



Tooty Fruity Vegie in Preschools Program Report 2008



NSW Health Department

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Executive Summary

In Australia, the prevalence of overweight and obesity in children has increased markedly over the past few decades.^{1,2} The rising levels of childhood obesity are likely to have major public health consequences since overweight tracks from childhood into adulthood and there is evidence that the precursors for diabetes and cardiovascular disease, some of which may be irreversible, already exist in overweight and obese children.^{3,4}

The Tooty Fruity Vegie Preschool project was developed by North Coast Health Promotion (NCHP) following the success of the Tooty Fruity Vegie in primary schools program, which has been implemented since 1999 in over 50 primary schools.^{5,6,7} Following the NSW childhood obesity summit,^{8,9} which highlighted preventing weight gain in early childhood as an effective population health intervention, the NCHP decided to develop a program that would target preschool children. NSW Health has contributed \$150,000 towards program implementation and evaluation. The 2006 program was a pilot to test both the feasibility of strategy implementation and evaluate whether any changes were possible with a one year intervention. A streamlined program was then implemented in 2007. Preschools volunteered to be part of the program and preschools with high numbers of Aboriginal children were prioritised over other preschools which became the control preschools.

Results from the project were very positive. In comparison to control students, intervention students significantly increased the number of fruit and vegetable serves in their lunch boxes and improved their Fundamental Movement Skills (FMS).

The percentage of children who had no Energy Dense Nutrient Poor (EDNP) items in their lunch boxes significantly increased in intervention preschools from pre to post while decreasing in controls. The percentage of children who had two or more EDNP items in their lunch boxes significantly decreased in intervention preschools from pre to post while increasing among controls.

Anthropometric findings were promising. There was a significant change in the mean waist circumference of children in intervention and control preschools between pre and post resulting in a mean relative decrease of waist circumference of 0.8cm among intervention preschool children. There were significantly less children who had an early adiposity rebound in intervention preschools when compared to controls.

These results indicate that the program was very successful in increasing healthy eating and active play behaviours for preschool children in the North Coast area of NSW. These positive results will assist the NCAHS and NSW Health to further develop programs which help address NCAHS and NSW Health goals of reducing childhood overweight and obesity.

A. Background

In Australia, the prevalence of overweight and obesity in children has increased markedly over the past few decades.^{1,2} The rising levels of childhood obesity are likely to have major public health consequences since overweight tracks from childhood into adulthood and there is evidence that the precursors for diabetes and cardiovascular disease, some of which may be irreversible, already exist in overweight and obese children.^{3,4}

Many of the behaviours linked to inappropriate weight gain, such as eating habits, food preferences, motor skills and enjoyment of physical activity, are formed in the early period of life before school, making this age group an important target for the prevention of obesity.³ Preschoolers are more likely than school-aged children to modify lifestyle behaviours¹⁰. One of the most effective ways to reach children between the ages of 3 – 5 years is through early childhood care facilities.¹

Although early childhood care offers enormous potential for addressing important issues linked to the development of childhood weight problems, only a few programs have published results and even fewer have sought to evaluate outcomes in terms of weight related variables.⁴

Programs that include a range of healthy eating and active play strategies, through supportive environments, formal curricula as well as parental education, offer promising results in arresting increasing levels of childhood obesity.³ Children with greater FMS proficiency tend to be more physically active¹¹ and are less likely to be overweight.¹² Little is known about current physical activity promotion at childcare. Taggart and Keegan's research suggests that childcare settings need to have both free play and adult-directed teaching of FMS.¹⁰ Child care staff have reported a lack of confidence, ideas and competence as barriers to providing structured opportunities for teaching children FMS.¹³ They have identified the need for comprehensive developmentally appropriate resources on healthy eating and physical activity.¹⁴

Replacing energy dense snacks with fruit and vegetables is a promising strategy for reducing energy intake.³ Children's food and drink intake are influenced by: exposure to foods and drinks, parental food preferences, role modelling, child parent interactions around food, parenting style, food security, genetic factors, perinatal effects and television viewing habits.¹⁵ In childcare, the key influences are: nutrition policies, formal curriculum, food exposure, physical education and the knowledge attitudes and practices of staff.¹⁵

The aim of the Tooty Fruity Vegie in Preschools program was to prevent unhealthy weight gain. Early childhood is a critical time for prevention and for establishing healthy eating and active lifestyles. Formal childcare services provide an important opportunity to influence food and activity patterns in young children.³ This project aimed to reduce the rising level of childhood obesity by increasing physical activity levels and reducing intakes of energy-dense food and drinks. Evidence in childhood obesity prevention is lacking but the objectives and strategies chosen are based on best available evidence from local, national and international projects and the ten key principles for obesity prevention based on the International Obesity Task Force.^{5, 16, 17}

B. Intervention Components and Strategies

The project aimed to increase community awareness of the importance of healthy eating and active play for children amongst parents and staff of eighteen North Coast preschools. The intervention included two components: 1. a healthy eating program, and 2. a physical activity program.

The healthy eating strategies included:

- Developing and implementing changes to preschool policies and environments (e.g. lunch box contents, sweet drink reduction, and availability of water)
- Improving staff & parents' knowledge and skills regarding healthy food, healthy eating and related parenting skills
- Providing positive food based integrated nutrition education to children (e.g. kids in the kitchen program, food tasting).

The physical activity strategies included:

- Developing and implementing changes to preschool policies and environments (e.g. integration of movement skills into program/curriculum)
- Implementing a fundamental movement skills training program
- Improving knowledge & skills of staff and parents regarding movement skills, encouraging physical activity and reducing sedentary behaviours especially screen based activities.

Project management teams (PMT) with representation from preschool staff, parents and health staff, were formed to ensure community ownership and took an active role in planning, implementation and evaluation of the program. The project focused on skilling and supporting parents in negotiating change in family eating and activity patterns. In particular, the project aimed to;

- decrease children's daily energy intake by replacing energy-dense snack foods with fruits and vegetables;
- decrease daily consumption of sweet drinks and increase water consumption;
- improve children's fundamental movement skills by providing the "FunMoves"¹⁸ program at preschools twice per week; and
- increase activity levels in the two hours after preschool by promoting active play and decreasing time in sedentary activity (television and computer games).

Preschools were encouraged to increase the number of physical activity sessions throughout the week. The PMT implemented sustainable strategies such as forming policies on active play, access to water and healthy food and the PMT and preschool staff ensured effective implementation of these policies. The preschools have formed ongoing partnership with the Area Health Service.

Intervention Plan

This project reflects the aim and guiding principles of the National Public Health Strategic Framework for Children 2005-2008 “Healthy Children – Strengthening Promotion and Preventing across Australia”. The strategies listed below reflect the framework’s strategic directions:

1. Strengthen capacity of communities
 - a) Increase community awareness of issue.
 - b) Community ownership of program (Community Participation in planning, implementation and evaluation)
2. Target Aboriginal and low SEIFA areas
3. Improve the knowledge and skills of key staff (preschool staff and parent volunteers)
4. Promote positive food based nutrition education to children.
5. Transform environments
6. Strengthen capacity of parents and families.
7. Develop Partnerships and mobilise resources
8. Build evidence and track progress for policy programs and practice

C. Evaluation Methods

This study had a quasi-experimental design and included process, impact and outcome evaluation. Most results were analysed via two-level or three-level hierarchical multiple regression models. Such models are considered best practice in educational research when clustering of individuals within schools is likely.¹⁹ A number of variables were measured in February/March (when the bulk of children are expected to have enrolled for the year) preceding the intervention and again in November/December after the conclusion of the intervention. The study was staged in 2 discrete phases in 2006 and 2007 (see table below). The data was pooled to measure the impact of a 9 months intervention in 18 intervention preschools by comparing them to 13 controls.

Participating preschools were selected from a pool of interested preschools. Once expressions of interest from preschools are received, a stratified random selection process took place. Firstly, preschools with high proportions of children of Aboriginal or low-income families were identified from preschool reports. At least 8 preschools from this group were randomly selected. The remaining intervention preschools were randomly selected from the pool of average or high parental income preschools. A similar process was followed for the selection of control schools so intervention and control preschools would be matched in terms of parents’ income and Aboriginality.

Main variables measured/examined

The main outcome variables and the instruments used to measure them are summarised in Table 1. Predictor variables intervention/control, pre/post and a variable for their interaction were used to assess the intervention effect on pre to post changes in outcome variables. Gender and age were covariates in the analysis. Anthropometric measures (weight & height, waist circumference) were also taken using standard procedures.

Instruments of measurement/observation and their validity

The parent survey had identical or very similar questions to the NSW Child Health Survey regarding both nutrition and physical activity. The parent survey and lunchbox audits were both adapted from the Deakin University Sentinel Site study, Romp and Chomp.²⁰

Validity of parents' food records regarding fruit and vegetable serves has already been demonstrated in the TFV in primary schools project.⁷

The Test of Gross Motor Skills Development (TGMD – 2) was used to test fundamental movement skills in this age group.¹¹ It is a norm-referenced measure of common gross motor skills, which has been validated for ages 3-11.¹¹

Table 1 Variables and Measurements

Main Outcome Variables*	Measured by/Instrument
<p><i>Body Mass Index (BMI) calculated from height and weight measurements.</i></p> <p><i>BMI based overweight and obesity status for age and gender.²¹</i></p> <p><i>Early (before age of 5.5 years) adiposity rebound based on difference between BMI values and pre and post (if post value greater than pre then adiposity rebound commenced).</i></p>	<p><i>Direct measurement of height and weight using height chart and scales.</i></p>
<p><i>Waist circumference in cm.</i></p> <p><i>Percentile cut-off points by age and gender (binary variable, eg 0=under percentile cut-off, 1=in the top 20 or 10% of waist girth for age and gender).</i></p>	<p><i>Measuring tape</i></p>
<p><i>Gross Motor Skills Quotient: aggregated and standardised score of six object control skills (overhand throw, catch, stationary dribble, stationary strike, kick, underhand bowl) and six locomotor skills (run, horizontal jump, side slide, gallop, hop, leap)</i></p>	<p><i>Modified test of gross motor skills development – 2¹¹</i></p>
<p><i>Food brought by child to preschool:</i></p> <ul style="list-style-type: none"> ▪ Number of fruit and vegetable serves in lunch box ▪ Number of energy dense & nutrient poor (EDNP) food items in lunch box¹ ▪ Number of sweet drinks (including fruit juice) in lunch box 	<p><i>Lunch box audit</i></p>

Main Outcome Variables*	Measured by/Instrument
<i>Child's nutrition and physical activity behaviours, and household environment/ethos reported by parent:</i> <ul style="list-style-type: none"> ▪ Time child spent outdoors after preschool yesterday ▪ Time spent by child in screen based activities yesterday ▪ Fruit serves eaten yesterday ▪ Occasions child ate legumes or vegetables yesterday ▪ EDNP snacks and high fat takeaways serves eaten yesterday ▪ Sweet drinks serves consumed yesterday ▪ Glasses of water (250 mls) consumed yesterday 	<i>Parents' survey</i>
Predictor Variables	
<i>Gender</i>	<i>Consent form</i>
<i>Age in months</i>	<i>Calculated from date of birth on consent form and date of research team visit to preschool</i>
<i>Intervention / Control</i>	<i>Preschool level variable</i>
<i>Pre / Post</i>	<i>Preschool level variable</i>
<i>Intervention/control by pre/post interaction</i>	<i>A calculated interaction term</i>
<i>Frequency of eating evening meal while TV is on</i>	<i>Parents' survey</i>
<i>Parents' enforcement of rules regarding playing outside, trying new foods and restricting time spent in screen based activities</i>	<i>Parents' survey</i>

* Some outcome variables listed were also used as covariates and predictors in other models

¹ EDNP items included sweet biscuits, bars, twisties, chips packets, roll-ups, sweet dips, lollies and other confectionary)

Data collection and analysis

Trained staff collected children's weight, height and waist circumference and lunch-box data. They also surveyed parents and the preschool directors. The data collection team visited preschools on two different days to maximise the number of children participating. Parents' written consent for anthropometrics and lunchbox checks were obtained before this but parents did not know the exact date of the audits (this minimised unusual lunchboxes on the day).

All data were entered into an MS Access database. Data cleaning, descriptive and univariate analyses were done using SAS. For final analysis, the data were exported into MLwiN. Multi-level regression models were fitted with link functions according to the distribution of outcome variables. Two or three

level models were fitted, i.e. occasions (pre/post) within students within preschools. Data entry, management and analysis were done by NCAHS Health Promotion Research and Evaluation staff. A Southern Cross University statistician was consulted during the final analysis.

Ethics Approval

The project received an ethics approval from the Health Service's Human Research Ethics Committee (HREC approval # 321) and each preschool committee approved the study prior to their enrolment in the program.

Process Evaluation

Process evaluation was undertaken to assess the extent to which the overall aims of the program were achieved as well as the uptake of individual implementation strategies within each intervention preschool. A survey of preschool directors in December of the intervention year explored the preschool director's perceptions of, and reactions to, both the individual strategies and the overall project.

A semi-structured interview was used to assess intervention preschool directors':

- Reasons for participating in, expectations of and satisfaction with the project overall;
- Perceptions of the level and acceptability of the project's demands on their own and other staff's time,
- Perceptions of staff and parent-volunteers' reaction to the project;
- Perceptions regarding the degree of success of the various strategies in their preschool;
- Intention to continue with the various strategies and perceived support required to do so.

D. Results

Sample and settings

Records from 560 students (yielding a total of 1005 records with 537 and 468 records at pre and post respectively) in 18 intervention and 13 control preschools were used in the study. Six intervention and one control preschools participated in the pilot project in 2006. The 2006 control preschool became an intervention preschool in 2007 with additional 11 intervention and 12 control preschools. This brought the total number of participating preschools to 30 with one school being control in 2006 and intervention in 2007. Of the 1005 records collected, there were 966 complete records of lunch-box audits (96.1%), 952 complete records for anthropometric measures (94.7%), 789 complete records of fundamental movement skills testing (78.5%), and 699 returned parent surveys (69.6%).

Process Evaluation

Achievement of overall aims of the project:

1. Strengthen capacity of communities

a) Increase community awareness of issue. The results of the Centre for Overweight and Obesity “Weight of Opinion” study¹⁴ and the School’s Physical Activity and Nutrition survey¹ were used to prepare media releases to increase community understanding of childhood obesity issues and of the need for prevention in early childhood.

Six TFV newsletters were distributed to preschools throughout the course of the project. The newsletters provided information related to healthy eating, fundamental movement skills and current research related to these issues. Some newsletters provided findings from data collected during the pre data collection phase of the project.

The project and the issue were promoted at the parent events at preschool in each of the four terms.

b) Community ownership of program (Community Participation in planning, implementation and evaluation)

All community based preschools where food is provided from home in the North Coast Area were sent invitations to join the project. Thirty one preschools from Coffs Harbour to Tweed Heads applied for and participated in the project during 2006 and 2007 and were either in the intervention or control arms of the study with control preschools having the option to receive the intervention in 2008 as an incentive to participate.

In all preschools a project management team (PMT) was formed with representation from parents and preschool staff. These teams assisted the NCAHS staff in planning, implementing and evaluating the program in their centres.

2. Target Aboriginal and low SEIFA areas

The project particularly targeted preschools with high numbers of Aboriginal and low income families.

3. Improve the knowledge and skills of key staff (preschool staff and parent volunteers)

Preschool staff were trained to provide healthy eating and physical activity programs within their preschools. The programs included learning activities, cooking and gardening programs and active games at preschool. Preschool staff were trained to deliver an age-appropriate fundamental movement skill acquisition program adapted from the “Lets Get Moving’ program, developed by Queensland Department of Sport and Recreation. We called the TFV Fundamental Movement Skill program (FMS) “FunMoves”.¹⁸

In 2006 parent volunteers were trained to run a cooking program with children in the preschools. This strategy was not repeated in 2007 as most of the preschools had their own cooking activities set up in a way which suited the organisation of their preschool. However we did promote the use of healthy recipes and provided the preschools with several healthy recipes which are based on fruit and vegetable ingredients.

4. Promote positive food based nutrition education to children.

Children received experiential healthy eating sessions including cooking and gardening. All children have participated in fruit and vegetable tasting sessions in each of the four terms.

Teachers provided indirect healthy eating messages included in arts, crafts, music, dance and role-playing activities which reinforced these experiences.

In Term 3 of 2006 and 2007, a fruit and vegetable puppet show from Brisbane performed at all 18 intervention preschools and was very well received.

5. Transform environments

Playground layout was not reviewed by project staff but was discussed with preschool staff and general recommendations to better promote active play were made.

6. Strengthen capacity of parents and families.

NCAHS staff provided a parent session in each of the 4 terms. Parent sessions focused on skilling and supporting parents in negotiating change. These sessions included skill development in feeding “fussy eaters”, parent and children’s roles and responsibilities in eating healthy food and drinks, healthy lunchboxes, positive eating environments, active play, fundamental movement skill development, active transport and neighbourhood walks, adequate sleep and limiting screen time. These messages were reinforced in preschool resources and newsletters.

The parent sessions only attracted a small number of parents, with the best attended being the session focussed on healthy eating. We “piggy backed” the FMS talk onto “school readiness” programs run for parents in Term 4. This strategy was successful.

A brief description about the project is included on the NCAHS website.

Bright posters were developed for communicating changes to the lunchbox policy to parents and staff, at the request of the preschools.

Recipes were provided for the preschools to photocopy and distribute to parents after the children had cooked the recipe in class. Some of these recipes were also included in the newsletters.

7. Develop Partnerships and mobilise resources

In 2006, eight final year Exercise Science students (Southern Cross University) were trained in the Queensland Sport and Recreation’s program for preschoolers “Moving with Children”. These students were assigned to each intervention preschool and they conducted two 30 minute sessions per week for the first three terms of 2006. The students and preschool staff shared expertise in physical activity and preschool education and were both enriched by the internship. In Term 4 the preschool staff delivered the FMS program themselves. At the end of 2006 the program was modified and revised with input from the preschool staff, the Exercise Science students, early childhood education specialists and children’s physical activity specialists. The new updated version of the FMS program was called FunMoves.

In 2007 preschool teachers were trained to deliver the new FMS program (FunMoves). Preschool staff conducted at least two or more 30-minute FunMoves sessions per week for the entire year of intervention.

In 2007, health promotion officers and nutritionists who had offered to be involved in supporting the program in the preschools attended the Preschool teachers' training day. They were given specific training on how to support the program in the preschool while the preschool teachers were trained in FMS.

A copy of Queensland Sport and Recreation's program for preschoolers "Lets Get Moving" was also provided to all teachers who attended the training in 2006 and 2007.

8. Build evidence and track progress for policy programs and practice

Changes in policy and practice in preschools (healthy lunches, access to drinking water), adequate space for physical activity, regular structured physical activity sessions and increased access to partners ensure the sustainability of this project.

After finishing preschool, many of the children entered primary schools that conduct the Tooty Fruity Vegie project (currently running in 55 schools) and so parents and children will receive continuity of healthy eating messages for the next seven years of schooling.

Evaluation of strategy implementation at each preschool;

Director Interviews

While a complete analysis of the director interviews is still underway, preliminary results show that the Director Interviews indicated that all preschools updated their nutrition policies and continue to implement them. In 2008 a health worker follow-up visit to handover and explain the evaluation report has met with very positive responses. All preschools visited were very appreciative of the follow-up and were keen to find out the results of the overall study. Anecdotal evidence from several preschools indicated the teachers thought the preschools had benefited greatly from being a part of the TFV in Preschool project. They felt the Nutrition Policy provided the backup to help them provide healthy eating information to parents especially in relation to what to pack in lunchboxes. All preschools noted that they have continued teaching the Fundamental Movement Skills however many have adapted the delivery of the program to suit their preschool's programming.

Impact and Outcome Evaluation

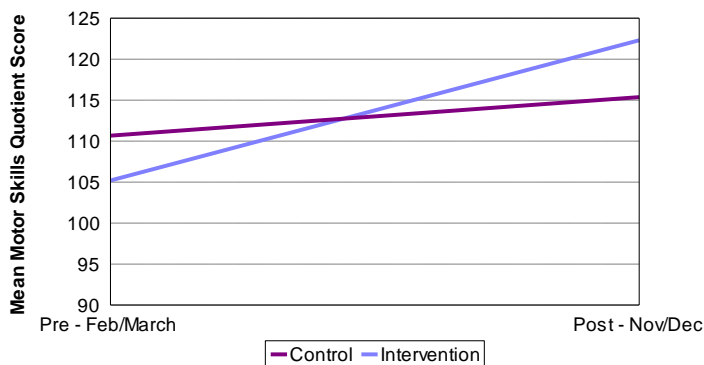
There were a number of encouraging findings:

1. Movement Skills

Both control and intervention preschools improved their movement skills. However, on average, children in intervention preschools have improved their movement skills significantly more than the children in the control preschool ($p < 0.0001$). The relative improvement was 12.4 units of the Gross Motor Skills Quotient (GMSQ), which is an 11.5% improvement in relation to baseline levels. See Figure 1.

The pre-to-post change was significantly larger among students who had poorer GMSQ scores before the intervention.

Figure 1: Significant Intervention Effect - Gross Motor Skills Quotient¹¹



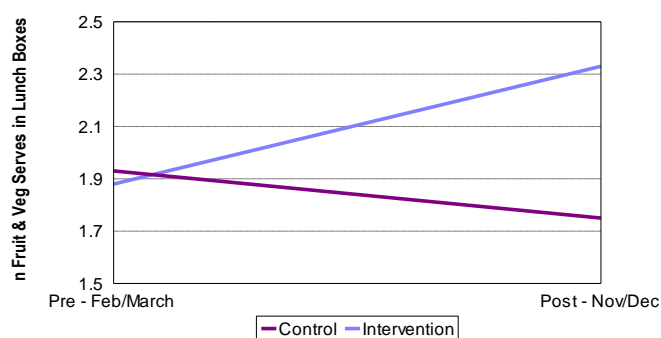
2. Foods in children's lunch boxes

a) Fruit and vegetables in lunch box

There was a significant increase ($p < 0.0001$) in the mean combined number of fruit and vegetable serves in lunch boxes among children in intervention preschools when compared to the control preschool children. The relative improvement was 0.625 serves of fruit and vegetables, which is a 33% improvement in relation to baseline levels. See Figure 2.

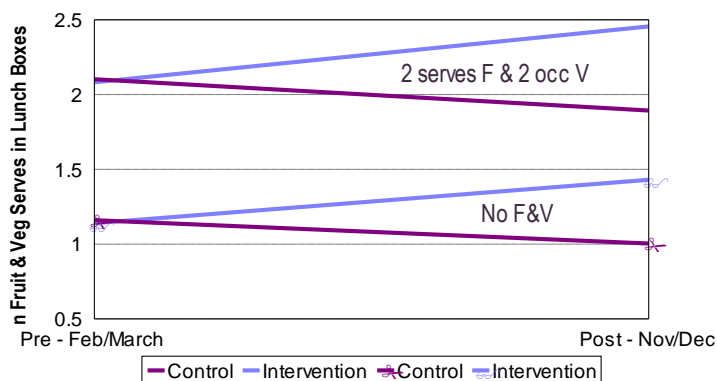
The pre to post change were significantly larger among students and preschools with lower levels of fruit and vegetables in the lunch boxes at pre.

Figure 2: Pre and post levels of fruit and vegetables in lunch boxes among intervention and control children



Increased number of fruit and vegetables in lunch boxes was not compensated for by eating less outside preschool hours. The significant increase was still present when the amount of fruit serves and occasions when child ate vegetables in the day preceding the survey was adjusted for. See figure 3.

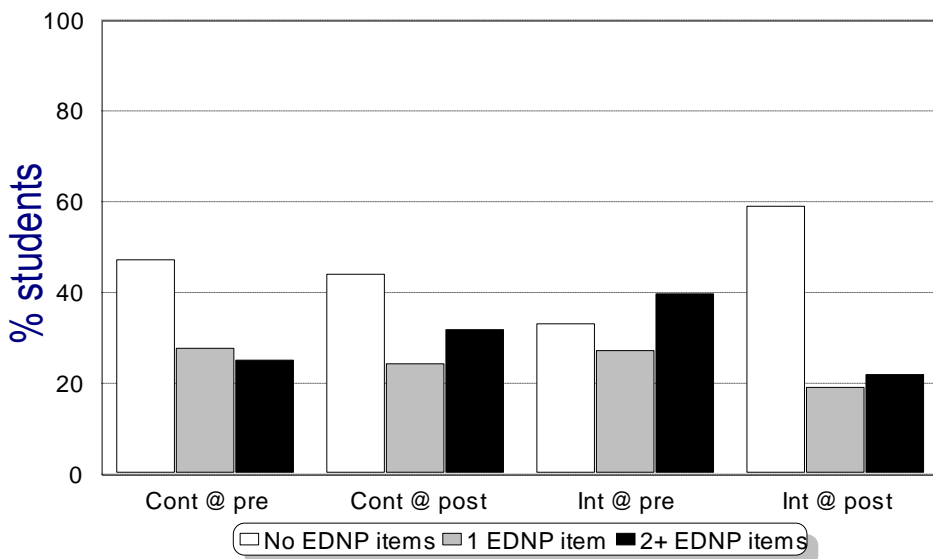
Figure 3: Lunch box fruit & vegetables – influence of fruit eaten and number of occasions vegetables eaten yesterday



b) Energy dense nutrient poor (EDNP) items in lunch boxes

The percentage of children who had no EDNP items in their lunch boxes significantly increased in intervention preschools from pre and post while decreasing in controls. The percentage of children who had two or more EDNP items in their lunch boxes significantly decreased in intervention preschools from pre to post while increasing among controls. See Figure 4.

Figure 4: Intervention effect on the number of EDNP items in lunch boxes



3. Anthropometric measures

The primary anthropometric measures for the Tooty Fruity Veggie in Preschool program were the Body Mass Index (BMI) and waist circumference. Waist circumference was included as it is considered to be a good predictor of coronary heart disease risk factors among children. The Body Mass Index (BMI) is a particularly problematic measurement for preschool children because of the adiposity rebound process that occurs between the ages of three to five years (on a population level, BMI increases between birth and the age of three, decreases between the ages of three and five and then

increases with age). Early Adiposity is considered to be an indicator for overweight and obesity later in life.²²

a) Changes in overweight and obesity rates

While the changes in overweight and obesity rates were in the desired direction, there were no significant intervention effects on BMI or overweight status.

b) Mean waist circumference

There was a significant change ($p=0.0012$) in the mean waist circumference of children in intervention and control preschools between pre and post when adjusted for age. Children’s mean waist circumference has increased in both groups, but the waist circumference of students in control preschools have increased significantly more than among students in intervention schools. This represented a relative improvement of 0.8cm.

The pre to post change were significantly larger among students with lower waist circumference at pre.

c) Adiposity rebound

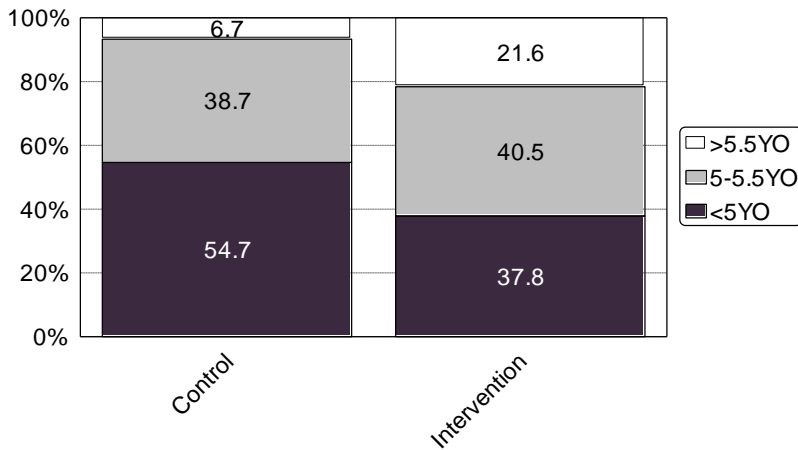
There were significantly less children who had an early adiposity rebound in intervention preschools when compared to controls ($p=0.017$) and this difference was still significant when the model was adjusted for age ($p=0.04$). See table 2 and figure 5.

Note: Within-student level pre to post changes were accounted for by creating this variable, ie early rebound was a product of comparing BMI levels at pre and post. Since this study was not designed to capture early adiposity rebound by measuring 3 times, the findings should be interpreted with caution.

Table 2: Percentage of children who had higher BMI post intervention (that is had started their adiposity rebound) among control and intervention preschool students in the 3 main age groups at post.

Age group (at post)	Control			Intervention		
	<5YO	5-5.5YO	>5.5YO	<5YO	5-5.5YO	>5.5YO
% rebound	54.29%	63.27%	38.5%	38.04%	47.10%	58.5%
% no rebound	45.71%	36.73%	61.50%	61.96%	52.90%	41.50%
% of all rebounds within cont/int	54.7%	38.7%	6.7%	37.8%	40.5%	21.6%

Figure 5: Intervention effect: % of children who started adiposity rebound by age group



E. Conclusions

The TFV Preschool program has been effective in changing parents’ and children’s behaviours, improving fundamental movement skills, increasing healthy food intake, and reducing intake of unhealthy food and drink. The program has also influenced environmental changes and nutrition policies which help to keep the program sustainable. Last, but not least, the program findings regarding overweight and obesity indicators are promising.

These findings strengthen the rationale for health promotion programs to target preschool aged children’s food intake and physical activity behaviours.

Recommendations

The outcomes of the TFV Preschool project suggest there would be positive benefits from the following actions:

- NSW Health to replicate the TFV Preschool project and rolls it out across all preschools in NSW.
- NSW Health to provide funding to support preschools in the uptake of the TFV Preschool project.
- Conduct further research into factors influencing early childhood overweight and obesity.

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