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Randomised Clinical Trial of a Family-Based Lifestyle Intervention for Childhood Obesity Involving Parents as the Exclusive Agents of Change

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Abstract

Parent-centred interventions for childhood obesity aim to improve parents' skills and confidence in managing children's dietary and activity patterns, and in promoting a healthy lifestyle in their family. However, few studies assess changes in parenting over the course of treatment. This study describes the evaluation of a lifestyle-specific parenting program (Group Lifestyle Triple P) on multiple child and parent outcomes. One-hundred-and-one families with overweight and obese 4- to 11-year-old children participated in an intervention or waitlist control condition. The 12-week intervention was associated with significant reductions in child BMI *z* score and weight-related problem behaviour. At the end of the intervention, parents reported increased confidence in managing children's weight-related behaviour, and less frequent use of inconsistent or coercive parenting practices. All short-term intervention effects were maintained at one-year follow-up assessment, with additional improvements in child body size. The results support the efficacy of Group Lifestyle Triple P and suggest that parenting influences treatment outcomes. Further research is needed to evaluate the long-term effectiveness of the intervention and to elucidate the mechanisms of change.

Keywords: Childhood obesity; Family-based; Treatment; Parenting; Triple P

Introduction

Family-based intervention for childhood obesity is well established in the treatment literature. Clinical trials have demonstrated the importance of involving parents in the intervention (Golan & Crow, 2004), combining nutrition and physical activity components (Schwingshandl, Sudi, Eibl, Wallner, & Brokenstein, 1999), and including behaviour change strategies (Graves, Meyers, & Clark, 1988). In recent meta-analyses (Oude Luttikhuis et al., 2009; Wilfley et al., 2007; Young, Northern, Lister, Drummond, & O'Brien, 2007), multi-component family-based interventions were associated with modest but clinically important short-term improvements in child body size, compared to standard care or no-treatment control conditions.

Historically, child weight management has included dietary prescription, child participation in sessions, and child weight loss as the target of the intervention (e.g., Epstein, Paluch, Roemmich, & Beecher, 2007). In recent years, these three components have been criticised. The arguments may be summarised as follows. Firstly, an emphasis on calorie-counting or dieting is not consistent with current dietetic practice (Gehling, Magarey, & Daniels, 2005).

Dietary restriction may lead to the development of disordered eating attitudes and behaviours (Braet, 1999) and limit children's ability to achieve long-term dietary change (Magarey, Gehling, Haigh, & Daniels, 2004). Secondly, involving children in the intervention may be unnecessary (and therefore not cost effective), or even counterproductive (Golan, Kaufman, & Shahar, 2006). If an obese child is singled out from siblings or family members, they may experience stigmatisation, or resist change (Golan, Weizman, Apter, & Fainaru, 1998). Thirdly, an emphasis on weight loss may predispose children to the development of a food or appearance preoccupation, disturbed body image, and eating disorders (Golan, Fainaru, & Weizman, 1998).

An alternative approach to child weight management is to target parents exclusively in the intervention, to advocate whole-of-family lifestyle change, and to aim for changes in weight-related behaviours and parenting skills rather than weight loss (Golan & Weizman, 2001). This newer approach shifts the focus from weight control issues to parenting issues, and in doing so, deemphasises children's responsibility for change, and highlights parents' role in providing an environment that is conducive to healthy behaviour. The advantages of a parent-only health-centred approach include cost efficiency (i.e., reduced therapeutic demands on the clinician as there are no child sessions; Golan et al., 2006), reduced risk of the adverse consequences of dietary restriction (Birch & Davison, 2001), and improved maintenance (i.e., children are less likely to resist change and more likely to adopt sustainable eating and activity patterns when the whole family is involved; Golan, Weizman, et al., 1998).

To date, three randomised clinical trials have evaluated the efficacy of this type of intervention. In the first study, a parent-only health-centred intervention, was associated with a lower rate of attrition (Golan, Weizman, et al., 1998), greater reduction in percentage overweight (Golan, Fainaru, et al., 1998), and better maintenance of treatment gains seven years post-intervention (Golan & Crow, 2004) than a child-only weight loss program. In the second study, better outcomes were achieved when parents attended the intervention alone than with their child (Golan et al., 2006). In the third study, a general parenting program and a parenting-plus-lifestyle intervention were associated with a greater decrease in child waist circumference than a waitlist control condition, but there were no differences between the conditions for BMI *z* score (Golley, Magarey, Baur, Steinbeck, & Daniels, 2007). In sum, there is only limited evidence that parent-only health-centred interventions for childhood obesity are more efficacious than standard care or no-treatment control conditions.

A parent-focused approach to child weight management assumes that parenting is related to treatment outcomes. However, rarely have changes in parenting been assessed over the course of treatment (Kitzmann & Beech, 2006), and the results of studies that have assessed parent outcomes are inconclusive. For example, Golan et al. (2006) demonstrated no change in parenting style over the course of treatment, but children of parents reporting a permissive parenting style at baseline were less likely to lose weight.

In cross-sectional research, both permissive and restrictive parenting styles have been related to an increased risk of obesity (Brann & Skinner, 2005; Faith et al., 2003; Gable & Lutz, 2000; Moens, Braet, & Soetens, 2007). When parents set fewer limits or monitor their children's food intake and activities less frequently, children consume more energy-dense foods and beverages (De Bourdeaudhuij, 1997; Klesges, Stein, Eck, Isbell, & Klesges, 1991), eat less vegetables (Vereecken, Keukelier, & Maes, 2004), watch more television (Gentile & Walsh, 2002), and participate in less physical activity (Arredondo et al., 2006; Schmitz et al., 2002). If parents impose stringent controls over the type and quantity of foods children consume, children are less likely to learn how to self-regulate energy-intake (Costanzo & Woody, 1985; Johnson & Birch, 1994), and are more likely to overeat (Birch & Davison, 2001; Levine, Ringham, Kalarchian, Wisniewski, & Marcus, 2006).

In qualitative research, parents of overweight and obese children have reported difficulty monitoring and controlling their children's eating behaviour, and a lack of knowledge about effective weight management strategies (Borra, Kelly, Shirreffs, Neville, & Geiger, 2003). These parents often feel frustrated about their child's weight and believe they are unable to resolve the associated problems (Walsh Pierce & Wardle, 1997).

Collectively, the available evidence suggests that parents of overweight and obese children are using ineffective parenting strategies, and are not confident in managing their child's weight-related behaviour. At this stage, it is unclear whether childhood obesity treatment leads to improvements in parenting skills or confidence, and whether these improvements are related to treatment outcomes.

This study evaluated the efficacy of a new childhood obesity intervention that teaches parents how to use positive parenting to promote healthy eating and physical activity in their families. Group Lifestyle Triple P (West & Sanders, 2009a) forms part of the Triple P e Positive Parenting Program (Sanders, 2008), a multilevel system of parenting and family support aimed at preventing and managing social, emotional, and behavioural problems in children. The three components of Group Lifestyle Triple P (i.e., nutrition, physical activity, and positive parenting) were selected because of their hypothesised links to the development and maintenance of childhood obesity (see Davison & Birch, 2001). During the intervention, parents are taught how to rearrange their family environment and encourage healthy behaviour (e.g., by modelling healthy eating, increasing access to active games, and rewarding healthy choices). They are also taught how to prevent and manage weight-related problem behaviour more effectively (e.g., by providing children with choices between healthy foods, monitoring children's television use, and having clear rules about soft drink consumption). Although Lifestyle Triple P builds upon the existing Group Triple P program, the present study is the first time Lifestyle Triple P has been subjected to a randomised trial. Lifestyle Triple represents a significant modification to Group Triple P and includes additional modules and activities aimed directly at parents of overweight and obese children.

The aim of this study was to evaluate the effects of the intervention on parenting and child weight-related behaviour, relative to a waitlist control condition. It was predicted that the intervention would be associated with the following outcomes: 1) decreased child body size; 2) decreased child weight-related problem behaviour; 3) increased parental self-efficacy in managing children's weight-related behaviour; and 4) decreased use of ineffective parenting practices. To address the shortcomings of previous studies (e.g., Kitzmann & Beech, 2006; Oude Luttikhuis et al., 2009; Wilfley et al., 2007), assessment included measures of parenting and protocol adherence, and involved a one-year follow-up. To provide realistic estimates of intervention efficacy, intention-to-treat procedures were used and effect sizes for intervention outcomes are reported.

Method

Participants

Participants were recruited through advertisements in school newsletters ("Is your child overweight?") in Brisbane, Australia, from September 2003 to October 2004. A standardised telephone interview was used to inform parents about the study and to assess eligibility. Families were eligible to participate if the parent described the child's body size as overweight, the child was between 4 and 11 years of age, and the parent agreed to attend a 12-week intervention. Families were excluded from the study if the child was taking medication that affects growth or weight control, or had a severe developmental delay or disability. If eligibility criteria were met, and parents provided consent to participate in the study, the family was placed on a waitlist list to receive the intervention. To increase accessibility to the program, six venues for intervention delivery were employed across the Brisbane metropolitan area. These sites were selected to yield a sociodemographically diverse range of potential eligible participants and included a university child and family psychology clinic, a large paediatric teaching hospital, and four state primary schools.

A total of 205 parents participated in the initial telephone interview. A total of 104 families were excluded from the study for reasons such as failure to meet eligibility criteria or failure to complete written consent forms. Therefore, 101 families provided data for this study. Sociodemographic characteristics of the sample are summarised in Table 1. A series of one-way between-groups ANOVAs and chi-square tests demonstrated no significant sociodemographic differences between the conditions. Children were aged

between 4 and 11 years (*M* = 8.54, *SD* = 1.66), and there were more girls (67.3%) than boys (32.7%). Twenty-six percent of children had a BMI in the overweight range and 74.3% in the obese range. Parents were aged between 25 and 54 years (*M* = 39.69, *SD* = 5.17), and were mostly mothers (97.0%). Thirty-eight percent of all parents had a BMI in the healthy weight range, and 62.4% of all parents had a BMI in the overweight or obese range. Families were predominantly two-parent families (81.2%), with an average of two children (*M* = 2.27, *SD* = 0.93), and most participants (75.3%) had an annual family income of AUD$20,000 to AUD$100,000. The majority of parents were tertiary educated (70.3% of mothers and 76.8% of fathers) and were employed outside the home (64.4% of mothers 93.9% of fathers). Mothers worked an average of 27 h per week (*M* = 26.69, *SD* = 12.33) and fathers worked an average of 45 h per week (*M* = 45.39, *SD* = 11.91). The vast majority of families had a white Australian or European ethnic background (87.1%). There were also families with Italian or Greek (5.9%), Asian (4.0%), and Indigenous (3.0%) backgrounds.

Table 1
Sociodemographic characteristics of the sample.

Variable	Intervention ($n = 52$)[a]		Waitlist control ($n = 49$)[b]		Difference between the conditions	
Continuous	*M*	*SD*	*M*	*SD*	$F(1, 99)$[c]	*p*
Child age (years)	8.58	1.69	8.50	1.65	0.07	.793
Parent age (years)	39.08	5.17	40.35	5.15	1.53	.219
Number of children	2.33	0.99	2.20	0.87	0.44	.508
Mother's paid work (hr/week)	27.13	10.50	26.69	12.33	0.02	.879
Father's paid work (hr/week)	45.42	6.83	45.39	11.91	<0.01	.988
Categorical	*n*	%	*n*	%	χ^2 $(1, N = 101)$[d]	*p*
Child sex						
Male	16	30.8	17	34.7	0.18	.674
Female	36	69.2	32	65.3		
Child BMI range						
Overweight	12	23.1	14	28.6	0.40	.528
Obese	40	76.9	35	71.4		
Parent sex						
Male	1	1.9	2	4.1	0.41	.610
Female	51	98.1	47	95.9		
Parent BMI range						
Healthy weight	20	38.5	18	36.7	0.16	.928
Overweight	11	21.2	12	24.5		
Obese	21	40.4	19	38.8		
Family type						
Original biological parents	42	80.8	38	77.6	0.16	.899
One original, one step parent	1	1.9	1	2.0		
Sole parent	9	17.3	10	20.4		
Ethnic group						
White	46	88.5	42	85.7	1.09	.834
Mediterranean	2	3.8	4	8.2		
Asian	2	3.8	2	4.1		
Indigenous	2	3.8	1	2.0		
Mother's education						
Secondary only	13	25.0	17	34.7	1.14	.287
Tertiary	39	75.0	32	65.3		
Father's education						
Secondary only	9	20.9	10	25.6	0.26	.614
Tertiary	34	79.1	29	74.4		
Mother employed						
No	20	38.5	16	32.7	0.37	.542
Yes	32	61.5	33	67.3		
Father employed						
No	3	7.0	2	5.1	0.12	>.999
Yes	40	93.0	37	94.9		
Annual family income						
<AUD$20,000	2	3.8	0	0.0	2.55	.534
AUD$20,000–40,000	13	25.0	11	22.4		
AUD$40,000–100,000	27	51.9	25	51.0		
>AUD$100,000	10	19.2	13	26.5		

Note. BMI = body mass index. Ethnic group: White = White Australian or European, Mediterranean = Italian or Greek, Asian = Chinese or Filipino, Indigenous = Australian Aboriginal or Peruvian Indian. Mother's and father's education: secondary only = high school grade 12 or lower; tertiary = trade, apprenticeship, TAFE, college, university.

[a] $n = 32$ for mother's paid work (20 unemployed), $n = 38$ for father's paid work (9 sole parents, 3 unemployed, 2 missing data), $n = 43$ for father's education and father employed (9 sole parents).

[b] $n = 32$ for mother's paid work (16 unemployed, 1 missing data), $n = 35$ for father's paid work (10 sole parents, 2 unemployed, 2 missing data), $n = 39$ for father's education and father employed (10 sole parents).

[c] $F(1, 62)$ for mother's paid work, $F(1, 71)$ for father's paid work.

[d] χ^2 $(2, N = 101)$ for parent BMI and family type, χ^2 $(3, N = 101)$ for ethnic group and family income.

Measures

Outcomes

BMI *z* score was the primary outcome. Height and weight were measured with a custom-made portable stadiometer and electronic scales (Metropol 62208, Soehnle, Murrhardt, Germany), using standard procedures (Davies, Roodvelt, & Marks, 2001). The international standard definitions (Cole, Bellizzi, Flegal, & Dietz, 2000; World Health Organization, 2000) were used to classify body mass index (BMI) into healthy weight, overweight, and obese. BMI *z* scores were calculated using the L, M, S parameters

published by the CDC (Kuczmarski et al., 2000). Secondary outcomes were weight-related problem behaviour, parenting self-efficacy, and ineffective parenting. These outcomes were assessed using the parental self-report questionnaires described below.

The Lifestyle Behaviour Checklist (LBC; West & Sanders, 2009a) is a newly developed measure of child weight-related problem behaviour and lifestyle-specific parenting self-efficacy (two constructs for which there are currently no other available instruments). The LBC lists 25 child problem behaviours related to eating (e.g., eating too quickly), physical activity (e.g., playing too many computer games), and overweight (e.g., complaining about being teased) in children aged 4–11 years and yields scores on two scales – the Problem scale and Confidence scale. For the Problem scale, parents are asked to rate the extent to which they experience each of these behaviours as a problem with their child (higher scores indicate greater problems). For the Confidence scale, parents are asked to rate how confident they feel managing each of these behaviours, even if not currently occurring (higher scores indicate greater confidence). The recommended clinical cutoffs are a Problem scale score greater than 50 (range = 25–175) and a Confidence scale score less than 204 (range = 25–250).

In this sample, the LBC had high internal consistency (a = .85 for the Problem scale and .95 for the Confidence scale in the total sample at PRE) and adequate test-retest reliability (rs = .87 and .71 respectively in the waitlist control condition from PRE to POST). Evidence for the LBC's content and construct validity has been presented elsewhere (West & Sanders, 2009b). Using an earlier version of the LBC, 91.1% of families with and without obese children were correctly classified. Parents seeking treatment for their obese child reported higher Problem scale scores and lower Confidence scale scores than parents of a healthy weight child recruited from the community.

The Parenting Scale (PS; Arnold, O'Leary, Wolff, & Acker, 1993) is a well-established measure of parental discipline practices that is widely used in clinical practice and research. For each of the 30 items, parents are asked to rate how they would respond to a given discipline situation by choosing between an effective or ineffective course of action. The ineffective parenting practices assessed by the PS include permissive or inconsistent discipline (e.g., coaxing or begging their child to stop a problem behaviour), coercive discipline (e.g., spanking their child), and emotional discipline and irritability (e.g., getting angry or upset when their child misbehaves).

In this sample, the PS had adequate internal consistency (a = .77 in the total sample at PRE) and test-retest reliability (rs = .81 in the waitlist control condition from PRE to POST). Previous studies have demonstrated the PS's content and construct validity. Parents of children with behaviour problems tend to report higher scores than parents of children without behaviour problems (Harvey, Danforth, Ulaszek, & Eberhardt, 2001), and the PS is sensitive to the effects of parent training (Sanders, Markie-Dadds, Tully, & Bor, 2000). The total score correlates with observational measures of ineffective parenting and child misbehaviour, as well as self-report measures of externalising problems and marital discord (Arnold et al., 1993).

Intervention Delivery

Consumer satisfaction. The Client Satisfaction Questionnaire-Revised (CSQ; West & Sanders, 2009a) was administered to assess parent satisfaction with the intervention. The CSQ was administered to parents in Session 12 and asked parents to rate the quality of the service provided, how well the intervention met the parent's needs, and the child's degree of progress. Scores range from 13 to 91, with higher scores indicating greater satisfaction with the intervention. In this sample, the Client Satisfaction Questionnaire-Revised had high internal consistency (a = .89).

Program Adherence. The Session Content Checklists (SCC; West & Sanders, 2009b) were used to assess facilitator adherence to the intervention protocol. The SCC lists the key content areas for each session to guide facilitators in their delivery of the intervention, were completed by the group facilitator and two research assistants. To check for protocol adherence, most group sessions were videotaped (15 sessions were not taped due to equipment failure or facilitator error). Research assistants completed Session

Content Checklists for a random selection (25%) of these videotaped sessions. The research assistants used in the study were trained by a supervising clinician to reliably code the presence or absence of specific content covered in each session. Inter-rater reliability was high (mean kappa = .98).

Design

This study employed a group randomised repeated measures design with two conditions: waitlist control and intervention; and two time periods: pre-intervention (PRE) and post-intervention (POST). Families allocated to the intervention condition were also assessed 12-month post-intervention (1 YEAR). The flow of participants through the study is shown in Fig. 1.

Procedure

Randomisation

Families who met eligibility criteria during the initial telephone interview were invited to register for a Lifestyle Triple P group at the venue nearest to their home. Once 10 families had registered at a particular venue, the group was randomly allocated to either the intervention condition (start immediately) or the waitlist control condition (start in 12 weeks time). Groups were allocated to conditions according to a list of computer generated random numbers. Families were not assessed until after randomisation because there was often a waiting period of several weeks before enough families had registered for a group at that venue. Waiting until randomisation had occurred ensured that T1 assessments were conducted for all families as close as possible to the commencement of the program, thus reducing variability in the length of time elapsed from initial contact to commencement of the intervention. The final sample randomised and allocated to condition excluded an additional 39 participants who were initially deemed eligible, but failed to provide informed consent and thus were no longer eligible to be part of the trial. Although potentially eligible participants were randomised to condition within site, their participant status and therefore final Allocation concealment and blinded outcome assessment were not possible due to limited staff and resources. Participants were aware of when the start date of their group was at PRE assessment (i.e. whether it would start straight away or they would need to wait for 12 weeks).

Assessment

The PRE assessment involved a 15-min measurement session attended by the parent who agreed to participate in the intervention and the target child. The participating parent also completed a booklet of questionnaires. The same assessments were completed at POST and 1 YEAR follow-up. The first questionnaire booklet included an information sheet, written consent form, family background questionnaire (West & Sanders, 2009a), the LBC, and the PS. Data collection was carried out with the approval of The University of Queensland Behavioural and Social Sciences Ethical Review Committee, the Royal Children's Hospital and District Health Services Ethics Committee, and the Strategic Policy and Education Futures Division of Education Queensland.

Intervention

Group Lifestyle Triple P is a modification of Level 4 Group Triple P (Turner, Markie-Dadds, & Sanders, 2002) tailored to the concerns of parents of overweight and obese children. The aim of the program is to reduce children's risk of chronic weight problems by increasing parents' skills and confidence in managing children's weight-related behaviour.

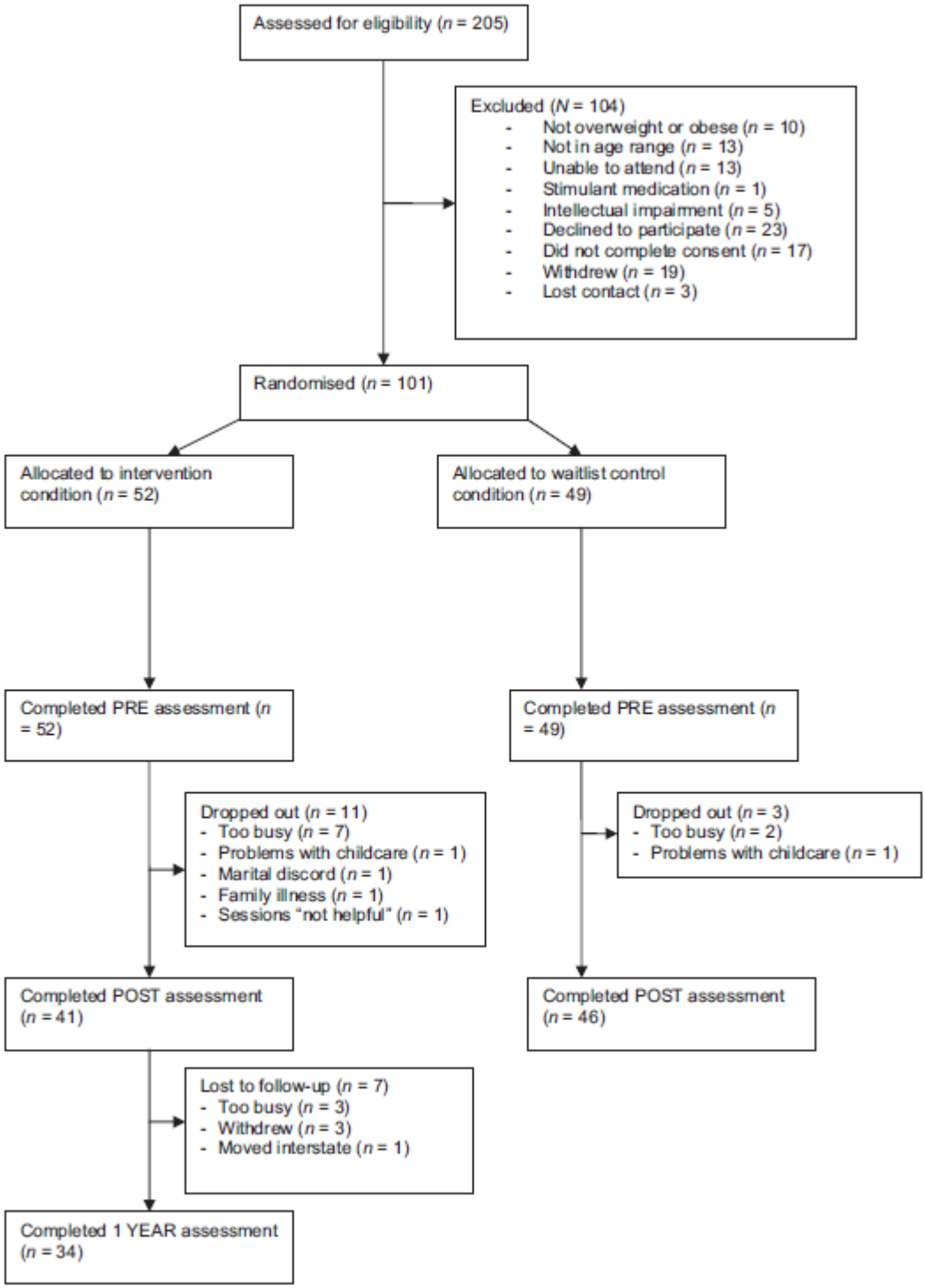

Fig. 1. Flow of participants through the study.

Group Lifestyle Triple P is a 12-week intervention that consists of nine 90-min group sessions and three 20-min telephone sessions. To help parents acquire new knowledge and skills, all sessions used an active skills training process (e.g., demonstrating and rehearsing skills) within a self-regulation framework (e.g., self-selecting goals and self-evaluating progress). Each parent received a workbook summarising the session content, and suggested between-session tasks.

In the first group session, motivational interviewing techniques were used to enhance parents' commitment to change. During subsequent group sessions, a range of specific strategies were introduced and practised. These included: (a) nutrition strategies (e.g., establishing eating routines, modifying recipes, reading food labels), (b) physical activity strategies (e.g., reducing television and computer time, increasing energetic play, encouraging involvement in sport), and (c) positive parenting strategies (e.g., keeping track of children's lifestyle behaviour, setting clear guidelines about food and activity, reinforcing healthy behaviour). During the telephone sessions, the facilitator reviewed parents' implementation of strategies, and problem-solved any difficulties. The final group session covered progress review and maintenance of treatment gains.

All sessions were facilitated by a clinical psychologist and accredited provider of Group Triple P (who co-authored the intervention materials), with assistance from graduate students in nutrition and dietetics, physical education, and psychology. All sessions were conducted by the same psychologist across sites. The graduate students had a minor co-therapist role and provided the facilitator with technical and administrative support during session.

Data Analysis

Preliminary data analyses included checks for adequate randomisation of participants to conditions, condition differences in rates of attrition during the study, and assessment of intervention quality. The efficacy of the intervention was evaluated in two ways: firstly, by assessing changes in child body size, weight-related problem behaviour, parenting self-efficacy, and ineffective parenting during the course of the intervention; and secondly, by assessing maintenance of positive change during the 12-month follow-up period. Both the statistical and clinical significance of changes were evaluated.

Short-term intervention effects were analysed using a two-way (condition by time) repeated measures (PRE vs. POST) MANOVA (including all four outcome variables) and a one-way (time) repeated measure (PRE vs. POST) MANOVA for each condition (to identify the source of the interaction). Maintenance of short-term intervention effects was analysed using two one-way (time) repeated measures (POST vs. 1 YEAR, PRE vs. 1 YEAR) MANOVAs for the intervention condition. A Bonferroni correction was applied to all univariate *F* tests to reduce the risk of Type 1 error (i.e., the family-wise *p*-value of .05 was divided by the number of variables in the analysis, leading to a more stringent *p*-value of .0125).

The clinical significance of changes from PRE to POST, and PRE to 1 YEAR was analysed using normative comparisons (Kendall, Marrs-Garcia, Nath, & Sheldrick, 1999) and Jacobson and Truax's (1991) reliable change index (RCI). This involved calculating the number of scores that moved from the clinical range to the nonclinical range (and vice versa) and the number of changes in scores that can be considered reliable (i.e., the probability that the change in score from PRE to POST or PRE to 1 YEAR is due to chance is less than 5%).[1]

All analyses used intention-to-treat procedures, with the last-point-carried-forward method for missing data (Kendall, Flannery-Schroeder, & Ford, 1999).

[1] Reliable change index = 1.96 x standard deviation x $\sqrt{2}$ x $\sqrt{(1 - \text{reliability coefficient})}$. Scores for the waitlist control condition over the 12-week waiting period were used to estimate standard deviation and the reliability coefficient.

Results

Preliminary Analyses

A series of one-way between-groups MANOVAs and chi-square tests demonstrated no significant differences between the 14 intervention groups at PRE. Therefore, analyses were conducted at the individual level rather than group level (i.e., these groups were not considered "clusters"; Medical Research Council, 2002). A second and third series of one-way between-groups MANOVAs and chi-square tests demonstrated no significant differences between the conditions at PRE, and between families who dropped out of the study and families who continued to participate. However, more families in the intervention condition did not complete POST assessment, χ^2 (1, N = 101) = 4.77, p = .029. The rate of attrition from PRE to POST (across both conditions) was 13.9%; the rate of attrition from PRE to 1 YEAR (intervention condition only) was 34.6%. Lack of time was reported as main reason for withdrawing from the study. Forty-one parents completed the intervention (i.e., attended 9 or more sessions, participated in individual catch-ups for missed sessions, and completed POST assessment).

Analyses were not conducted at the level of site due to several factors: firstly, all sites were in the same city that drew on the same general population (no rural vs. urban differences); secondly, the same therapist was used to run all groups across all sites reducing the likelihood of site-by-therapist interactions; and thirdly, all sites were mixed with respect to SES status of parent. Other Triple P trials (e.g., Leung, Sanders, Ip, & Lau, 2006; McTaggart & Sanders, 2007) show little evidence that SES predicts treatment outcome of parents completing Group Triple P.

Short-term Intervention Effects

The multivariate condition x time interaction was significant, $F(4, 96) = 8.87$, $p < .001$. All variables were associated with significant univariate condition x time interactions (see Table 2 for univariate F statistics and effect sizes). This suggests that the change in scores from PRE to POST was different across conditions. The largest effect size was for PS Total, and the smallest effect size was for BMI *z* score.

In the follow-up one-way analyses to locate the source of the significant interaction, the time effect was significant for the intervention condition, F (4, 48) = 13.06, $p < .001$, but not for the waitlist control condition, F (4, 45) = 1.19, p = .326. As shown in Table 2, in the intervention condition, all variables were associated with significant univariate time effects. From PRE to POST, child body size, weight-related problem behaviour, and ineffective parenting decreased; and parenting self-efficacy increased (see Table 3 for means and standard deviations).

Table 4 shows the proportion of reliable changes from PRE to POST. The distribution of positive and negative reliable changes differed significantly across conditions for all four variables. In the intervention condition, 25e35% of families showed reliable positive changes (i.e. a decrease in BMI *z* score, LBC Problem, or PS Total; or an increase in LBC Confidence), compared to less than 9% of families in the waitlist control condition.

The proportion of clinical changes from PRE to POST also differed significantly as a function of condition. As shown in Table 5, LBC Problem and LBC Confidence were associated with significant condition effects. More families in the intervention condition showed positive clinical changes (i.e., their scores moved from the clinical range to the non-clinical range) than families in the waitlist control condition for weight-related problem behaviour (34.6% vs. 2.0%) and parenting self-efficacy (42.3% vs. 10.2%).

Table 2
Univariate *F* statistics for the short-term intervention effects.

Variable	Condition by time interaction ($N = 101$)				Time effect			
					Waitlist control ($n = 49$)		Intervention ($n = 52$)	
	$F(1, 99)$	p	d	CI	$F(1, 48)$	p	$F(1, 51)$	p
BMI *z* score	17.53	<.001*	0.13	0.06, 0.21	1.19	.281	32.85	<.001*
LBC problem	10.41	.002*	0.72	0.27, 1.17	3.27	.077	21.50	<.001*
LBC confidence	18.81	<.001*	0.92	0.38, 1.45	< 0.01	.977	29.70	<.001*
PS total	19.84	<.001*	1.05	0.09, 2.00	0.04	.834	25.71	<.001*

Note. BMI = body mass index, LBC = Lifestyle Behaviour Checklist, PS = Parenting Scale.
*$p < .0125$.

Table 3
Means and standard deviations for PRE (pre-intervention), POST (post-intervention), and 1 YEAR (follow-up).

Measure	Waitlist control ($n = 49$)				Intervention ($n = 52$)					
	PRE		POST		PRE		POST		1 YEAR	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
BMI *z* score	2.11	0.46	2.10	0.45	2.15	0.43	2.04	0.44	1.96	0.46
LBC problem	76.31	19.31	73.78	19.33	71.88	21.14	59.37	20.66	61.21	24.02
LBC confidence	165.61	44.15	165.76	46.40	167.46	45.12	204.37	37.53	199.31	43.11
PS total	3.35	0.43	3.36	0.49	3.16	0.52	2.73	0.69	2.85	0.69

Note. BMI = body mass index, LBC = Lifestyle Behaviour Checklist, PS = Parenting Scale.

Table 4
Proportion of reliable changes from PRE (pre-intervention) to POST (post-intervention).

Variable	Waitlist control ($n = 49$)						Intervention ($n = 52$)						Difference between the conditions	
	Negative change		No change		Positive change		Negative change		No change		Positive change		χ^2 ($df = 2$, $N = 101$)[a]	p
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%		
BMI *z* score	0	0.0	48	98.0	1	2.0	0	0.0	37	71.2	15	28.8	13.60	<.001*
LBC problem	0	0.0	48	98.0	1	2.0	1	1.9	35	67.3	16	30.8	16.20	<.001*
LBC confidence	2	4.1	46	93.9	1	2.0	0	0.0	39	75.0	13	25.0	12.78	.002*
PS total	4	8.2	44	89.8	1	2.0	1	1.9	33	63.5	18	34.6	18.51	<.001*

Note. Negative change = reliable change in a negative direction (e.g., increase in BMI *z* score), no change = no reliable change, positive change = reliable change in a positive direction (e.g., decrease in BMI *z* score), BMI = body mass index, LBC = Lifestyle Behaviour Checklist, PS = Parenting Scale.
*$p < .05$.
[a] $df = 1$ for BMI *z* score.

Table 5
Proportion of clinical changes from PRE (pre-intervention) to POST (post-intervention).

Variable	Waitlist control ($n = 49$)						Intervention ($n = 52$)						Difference between the conditions	
	Negative change		No change		Positive change		Negative change		No change		Positive change		χ^2 ($df = 2$, $N = 101$)[a]	p
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%		
BMI range	0	0.0	49	100.0	0	0.0	0	0.0	47	90.4	5	9.6	4.96	.057
LBC problem	1	2.0	47	95.9	1	2.0	1	1.9	33	63.5	18	34.6	17.59	<.001*
LBC confidence	6	12.2	38	77.6	5	10.2	1	1.9	29	55.8	22	42.3	15.41	<.001*
PS total	2	4.1	42	85.7	5	10.2	1	1.9	39	75.0	12	23.1	3.24	.198

Note. Negative change = score moved from the non-clinical range to the clinical range, no change = score remained in the same range, positive change = score moved from the clinical range to the non-clinical range, BMI = body mass index, LBC = Lifestyle Behaviour Checklist, PS = Parenting Scale.
*$p < .05$.
[a] $df = 1$ for BMI range.

Maintenance Effects

From POST to 1 YEAR, the multivariate time effect was significant, $F(4, 48) = 6.34$, $p < .001$. As shown in Table 6, BMI *z* score was the only variable with a significant univariate time effect. This indicates that the short-term intervention effects for weight-related problem behaviour, parenting self-efficacy, and ineffective parenting were maintained during the follow-up period; and that there were further reductions in child body size.

From PRE to 1 YEAR, the multivariate time effect was also significant, $F(4, 48) = 10.21$, $p < .001$. All variables showed significant univariate time effects and medium effect sizes. From initial measurement

to follow-up assessment, the mean reduction in BMI *z* score was 0.19. One child moved from the obese range to the healthy weight range, 2 children moved from the overweight range to the healthy weight range, and a further 11 children moved from the obese range to the overweight range.

The proportion of reliable and clinical changes from PRE to 1 YEAR is shown in Table 7. For BMI *z* score, the proportion of reliable positive changes was 38.5% (compared to 28.8% from PRE to POST). Over the course of the intervention,10% of children moved from the obese range to the overweight range. During the follow-up period, a further 17% of children moved into the overweight or healthy weight ranges.

Table 6
Univariate *F* statistics for the maintenance effects ($n = 52$).

Variable	POST to 1 YEAR		PRE to 1 YEAR			
	$F(1, 51)$	p	$F(1, 51)$	p	d	*CI*
BMI *z* score	11.65	.001*	27.38	<.001*	0.43	0.18, 0.67
LBC problem	0.85	.361	18.71	<.001*	0.47	0.20, 0.74
LBC confidence	1.62	.208	21.00	<.001*	0.72	0.31, 1.14
PS total	6.45	.014	19.38	<.001*	0.51	0.16, 0.85

Note. POST = post-intervention, 1 YEAR = follow-up, PRE = pre-intervention, BMI = body mass index, LBC = Lifestyle Behaviour Checklist, PS = Parenting Scale.
*$p < .0125$.

Table 7
Proportion of reliable and clinical changes from PRE (pre-intervention) to 1 YEAR (post-intervention) ($n = 52$).

Variable	Reliable change						Clinical change					
	Negative change		No change		Positive change		Negative change		No change		Positive change	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
BMI *z* score	0	0.0	32	61.5	20	38.5						
BMI range							1	1.9	37	71.2	14	26.9
LBC problem	1	1.9	38	73.1	13	25.0	1	1.9	34	65.4	17	32.7
LBC confidence	1	1.9	40	76.9	11	21.2	2	3.8	30	57.7	20	38.5
PS total	1	1.9	36	69.2	15	28.8	2	3.8	43	82.7	7	13.5

Note. For reliable change: negative change = reliable change in a negative direction (e.g., increase in BMI *z* score), no change = no reliable change, positive change = reliable change in a positive direction (e.g., decrease in BMI *z* score). For clinical change: negative change = score moved from the non-clinical range to the clinical range, no change = score stayed in the same range, positive change = score moved from the clinical range to the non-clinical range. BMI = body mass index, LBC = Lifestyle Behaviour Checklist, PS = Parenting Scale.

Intervention Quality

Parents who participated in the intervention reported high levels of satisfaction on the Client Satisfaction Questionnaire e Revised ($M = 78.46$, $SD = 7.18$). All parents who completed the questionnaire (95.1% of families who completed the intervention) rated the quality of the intervention as *good* to *excellent*, and were satisfied with the amount of help they received. Most parents felt that the intervention met both their child's and their own needs, and were satisfied with their child's degree of progress: 100% reported improvement in child food intake, 97.4% reported improvement in child physical activity, and 84.6% reported improvement in child behaviour.

Analysis of the Session Content Checklists indicated 98.23% self-reported compliance and 98.42% observer-rated compliance with the intervention protocol.

Discussion

This study evaluated the effects of a parent-only lifestyle intervention on child body size, weight-related problem behaviour, parenting self-efficacy, and ineffective parenting. All four hypotheses were supported.

As predicted, child body size decreased over the course of the intervention. The reduction in mean BMI *z* score was 0.11 in the first 12 weeks (compared to no change in the waitlist control condition), and 0.08 in the next year. By follow-up assessment, one third of families had achieved reliable and clinically significant reductions in BMI *z* score, and three children had achieved a healthy body size.

It is difficult to compare these results to previous studies due to differences in research design, intervention length, measures, and reference population. For example, only two of the studies evaluating parent-only health-centred interventions have reported BMI *z* scores. Golan's (2006) parent-only condition was associated with a 25% reduction in mean BMI *z* score (using a US reference population) at 12-month follow-up assessment (compared to a 9% reduction in this study). Golley et al.'s (2007) parenting-plus-lifestyle condition was associated with an 11% reduction in mean BMI *z* score (using a UK reference population) at 6-month follow-up assessment (although this was not significantly different from the 5% observed in the waitlist control condition). Both studies involved interventions with substantially more sessions (22 and 16 sessions respectively compared to 12 sessions) and parent-clinician contact (21 h compared to 14.5 h) than Group Lifestyle Triple P, and were delivered over a longer period of time (6 months compared to 3 months). None of these previous studies reported the clinical significance of changes.

Only a handful of weight-reduction programs that involve children in the intervention have used BMI *z* score as the primary outcome and employed intention-to-treat procedures in analyses. Epstein et al. (2007) summarised the outcomes of eight studies conducted over the last 25 years evaluating family-based obesity treatment programs. Eighteen months post-intervention, the overall effect size for BMI *z* score was higher than in the present study and more children had achieved a healthy body size (11% across recent studies compared to 6% in this study). Once again, the intervention involved more sessions over a longer time period.

The second hypothesis was that children's weight-related problem behaviour would improve. To support this contention, mean LBC Problem score decreased over the course of the intervention, and was significantly lower at follow-up than at initial assessment. This suggests that the behaviours parents previously perceived as being problematic (e.g., children eating too much, watching too much television, complaining about doing physical activity) were now occurring less frequently, or were easier for parents to manage. One quarter of parents reported reductions in child weight-related problem behaviour that were reliable and clinically significant. This is the first study to assess this construct.

The third hypothesis was that parents would report being more confident in managing their child's weight-related behaviour. Mean LBC Confidence score decreased from pre- to post-assessment and from pre- to follow-up assessment. One fifth of parents reported reliable increases in parenting self-efficacy, and by follow-up, 40% of scores had moved into the non-clinical range. LBC Confidence was associated with the largest effect size of all four variables, which suggests that an important outcome of Group Lifestyle Triple P is improving parents' beliefs that they can manage their child's weight-related behaviour effectively.

The fourth hypothesis was that levels of ineffective parenting would decrease in the intervention condition. Over the first 12 weeks there was a significant decrease in ineffective parenting (compared to no change in the waitlist control condition), that was maintained at follow-up assessment. After participating in a Lifestyle Triple P group, parents reported using less ineffective parenting practices (such as giving in to their child's demands, raising their voice, or getting into arguments with their child) and more effective parenting practices (such as giving clear instructions and warnings, responding to their child's misbehaviour consistently, and staying calm when their child misbehaves). One third of families showed reliable decreases in ineffective parenting, and 14% showed clinically significant decreases. This is the first study to demonstrate clear changes in parenting style over the course of childhood obesity treatment.

The current intervention reduced child body size and resulted in an improvement in parenting skills and confidence both immediately after intervention and at 12-month follow-up. Despite this generally positive effect some parents reported difficulties maintaining positive changes in parenting. At follow-up assessment, several parents commented that they would have preferred to have more sessions spread over a longer time period. Extending the length of the intervention may help to maintain changes in parenting in the long-term.

This study supports previous research demonstrating a link between parenting and childhood obesity (e.g., Faith et al., 2003). Ineffective parenting and low parental self-efficacy may be risk factors for childhood obesity, and improvements in parenting practices and self-efficacy may mediate improvements in child body size. Future research with a larger sample size would be useful to identify mediators and moderators of intervention efficacy.

This is one of only three published studies evaluating the efficacy of a parent-only health-centred intervention for childhood obesity. The main strength of the study is thorough evaluation of the clinical importance of intervention outcomes by calculating effect sizes and reliable change indices, and performing normative comparisons; however, two limitations should be noted. The first limitation is that families who participated in the study were self-referred (i.e., parents were concerned about their child's weight and interested in doing something about it). However, self-referring parents who express concerns about their child's weight and are motivated to do something about it represent approximately one fifth of parents of overweight or obese children e most parents are either unaware or are not concerned about their child's weight (Crawford, Timperio, Telford, & Salmon, 2006). As participants were randomly allocated to condition their motivational state does not confound the findings, however it may affect the generalisability of the results. Group Lifestyle Triple P is an intensive intervention that requires parents to commit to all 12 sessions; it may not be effective (nor appropriate) for parents with low levels of concern or motivation to address their child's weight problem. It is also worthwhile noting that a single practitioner delivered all the intervention. Although this facilitated protocol adherence, the generalisability of the findings would be further strengthened in future studies by the use of a more diverse range of practitioners and delivery settings to establish the robustness of the intervention effects and to test for therapist effects.

The second limitation relates to the sample. Although the sociodemographic characteristics of the sample were typical for the Australian general population, participants were mainly white, well-educated parents with moderate levels of employment and income. The sample included some sole-parent and low-income families, and some children of mixed ethnicity; however, further research is needed to clarify whether similar findings would be obtained with higher-risk families (e.g., families experiencing poverty, minority families or parents from non-English speaking backgrounds).

In conclusion, Group Lifestyle Triple P appears to be a useful and efficacious treatment option for parents of overweight and obese children aged 4e11 years, who are concerned about their child's weight and are willing to make changes in their family's lifestyle. Further trials are needed to establish the long-term efficacy of an extended version of the intervention, evaluate its effectiveness in community settings with a more diverse sample, and elucidate the mechanisms of change.

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