APPENDIX B – PARENT DIARY EXCERPT

FAMILY ID | | | |

GROUP | | |

INCREASING CHILDREN'S LIKING FOR AND CONSUMPTION OF VEGETABLES

PARENT DIARY



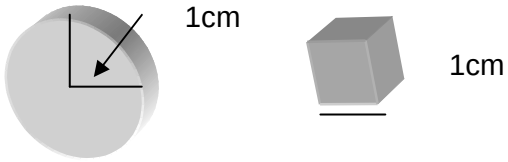
INTRODUCTION

The aim of study is to increase children's **liking** of vegetables. We testing whether taste exposure is an effective strategy that parents can use. The helpful hints and techniques are based on previous research in this area.

SERVING SIZE GUIDE

A large serving of a new food can be scary for children so you only need to offer a small piece to taste. How much kids are prepared to taste will vary. You might need to accept that a teeny tiny piece is all they are willing to have. It's okay to let them choose the piece or serve themselves.

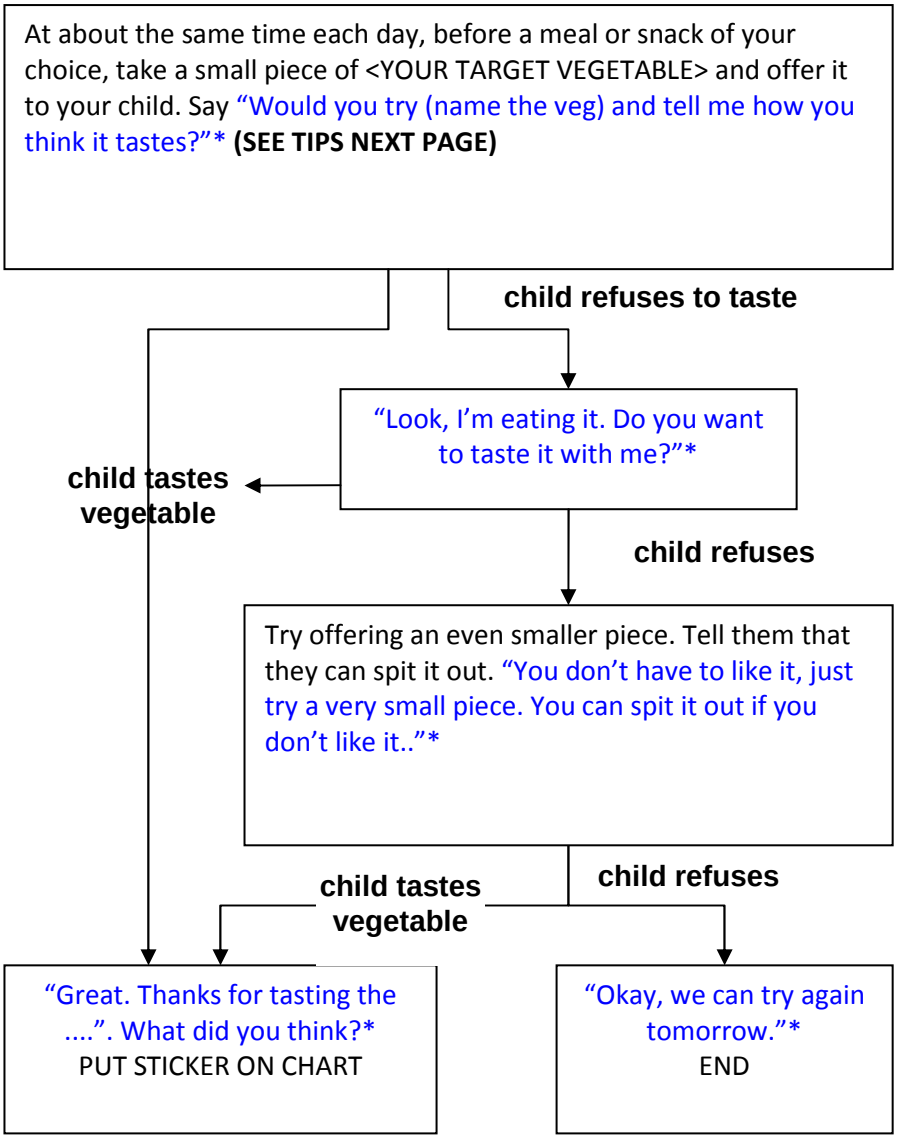
Example pieces:



Vegetable	**Suggested Approx Serving Size**
Peas, Corn, Legumes	1 piece, eg, 1 pea, 1 kernel of corn, 1 chickpea
Carrot, Cucumber	¼ - ½ circle or 1cm length of a thin stick
Celery, Snowpeas, Capsicum, Beans	½ - 1cm piece
Mushroom	¼ slice or 1cm piece
Lettuce, Spinach	1cm piece
Cauliflower, Broccoli	1 cm piece *You could also offer just the stalk or head
Pumpkin, Zucchini, Eggplant	1cm piece

SUMMARY OF WHAT TO DO

Follow the flow chart below depending on your child's responses. There are tips on the following pages to help you at each stage of the process.



*You can use your own (similar) words to keep it natural.

HOW TO ENCOURAGE YOUR CHILD TO TASTE THE VEGETABLE

Children are more likely to try something they know well.

⇒ Tell them what the vegetable is ("this is red capsicum").

⇒ Involve them in the kitchen when you prepare or cook it, e.g., let them see you take it out of the fridge, and even better, cut off a piece for them while they are watching.

⇒ Ask them to get it out of the fridge.

⇒ Comment on the colour, how it feels to touch, the smell, the sound it makes when you bite it ("it's fire engine red").

⇒ Some children might just like to touch and play with the vegetable.

⇒ If you're out shopping, get them to find the veg and pay for it.

Offer a small piece

⇒ A large serving of a new food can be scary so you only need to offer a small piece to taste (refer to serving size guide).

Taste it together

⇒ It's important that your child sees you enjoying the vegetable

Keep it LOW KEY.

⇒ Encourage a little taste but do not force. It's important to keep the whole thing as stress free as possible, for both of you.

The focus should be on getting your child to taste the same vegetable each day, at this point they don't have to like it!

IF THEY DO NOT WANT TO TRY THE VEGETABLE YOU CAN

If you get a "No, thanks" or "Yuck, no way", try:

- Tasting a piece yourself

If they're still not keen you can also try:

- Cutting a few small pieces and asking them to choose which piece they'd like to try.
- Tell them that they can spit it out (try this as a last strategy)

As tempting as it might be to keep going, it's best to leave it at that. Try not to show that you're frustrated even though you might be.

THINGS TO TRY TO AVOID DOING

- Getting angry "I'll be very cross if you don't do it" or pleading "It would make Mummy very happy" or "Show Daddy what a good girl you are" if your child doesn't want to try any.
- Threatening to take away something, eg. "if you don't try it you can't watch TV" or punish them in any way.
- Promising a reward, especially another food, if they do try some. Although putting on the sticker might be rewarding, it's best to keep this low key, say "you can put a sticker on the chart once you've had a taste" rather than "if you don't taste it you can't have a sticker."
- Giving up even if they refuse for several days in a row.

- Avoid any “good for you”, “it’s nice” type of comments

COMPLETING THE DIARY

Please stick to the instructions as best you can and complete the following diary for the next 14 days. If you do something different from the instructions please let us know. For each day there is space for you to make any comments on how it is going i.e. if you have a lot of trouble or any methods you are using to get your child to taste the vegetable. Additional space for comments is provided at the end.

STICKER CHART

Every day that your child tastes the vegetable, they can choose a sticker to put on the chart. If they like the taste, they choose a smiley face. If they don’t like the taste, they choose a frowning face. And if they think the taste was just ok, they choose a neutral face.

DAY 1

Time of Day: _____

Q1 Reaction

☐ whole veg piece eaten and asked for more
☐ whole veg piece eaten
☐ part of veg piece eaten
☐ bite taken then spat out
☐ refused to taste
☐ vegetable was not offered today

Q2 Overall, how well do you think you stuck to the guidelines provided?

Not at all well 1 2 3 4 5 6 7 Extremely well

General comments:

DAY 2

Time of Day: _____

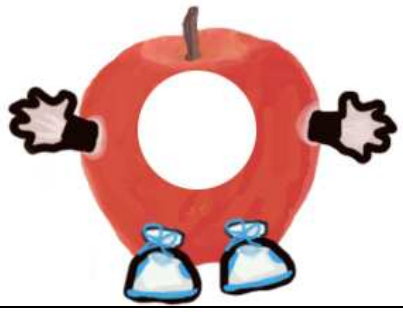
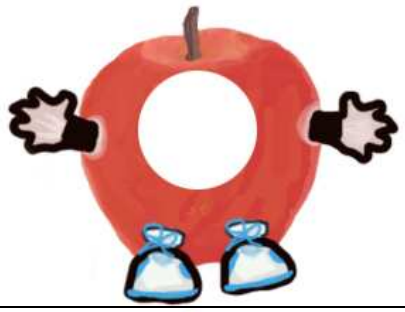
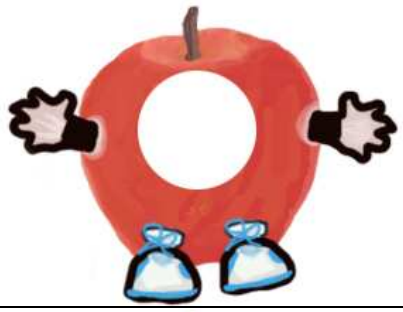
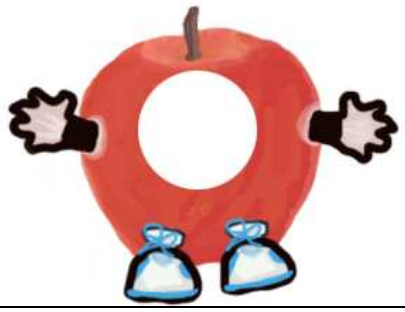
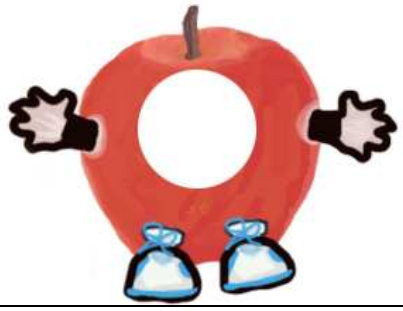
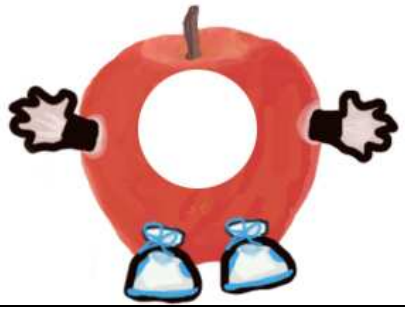
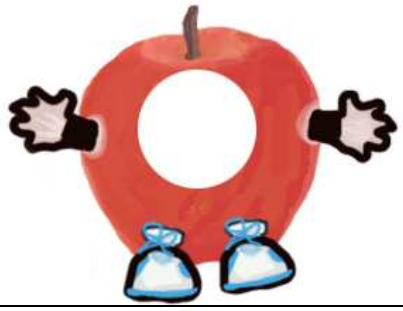
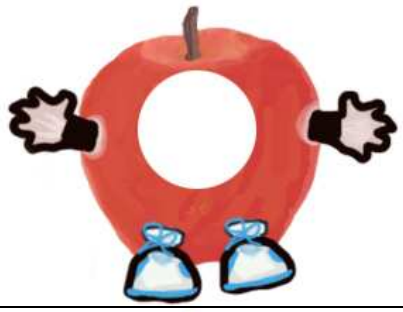
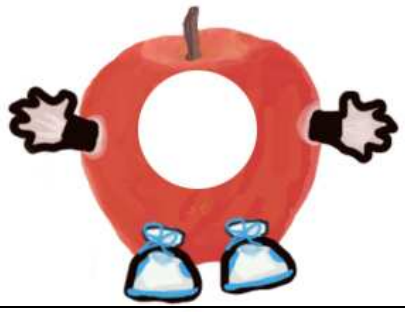
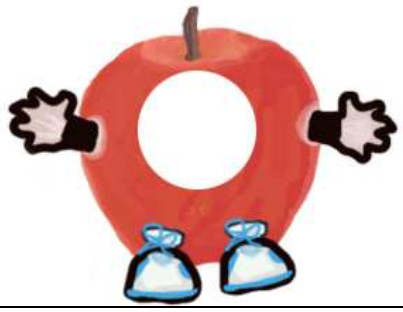
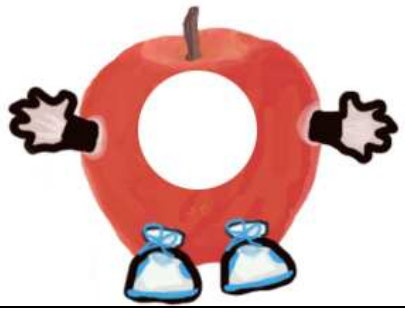
Q1 Reaction

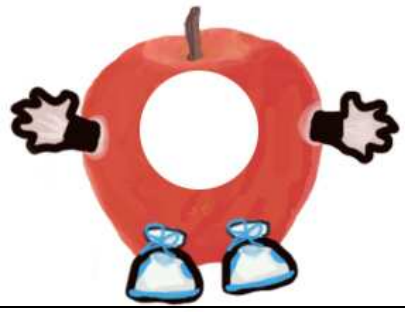
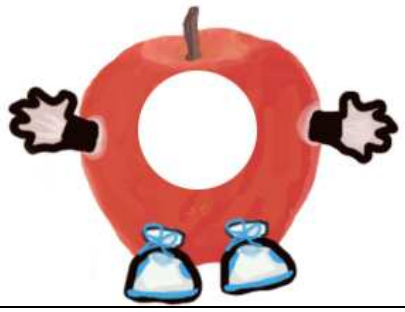
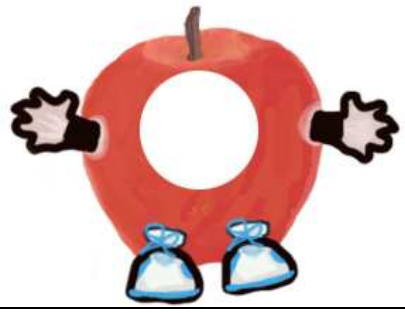
☐ whole veg piece eaten and asked for more
☐ whole veg piece eaten
☐ part of veg piece eaten
☐ bite taken then spat out
☐ refused to taste
☐ vegetable was not offered today

Q2 Overall, how well do you think you stuck to the guidelines provided?

Not at all well 1 2 3 4 5 6 7 Extremely well

General comments:

	
	
	
	END OF WEEK ONE. WELL DONE!
	
	

	
	END OF WEEK TWO. WELL DONE!

APPENDIX C – FEEDBACK TO PARTICIPANTS

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Children's Vegetable Liking Study

Nadia Corsini & David N Cox

Report to participants

January 2010

Know-how for Horticulture™

Thank you

We would like to thank you for participating in the Children's Vegetable Liking Study that sought to encourage children to like and eat vegetables. In gratitude we provide a summary of results from the study that may be of interest to you. Overall the project was successful and we think we have found a good strategy to encourage children's liking for and consumption of a vegetable they did not previously like.

The study

- You and your child were randomly allocated to one of three groups. One group was an 'exposure' intervention (Exposure Only) the second was an 'exposure plus the immediate reward of a sticker' (Exposure + Reward), and the third, a control group.
- Exposure refers to offering a small piece of a vegetable everyday for 2 weeks.
- We wanted to test if exposing children to a vegetable would increase their liking and consumption of that vegetable.
- We did not know if an immediate reward (the stickers) would have a positive or negative effect. Giving a reward is an intuitive reaction but some studies have shown that offering a reward is not effective because when the reward stops so does liking for the target food.
- The study took place in homes across metropolitan Adelaide, SA involving children aged 4 – 7 years old and their parents.
- Parents identified a vegetable that was neither liked nor greatly disliked as a target for change. A wide range of vegetables were identified as targets.
- In total, 185 parents and their children started the study and 164 finished the study (at 3 months follow up).

The results

Some facts about the study participants

The parents who participated in the study tended to be well educated (61 per cent completed university), were female (90 per cent), and had a tendency to like new foods. There were slightly more boys in the study (60 per cent) and nearly half of the children had a sibling. As a group, the children also scored quite high on a measure of food neophobia, which is the tendency to dislike new foods (you might notice this as general fussiness or being wary about certain foods). You might remember rating some questionnaire items such as "My child does not trust new foods" and "At social gatherings, my child will try a new food". Food neophobia is at its highest between the ages of 4 and 7 years and it tends to reduce as children get older.

Effects on liking of the target vegetable

Liking was measured by asking children to describe the taste of the vegetable using 3 pictures ('yucky face', 'just ok face' and 'yummy face').

Results are reported below on children who tasted the target vegetable 9 times or more (70%).

Figure 1 shows the average change in liking for the target vegetable between the start of the study (baseline) and after the two-weeks of exposure. The black bars represent the change. Both the 'Exposure Only' and 'Exposure + Reward' groups showed a statistically significant

change. This shows that the exposure technique worked and that the addition of reward had no detrimental effect.

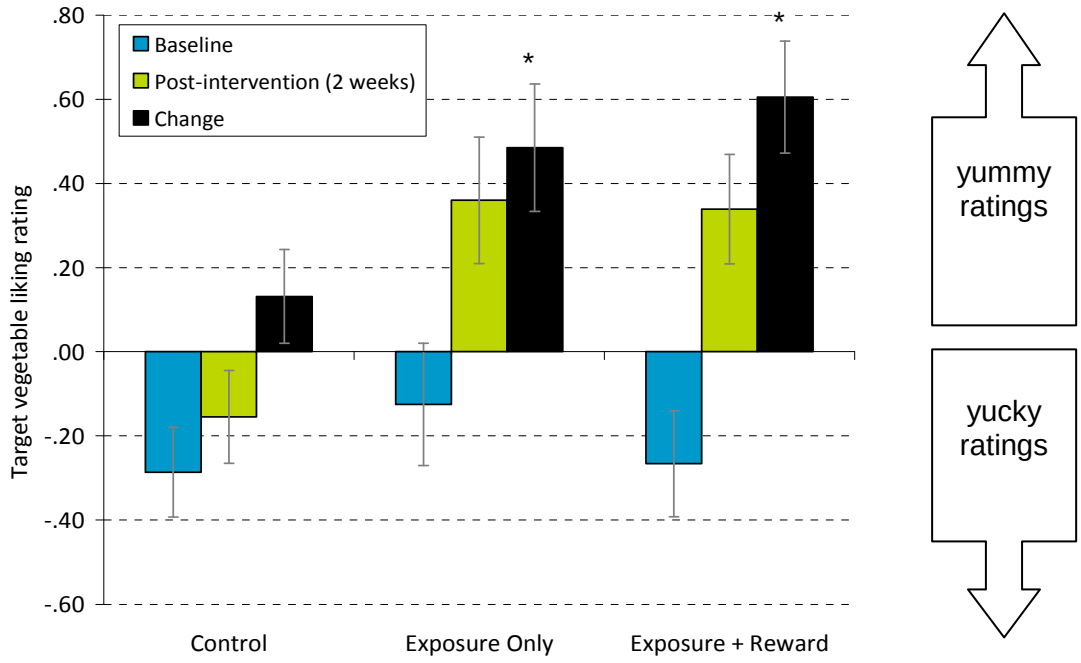

Figure 10. The average (Mean) and variance (standard error) target vegetable liking ratings at baseline and post-intervention (2 weeks). Significant changes in liking from baseline are indicated by asterisks. Scores can range from -2.00 (not tasted) to +1.00 ('yummy').

Figure 2 shows that when we measured the children's liking for the target vegetable at four weeks and three months, the changes in liking seen at two weeks were sustained. This is important because it shows that the exposure had a lasting effect and also that once the rewards ceased, the effects on liking still remained.

At 3 month follow-up, 53% of children in Exposure Only and 58% of children in Exposure + Reward rated their target vegetable as 'yummy', compared with 38% of the children in the control group.

Liking for a target vegetable did not generalise to a liking for other vegetables that the children tasted in the taste test. This suggests that children need to be exposed to a variety of vegetables throughout childhood.

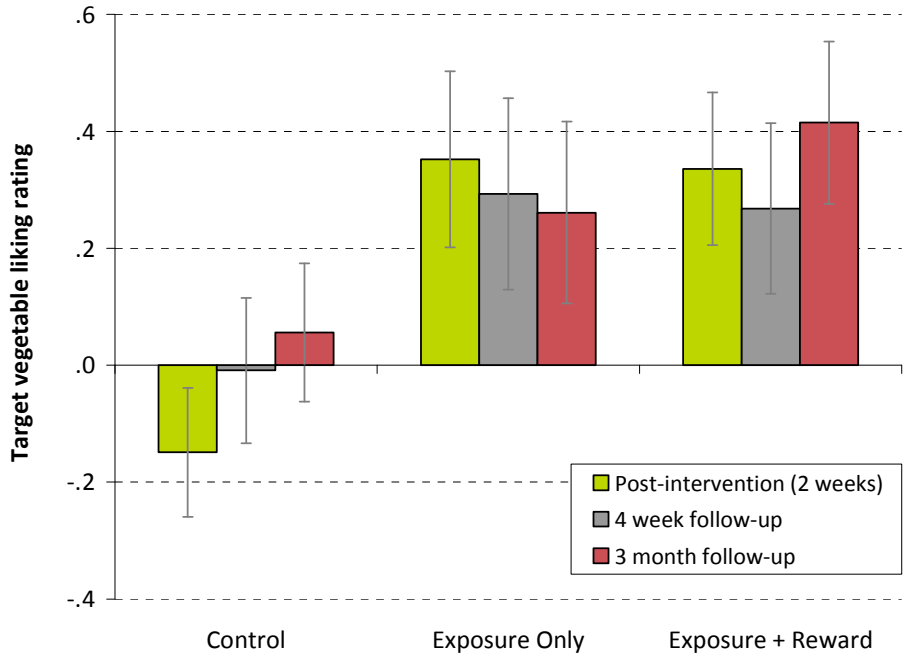

Figure 11. The average (Mean) and variance (standard error)) vegetable liking ratings at post-intervention, 4 week follow-up and 3 month follow-up. Liking responses can range from -2.00 (not tasted) to +1.00 ('yummy").

Effect on consumption

Figure 3 shows that there was a significant change in intake of the target vegetable for the Exposure + Reward group and for the control group. Intake was measured by how much your child ate from ½ cup of the vegetable you prepared for the taste test. Although it looks like the Exposure Only group did well too, this change was NOT significant statistically because there was quite a bit of inconsistency in the data in that particular group.

Children's usual vegetable intake

Children's intake was also measured in another way to see if the study made any difference to children's usual vegetable intake. We calculated a score from the information you provided in the questionnaire. For example, we asked you to tell us which vegetables (from a list of 23) your child had consumed in the past week, and how often your child consumed vegetables on the previous day.
Figure 4 shows that usual vegetable intake improved over the course of the follow-up period for both the Exposure Only group and the Exposure + Reward group.

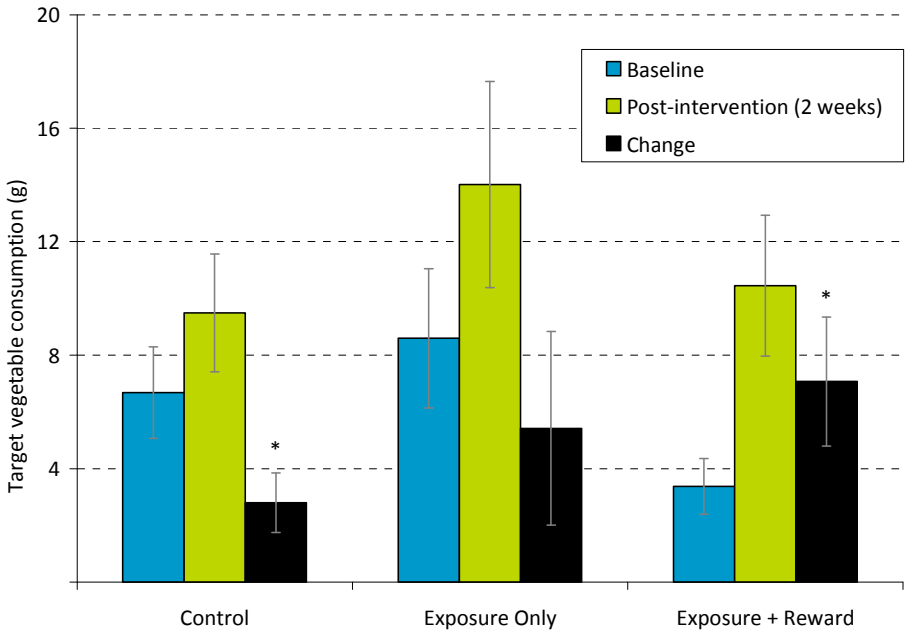

Figure 3. Mean (SE) target vegetable consumption (g) at baseline, post-intervention, and magnitude of change in consumption from baseline to post-intervention

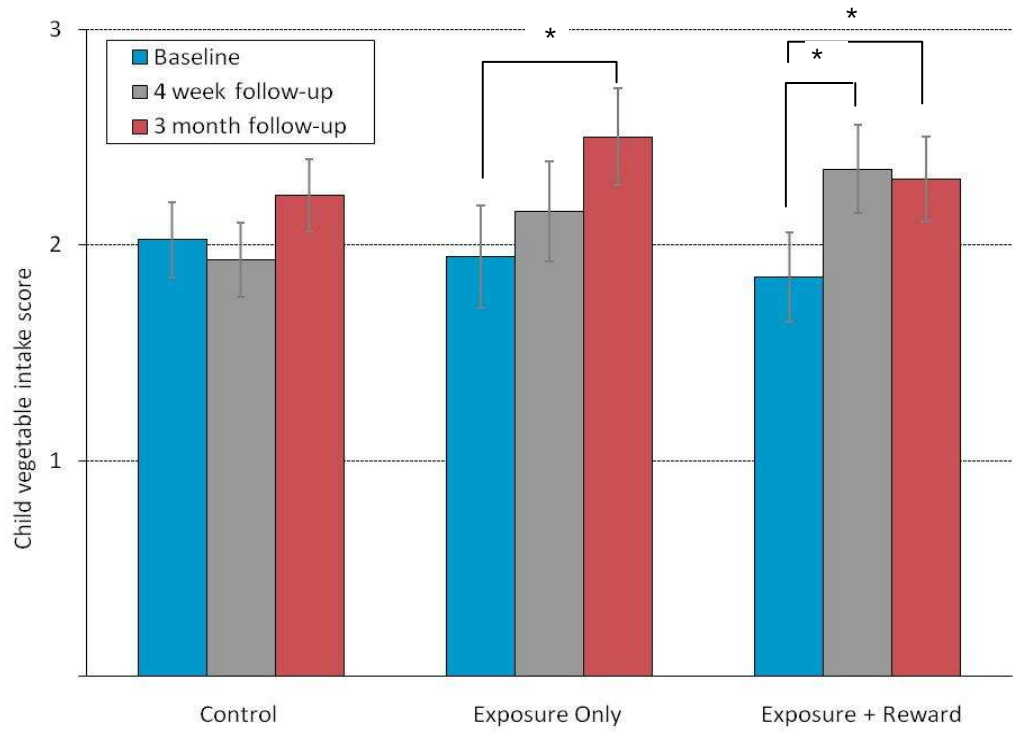

Figure 4. Mean (SE) child's usual vegetable intake score at baseline, 4 week follow-up and 3 month follow-up

Strategies to encourage consumption of the vegetable

Some parents were invited to give us further feedback based on their experiences in the study. We were interested in which aspects of the instruction booklet you found to be the most useful

in encouraging your child to eat the vegetable. Nine strategies were identified. The 3 most commonly mentioned were Size of Vegetable, Low Key Approach, and Instructions. Parents indicated that presenting a small amount or piece of the vegetable was helpful in encouraging the child to taste the vegetable. Keeping the process low key was helpful to both the parent and the child. The instructions (which included the flow chart along with general tips) made it easier for the parent to know how to encourage the child to taste the vegetable and manage different situations. The Repeated Exposure message (the intervention focus) was also identified as a helpful concept in reminding you about the importance of persistence and the value of even 'small tastings' in encouraging liking of vegetables.

Conclusions

In summary, taste exposure is a simple technique that parents can use at home to increase children's liking of a vegetable that they did not previously like.

Next steps for you

As the results show that the technique needs to be repeated across a range of vegetables we hope you will continue to follow the procedure in some way. Even if the intensive 2 week technique didn't suit you or your child, keep in mind the basic principle which is 'to keep offering small amounts of different vegetables for your children to try'. Exposing children to a range of vegetables is likely to encourage them to eat a wide variety of foods. Eating a variety of foods is generally thought to be useful in obtaining a healthy diet.

If you find it helpful to use a reward to encourage your child's taste for vegetables, remember that a reward should be immediate, not food-related and help the child to measure and communicate their achievement of tasting. It should not be a bribe. You might be interested to know that parents in the Exposure + Reward group offered the target vegetable more often during the study, and the children were more likely to taste the vegetable and were less likely to refuse to taste the vegetable.

Next steps for us

We have asked for further funding to extend this work across Australia. We are aware it can be difficult to offer vegetables to children who persistently refuse to taste them so one aspect of a new study would be to see if we can provide information that might help parents in this respect. We have also taken on board your feedback from the interviews. If we are successful in obtaining funding, we will test how helpful such support may be.

This project has been funded by Horticulture Australia Limited using the vegetable levy and matched funding from the Australian Government.

Thank you

Nadia Corsini & David N Cox

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