

Tooty Fruity Vegie in Preschools: an obesity prevention intervention in preschools targeting children's movement skills and eating behaviours

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Introduction

The rising levels of childhood obesity are likely to have major public health consequences since being overweight during childhood can continue into adulthood. There is evidence that the precursors for diabetes and cardiovascular disease, some of which may be irreversible, already exist in overweight and obese children.^{1,2}

Many 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.² Preschoolers are more likely than school-aged children to modify lifestyle behaviours.³ One of the most effective ways to reach children between the ages of three to five years is through early childhood care facilities.² 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.²

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.² Children with greater Fundamental Movement Skills

(FMS) proficiency tend to be more physically active⁴ and are less likely to be overweight.⁵ Little is known about physical activity promotion in childcare. Taggart and Keegan's research suggests that childcare settings need to have both free play and adult-directed teaching of fundamental movement skills.⁶ Childcare staff have reported a lack of confidence, ideas and competence as barriers to providing structured opportunities for teaching children fundamental movement skills⁷ and have identified the need for comprehensive developmentally appropriate resources on healthy eating and physical activity.⁸

Replacing energy dense snacks with fruit and vegetables is a promising strategy for reducing energy intake.² 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.⁹ In childcare, the key influences are: nutrition policies, formal curriculum, food exposure, physical education and the knowledge attitudes and practices of staff.⁹

The Tooty Fruity Vegie (TFV) program drew on the North Coast Health Promotion team's experience, where programs using similar intervention strategies in primary schools resulted in increased fruit and vegetable consumption¹⁰ and improved

Abstract

Issue addressed: This paper outlines the implementation strategies and evaluation methods of the Tooty Fruity Vegie (TFV) in Preschools program in NSW Australia which addressed diet, movement skills and overweight indicators.

Methods: The TFV program was a one-year intervention conducted during 2006 and 2007 in 18 preschools (matched with 13 control preschools). The study had a quasi-experimental design with pre- and post-intervention evaluation of nutrition and physical activity variables as well as anthropometric measures. Details of the program's methodological aspects such as the recruitment process, intervention strategies and evaluation instruments are described.

Key words: motor skills, overweight, preschools, healthy eating.

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So what?

The paper describes how the Tooty Fruity Vegie in Preschool program addressed some of the shortfalls in literature regarding childhood obesity prevention interventions.

fundamental movement skills.^{11,12} The program was piloted in 2006, and expanded to more preschools in 2007, to test the feasibility of strategy implementation and evaluate whether any changes occurred following a one-year intervention.

While the results of the program evaluation will be published in other papers, this paper describes the program's methodological aspects such as the recruitment process, intervention strategies, evaluation methods and instruments for the benefit of other health promotion and education professionals.

Methods

Recruitment

Preschools were asked to submit an expression of interest to participate in the program. More preschools volunteered for the program than the team was able to accommodate, so preschools in towns with a high proportion of disadvantaged populations were prioritised. Preschools were randomly assigned to be in the intervention or control arms of the study with control preschools having the option to receive the intervention in the following year as an incentive to participate. All children in the selected schools were invited to participate in the study. Parents provided informed consent for their children's participation and to be contacted for a follow-up study within five years.

Intervention components and strategies

The intervention strategies included skills development and awareness-raising for parents, staff and children, and social support for parents to foster behaviour changes in their children through feedback and reinforcement (positive feedback and policies on food and drinks at preschool). Project management committees (PMCs), with parents, staff and health professionals in each preschool, oversaw strategy implementation and ensured sustainability of the program after the one-year supported intervention. PMCs were also encouraged to build on the program by adding their own strategies to those below.

Selection and application of theory

The Health Belief Model (HBM)¹³ and the Competence Motivational Theory (CMT)¹⁴ helped shape the TFV strategies. HBM was chosen as the model for selecting strategies that encourage parents to provide healthy eating and active play opportunities. At parent workshops and in newsletters, parents were encouraged to consider the risks posed by poor eating and low levels of physical activity then given support and practical, achievable advice to modify eating and activity behaviors to reduce these risks. CMT suggests that children's motivation to participate in physical activity is influenced

by their actual and perceived competence, social support and enjoyment of the activities, so it guided the choice of the practical FMS and experiential food strategies for the children. The TFV team used the theory to design a games-based approach to FMS development to enable children to have fun and experience success developing skills. Similarly, sessions that aimed to introduce new foods to children used a non-threatening, play approach to reduce the aversion that they may feel and celebrate small successes.

Capacity building and community participation theories have been applied to build community action and ensure sustainability of the project.¹⁵⁻¹⁷ The PMCs were engaged to substantively participate in the project by determining the preschool's priorities and implementation, which is the second highest level of participation in Baum's continuum of participation after structural participation.¹⁶

The program drew from Goodman's 10 dimensions of community capacity¹⁷ to ensure that strong networks were built between all participants. Strategies to enhance community resources, skills and power such as PMC meetings, training and target group participation in planning and implementation were designed to develop a sense of community and shared values. Building community capacity by empowering the target group is anticipated to lead to sustainability, particularly where leadership around this program has developed through PMCs.

Healthy eating strategies

The TFV team developed some strategies and adapted others from existing programs including 'What is Better Food at Preschool?',¹⁸ 'Caring for Children',¹⁹ 'Good Food in Family Day Care',²⁰ and 'Nutrition Ready to Go at Out Of School Hours Services'.²¹ The team worked with PMCs to review any existing preschool food policies and discuss their impact on lunchbox contents. The PMCs revised the policies to explicitly identify appropriate and inappropriate foods for preschool lunchboxes. The new policy was extensively communicated to parents along with healthy lunchbox displays. Fluorescent pictorial posters of 'better foods' and 'foods better left out' were displayed in prominent areas of the preschool. The PMCs reviewed access to water and made changes to ensure all children could access drinking water at all times without having to ask an adult for assistance. Parents were discouraged from packing sweet drinks, including fruit juice, to assist in promoting milk and water consumption.

Health professionals (dietitians, health promotion officers or child and family health nurses) gave interactive workshops on positive parenting and healthy eating, with particular emphasis on how to feed fussy eaters. These workshops included tips on increasing fruit and vegetable consumption and reducing

energy-dense nutrient-poor (EDNP) food and drinks. Parents were also encouraged to attend positive parenting courses, which were available in most towns free or at reduced cost. Each preschool received a copy of the 'Family Food DVD',²² which models practical ways to improve children's eating habits, for their parent library.

Children were given simple, positive and consistent messages in a number of ways. Each term they had a visit from a health professional (often dressed in a full-sized carrot or apple costume) who conducted interactive activities such as sorting foods into 'sometimes' and 'everyday' categories. After this, children washed their hands and sat at tables with sliced fruit and vegetables platters. They used tongs and paper napkins and were encouraged to taste foods or make pictures out of the foods on their napkins. Staff gave positive reinforcement but parents were discouraged from attending these sessions (they were later told which foods their child had tried so they could continue to offer these foods at home). Parents were informed of the upcoming taste testing in advance to ensure children with known allergies were accommodated. Later in the year, children grew fruit and vegetables in gardens or pots and had simple, healthy cooking classes run by parents or staff but assisted by health professionals. In addition to these 'core' components of the program, preschool teachers were given a manual of other ideas for including positive food messages in art, drama, role-play, music and stories. A puppet show promoting the consumption of fruit and vegetables also visited each preschool.

Physical activity strategies

Preschool staff were trained to implement 'FunMoves', a games-based fundamental movement skills program that was developed by TFV project staff, at least twice a week.²³ The 'FunMoves' program was influenced by the Queensland Department of Local Government, Sport and Recreation's 'Moving with Young Children' program for preschoolers,²⁴ but was more structured and focused primarily on the 12 fundamental movement skills listed in Table 1 and their components. The 'FunMoves' program consists of two terms of 10 sessions. Each session was repeated twice per week and each term was repeated twice per year. Each session had a five minute warm-up or transition session at the beginning, which included movements that increase stability and balance. The warm-up sessions often included music or singing. After this, children moved into small groups (about five to eight children) with a staff member or roster parent, and used equipment and games to develop a particular skill. For example, children were encouraged to act like frogs and jump over lily pads in one game. After three activities (each lasting about five minutes) the children returned to a central spot and had a cool down transition time, usually with song or music. Preschool

staff received a one-day training in running the 'FunMoves' program and were given a kit comprising program notes and 30 laminated cards for each of the games. The cards contained instructions on how to set up the equipment, how to play the game, including how to adapt it for different age groups and skill levels, and verbal cues to increase children's skill proficiency. The cards were designed so that untrained parents or casual staff could quickly read the card and run the activity.²³ Preschool staff received a small grant, which covered wages for two staff to attend training and equipment for running the program (balls, bats, etc).

The PMC reviewed the playground layout and access to sports equipment during free play times and made adjustments to encourage more physical activity and easier access to water and FMS equipment during free play. Health professionals held parent workshops on teaching FMS at home and all preschool parents received written material on ideas for fun games to play with children at home. At an introductory workshop at the start of the year, parents were given information about the program as well as information on the likely causes of overweight and obesity in children and obesity prevention strategies. This workshop emphasised the need to limit screen based activities and gave tips on how to set limits and offer alternatives to screen based activities. In addition, each month a four-page newsletter was provided to each parent at intervention preschools that gave more tips on healthy eating, games to play, and how to advocate for changes to make healthy choices the easy choices in communities.

Evaluation components and strategies

Formative evaluation

In order to identify the most appropriate strategies for the target group, the authors reviewed the published literature and unpublished reports on similar interventions as well as the research on the causes of overweight and obesity in early childhood. Discussions were held with researchers and practitioners specialising in interventions for this age group across Australia. The first two authors undertook training in movement skills²⁴ for early childhood teachers and consulted lecturers from early childhood training institutions. Preschool directors were interviewed to gauge their attitudes (and their perceptions of parents' attitudes) and knowledge of childhood obesity, FMS development, nutrition issues at preschool, and their current relevant health promotion activities. These resulted in a portfolio of possible strategies that was presented to a steering committee of key stakeholders who assisted in strategy selection and the practicalities of data collection for this target group. Stakeholders included representation from the Department of Community Services (who are responsible for licensing preschools in NSW), Early Childhood teacher

training academics, preschool teachers, health promotion specialists and parents of preschool aged children.

The program was piloted in six preschools and the evaluation also conducted in one control preschool in the first year. By staging the implementation in this way, the team was able to modify the implementation and evaluation processes to be more efficient to minimise disruption in the normal preschool routine. For example, in the first year, children had their morning tea time delayed so the evaluation team could complete the measurements, which included auditing the lunch boxes. In the second year, the evaluation team modified the evaluation process to get the measurements completed before the usual morning tea. However, because the evaluation required a pooling of both years results, the implementation strategies and evaluation tools remained the same.

Process Evaluation

Process evaluation was undertaken to assess uptake of individual implementation strategies within each intervention

preschool. A structured interview with preschool directors in December of the intervention year explored the reach, frequency, director's perception of the quality and perceived sustainability of each strategy using a structured scoring matrix. The implementation level of each strategy was rated in relation to the proportion of the target group (children, parents or preschool staff) reached (reach), how often this strategy occurred (frequency), usefulness of the strategy on a 1-5 scale (quality) and the desire to continue with the strategy in the future (sustainability).

Outcome measures

The primary outcome measures for the Tooty Fruity Vegie in Preschool program were Body Mass Index (BMI) and waist circumference. Because of the short duration of the program and because the adiposity rebound common in this age group may obscure the intervention effects on overweight and obesity indicators, the intermediary impact indicators were very important. They included: FMS proficiency, access to and consumption of fruit and vegetables, EDNP food and sweet

Table 1: Outcome and predictor variables and measurement instruments.

Outcome Variables	Measured by/Instrument
Gross Motor Skills Quotient: aggregated and standardised score derived from testing 12 skills, six object control skills (overhand throw, catch, stationary dribble, stationery strike, kick, underhand bowl) and six locomotor skills (run, horizontal jump, side slide, gallop, hop, leap).	Modified test of gross motor skills development ^{2,25}
Body Mass Index calculated from height and weight measurements.	Direct measurement of height and weight
Overweight and obesity status for age and gender (Cole et al. 2000). ²⁸	Calculated using Cole et al. (2000) age and gender cut-off levels.
Change in BMI ²⁹	Calculate BMI change using pre and post levels.
Commencement of adiposity rebound ³⁰⁻³²	Based on BMI change trajectory.
Waist circumference in cm	Measuring tape
Percentile cut-off points by age and gender (binary variable, e.g. 0=under percentile cut-off, 1=in the top 20 or 10% of waist girth for age and gender).	
Child's nutrition and physical activity habits, and household environment/ethos reported by parent:	Parents' survey
<ul style="list-style-type: none"> • Time child spent outdoors after preschool yesterday, • Time spent by child in screen based activities yesterday, • Games played with child yesterday, • Transport mode to and from preschool yesterday, • Parents' enforcement of rules regarding trying new foods, playing outside and limiting TV viewing time • Fruit serves eaten yesterday • Occasions child ate legumes or vegetables yesterday • Energy dense & nutrient poor (EDNP) snacks and high fat takeaways serves eaten yesterday • Sweet drinks serves and mls of water consumed yesterday • Frequency of eating evening meal while TV is on • Number of fruit and vegetable serves in lunch box • Number of EDNP food items in lunch box • Number of sweet drinks (including fruit juice) 	Lunch box audit
Predictor Variables	
Gender	Consent form
Age in months	Calculated from date of birth on consent form and date of visit
Intervention / Control	Preschool level variable
Pre / Post	Preschool level variable
Intervention/control by pre/post interaction	A calculated interaction term
Apparent Heat Index from measured temperature and calculated relative humidity. Used in model to adjust for effect of apparent stress on FMS performance. ^{33,34}	A calculated variable. Dry and wet globe temperatures in Co taken in every preschool

drinks, time spent in screen-based activities and outdoors after preschool and parenting styles. Outcome measures were assessed at baseline and 10 months later. The data collection method for each outcome and predictor variable is described in the table below and the paragraphs following it. Measurements were taken at the end of the summer (start of the school year) and at the beginning of summer (end of the school year).

Anthropometrics

Trained health professionals measured the weight and height of children. Weight was measured in light clothing and without shoes to the nearest 0.1 kg using digital scales. Height was measured to the nearest 0.1 cm using a stadiometer and all measurements were taken in the morning prior to the mid morning snack, by trained investigators. Waist circumference was taken at the level of the natural waist, between the ribs and ileac crest and over the navel, at the end of a normal expiration. Measurements were taken at the end of summer (start of the school year) and at the beginning of summer (end of the school year). Following the pilot, only two research assistants measured waist circumference and they measured the same children pre and post.

FMS

FMS proficiency was measured using the second edition of the Test of Gross Motor Development (TGMD-2). The children's average performances for two trials of each of the 12 skills was recorded and compared to age and gender adjusted standards.²⁵ Test conditions, where possible, were standardised in all preschools and were usually conducted outside on soft fall or grass in the shade. Concrete was used for the dribble. Each test was done using the same equipment and where possible, the same observer observed children at the pre and post testing. Children in both control and intervention preschools were given set prompts to do their best, i.e. run fast, throw hard, dribble gently, and told the direction of where to run, throw, jump etc. The testers also demonstrated each skill before each child's turn. Children participated in the FMS testing individually or in pairs. The observers were first trained using slow motion video imagery of preschool children attempting all 12 FMS, and then practiced testing preschool and primary school age children of Health Promotion staff members. When primary school children participated they were asked to perform skills using their non-dominant limb.

Physical activity outside preschool

Parental report of physical activity engagement of their young children is a reasonable method of physical activity assessment in this context.²⁶ Each parent self-completed a written survey asking about time spent in small screen activity and outdoors

and mode of travel to preschool on the previous day, based on the 'Romp and Chomp' eating and activity survey.²⁷ Testing was conducted only between Tuesdays and Fridays to eliminate differences in activity patterns due to weekends, and on the same day for each preschool pre- and post- intervention at the start of the day before morning tea.

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.

Discussion

This program is the only preschool obesity prevention program of this kind that we know of in Australia. A recent synthesis on the evidence on the effectiveness of interventions to prevent unhealthy weight gain in children found there was a significant gap in obesity prevention programs targeting preschool aged children.²⁶ In Victoria, the Romp and Chomp program focuses on helping families with 0-5 years olds lead healthy active lives by using early childhood services to give key messages about healthy eating and active play, supportive policies and training for staff and education resources and social marketing messages. In Queensland, The Department of Local Government, Sport and Recreation has developed Moving with Young Children, a training program to help early childhood staff incorporate age-appropriate physical activity into early childhood environment.²⁴ The key difference between our program and these other two is that our program uses a structured, twice weekly fundamental movement skill and practical healthy eating curriculum as part of the preschool program that was complemented by strategies aimed at parents.

The TFV program has several limitations. The structured curriculum that included twice-weekly FMS sessions is in contrast to the emergent curriculum framework where children are free to choose to become involved in activities or not. However, the steering committee felt that the current practice allows too many children to spend the entire day at preschool being sedentary and that providing two half-hour FMS games sessions per week for the whole group of children was not overly structured and could be compared to the existing Movement in Music sessions.

The evaluation for the program was designed to capture changes in several important intermediary impact indicators (levels of proficiency of fundamental movement skills, dietary intake, parenting styles and physical activity levels), that would support any changes in anthropometrics, by using a variety of instruments that had been validated in Australia with similar

Table 2: Methodological issues in evaluation process.

Methodological issue	Managed by
Selection process: Preschools were allocated to become control or intervention after expressing interest. This situation often induces a 'priming and training effect' of the evaluation on staff teaching and may improve outcomes among control preschools	Control preschools were promised program resources and the opportunity to participate in the program in the year following the study. But specific information (eg skill components and skill training activities) was withheld during the first year. An interaction term pre/post* intervention/control was used in the final analysis to detect significant changes that were due to intervention and beyond possible 'training effects' which may have occurred in control preschools.
Preschool level factors (policies, culture, way of implementing the project) could produce a large clustering design effect	Specialist software was used in the final analysis which fitted multi level regression models that included student and preschool level variances as well as all other relevant predictor variables.
Parental consent including a possible follow-up study	Written parental consent was required prior to children participating in all evaluation activities. Parental consent was also sought to be contacted in future for a follow-up study.
Parent survey design and administration and response rates	The survey was based on the Deakin sentinel study so comparable data were collected. Additional questions were added regarding mother's education, Aboriginality, whether or not any parents had completed a parenting course in the past two years, and the number of hours the child slept on the previous night. Due to resource constraints the survey was administered as a written questionnaire rather than a telephone interview. While some parents had time to fill the survey in the preschool, many parents took it with them to return by mail. A second round of parents' surveys was sent to parents, who did not return their surveys, within a week, using the preschool pigeon-hole system.
Measuring FMS	The Test of Gross Motor Skills Development (TGMD) ²⁵ is a validated instrument for both clinical and population studies for the ages of 3-10.
FMS measurement reliability	Each of the six testers was paired with each of the other testers for reliability measurements during training and the pilot study. It was impossible for more than a pair of testers at a time to score a child's movement skills due to space restrictions, the children's age and their response to a large number of adults observing them. Under these circumstances Pearson correlation coefficients for paired observations were calculated for the gross motor skill quotient scores (which was the main outcome variable for FMS) to determine inter-tester reliability. A high inter-tester reliability was established. Since there was less scope for further reliability testing during the 2007 implementation due to the size of the project and the available resources, the same testers conducted pre and post testing on the same child in most cases.
Waist circumference measurement reliability	Waist circumference was included as it is considered to be a good predictor of coronary heart disease risk factors among children. ³⁵ In the pilot stage, there were issues regarding the accurate recording of waist circumference. In the second stage of the project, waist circumference was measured only by two trained research assistants who measured the same children at pre and post whenever possible. Only records of preschools where the same tester measured waist circumference pre and post were used in the analysis.
Body Mass Index (BMI) is a somewhat 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). ³²	Cole et al. (2000) have determined age and gender adjusted overweight cut-off points for children based on 25 and 30 BMI units at age 18 from a pooled dataset combining a number of large international datasets. ²⁸ Other overweight and obesity indicators were included in the study, i.e. waist circumference, BMI change, adiposity rebound commencement.
Height measurement equipment	Children were frightened of the height rod in the pilot stage so it was replaced with a laminated giraffe height chart.
Lunch box audit reliability	Testers recorded the lunch box contents in detail. An experienced coder coded all lunch box content data. Fruit and vegetables were coded into servings and potato crisps and fruit juice were not counted as fruit and vegetables. EDNP food and drinks do not have recognised serve sizes so were counted as number of items.

aged children.^{4,27} Many of the instruments used had been trialled in Australia and proved to be acceptable to parents, children and early childhood staff.²⁷

However, the evaluation raised a number of methodological issues that had to be addressed by the project team. Table 2 describes the key methodological issues and how they were managed.

The use of formative evaluation and a pilot stage enabled acceptable intervention strategies and evaluation methods to be selected for the target group and setting, and assisted in the project becoming a collaboration between partners rather than an implementation on preschools. The two-staged design of implementation allowed the team to feedback to the steering group and enabled rapid fine tuning of the intervention and evaluation strategies and procedures in response to evaluation feedback. The downside of this was that some of the data collected in the first year could not be used in the final analyses. Allowing preschools to add additional strategies to the prescribed ones assisted in preschools taking ownership of the project, but again, made the analysis more complicated.

The forthcoming results of the project will provide much needed information about the efficacy and feasibility of the strategies used in the study. Long-term follow-up (five years) is planned. This paper will allow other research groups to benefit from the experience of the project. The project is highly transferable and based on the preliminary results NSW Health is rolling the program out to all child care centres in NSW over the next four years.

There are many challenges in designing a multistrategic intervention with children and more so when it includes a comprehensive evaluation. The evaluation methods needed to be acceptable to young children, their parents and carers and meet Ethics Committee standards and of course, do no harm. The evaluation and research design had to be rigorous yet appropriate to the applied nature of the research, and the human and financial resources available for the health promotion team. The intervention had to be flexible enough for preschools to take ownership of the program and value-add to the prescribed strategies so as to make measurable changes in healthy eating and physical activity and contribute to the sustainability of the program.

Health Promotion practitioners working in areas where existing evidence is sparse need to ensure that they design interventions using relevant theories, refine their plans based on results of their formative evaluation, include rigorous evaluation and consider how the research outcomes can add to existing evidence. However, this needs to be balanced with the need to deliver acceptable, effective and efficient interventions that improve the health and well-being of the community.

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