

To appear in [Obesity Reviews](#)

[Link to the main text](#)

Online Supplementary for

Social influence in childhood obesity interventions: a systematic review

M. S. Jalali^{1,*}, Z. Sharafi-Avarzaman², H. Rahmandad¹, A. S. Ammerman³

¹Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts, United States of America

²Faculty of Economics and Business Administration, Goethe University Frankfurt, Frankfurt, Germany

³Center for Health Promotion & Disease Prevention, Gillings School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States of America

*** Corresponding author:**

M. S. Jalali, jalali@mit.edu

Table S1 Summary of 32 reviewed studies

Study, country	Objective, Type, Duration, Participants, Study design	Findings	Results summary / *** Quantitative results
Israel et al. 1985 [52] United States	<p>Objective: Evaluate the effect of training in general child management skills with a behavioral treatment program</p> <p>Intervention type: Treatment, randomized controlled trial</p> <p>Intervention duration: 9 weeks; 1 year follow-up from program inception</p> <p>Participants: Thirty-three overweight children (8-12 years) and their parents</p> <p>Study design: Families assigned to parent training (PT) group and parents assigned to weight reduction only (WRO) group attended nine weekly 90-minute sessions. The treatment was based on CAIR: cue control rules, activity, intake, and rewards. The families participated in separate child and parents groups.</p>	<p>At 1-year follow-up, children in the PT condition had a superior maintenance of improved weight status. There was also a positive correlation between changes in child and parent weight status during the follow-up period.</p>	<p>Importance of parents as change agents</p> <p>*** Percent Overweight</p> <p>PT group: Week 1: 50.60 (17.48); Week 9: 43.40 (21.63); Year 1: 40.40 (32.86)</p> <p>WRO group: Week 1: 46.82 (15.57); Week 9: 33.61 (16.99); Year 1: 45.53 (21.21)</p>
Israel et al. 1994 [53] United States	<p>Objective: Examine the effect of a multiple-component self-regulation intervention</p> <p>Intervention type: Treatment, randomized trial</p> <p>Intervention duration: 26 weeks; 1 and 3 years follow-up from program inception</p> <p>Participants: 34 families including obese children (8-13 years) and at least one of the parents</p> <p>Study design: Participants were assigned to standard treatment (ST) and enhanced child involvement (ECI) groups. Parents were given the primary responsibility in the ST group. ECI followed the same intervention with greater emphasis on child self-regulation. Treatment for both groups was based on CAIR. The core of the intervention was a four-component model of self-regulation: goal setting, self-monitoring, self-evaluation, and self-consequence.</p>	<p>Children in ST and ECI achieved a significant reduction in percentage overweight, however most children did not achieve non-obese status at the follow-ups.</p>	<p>The results of ECI group was better than of the results of ST group over the long term.</p> <p>***Percent Overweight:</p> <p>ST group: Week 1: 45.94 (17.11); Week 26: 33.43 (17.00) Year 1: 45.15 (23.87); Year 3: 52.30 (24.37)</p> <p>ECI group: Week 1: 48.10 (18.31); Week 26: 32.55 (17.35) Year 1: 42.32 (22.50); Year 3: 43.29 (21.18)</p>
Golan et al. 1998 [54, 55] Israel	<p>Objective: Study the reduction in overweight and changes in eating-related behaviors in obese children where the parents were the exclusive agents of change.</p> <p>Intervention type: Treatment, longitudinal randomized prospective study</p> <p>Intervention duration: 12 months; 6 months follow-up</p> <p>Participants: 60 children, parents of 30 children in the experimental group (parents as agents of change) and 30 children in control group (children as agents of change)</p> <p>Study design: Forty-hr-long support and educational group sessions for parents in the experimental group and 30-hr-long group sessions for children in the control group</p>	<p>Selecting parents as the sole agents of change resulted in more weight reduction and more adherence to the program than selecting children as the main focus of change.</p> <p>Significant differences between the two groups in the reduction of exposure to food stimuli and changes in eating habits were found.</p>	<p>Targeting parents as the exclusive agents of change is more effective than conventional treatments.</p> <p>***Experimental group: 79% of children lost more than 10% of their excess weight; 35% of children reached non-obese status (<10% overweight)</p> <p>Control group: 38% of children lost more than 10% of their excess weight; 14% of children reached non-obese status</p>
Epstein et al. 2001 [56] United States	<p>Objective: Evaluate the effect of a parent-focused behavioral intervention on parent and child eating changes and on % overweight changes in families that contains at least one obese parent and a non-obese child.</p> <p>Intervention type: Treatment, randomized behavioral weight-control program</p> <p>Intervention duration: 6 months; 6 months follow-up (at months 6 and 12)</p> <p>Participants: 30 families, one obese parent and a non-obese child (6-11 years)</p> <p>Study design: Comprehensive behavioral weight-control program for parents; encourage increased fruit/vegetable intake <i>or</i> decreased intake of high-fat/high-sugar foods.</p>	<p>Focus on what can be eaten (versus what cannot) may increase adherence to caloric restrictions for weight control.</p> <p>Targeting fruit/vegetable intake in children increases intake of nutritionally dense foods and decreases intake of low nutrient dense foods.</p> <p>Reduction in high-fat/high-sugar intake in children can be achieved by focusing on parent change.</p>	<p>Reduction in high-fat/high-sugar food intake in children of both groups; significant change in food patterns</p> <p>*** Group: Fruits and vegetables (Servings per day): Increase Fruit and Vegetable: 0.72 ± 1.11 Decrease Fat and Sugar: -0.55 ± 1.31 (significant between-group differences over time)</p> <p>Group: High-fat/high-sugar (Servings per day): Increase Fruit and Vegetable: -4.50 ± 7.97 Decrease Fat and Sugar: -8.50 ± 7.58 (p < 0.001)</p>

Study, country	Objective, Type, Duration, Participants, Study design	Findings	Results summary / *** Quantitative results
Beech <i>et al.</i> 2003 [57] United States	<p>Objective: Evaluate the acceptability, feasibility, and outcomes of two family-based interventions in pre-adolescent African-American girls</p> <p>Intervention type: Prevention, randomized controlled pilot trial</p> <p>Intervention duration: 12 weeks; post-assessment follow-up only at week 12</p> <p>Participants: 60 African-American girls (8-10 years) and their parents/caregivers</p> <p>Study design: A culturally tailored and family-based interventions (child targeted intervention with girls only, and parent-targeted intervention with parents only). The program focused on nutrition and physical activity, with a control group that focused on self-esteem.</p>	Girls in both groups demonstrated a trend toward reduced BMI and waist circumference.	<p>The pilot results show that both groups were similarly effective in facilitating the desired changes in the girls' behavior over the short term.</p> <p>***Mean differences in BMI (baseline-adjusted) at 12 weeks:</p> <p>Parent-targeted vs control: -0.40 (0.25)</p> <p>Child-targeted vs control: -0.38 (0.25)</p>
Harvey-Berino and Rourke 2003 [58] Canada & United States	<p>Objective: Assess the effectiveness of maternal participation plus parenting support vs parenting support only in reducing obesity among preschool Native-American children.</p> <p>Intervention type: Prevention, randomized pilot trial</p> <p>Intervention duration: 16 weeks; post-assessment follow-up only at week 16</p> <p>Participants: 43 child-mother pairs</p> <p>Study design: Subjects were randomly assigned to parenting support (PS) or obesity prevention plus parenting support (OPPS) group. Subjects in both groups participated in a 16-week intervention conducted by an indigenous peer educator in the home of each participant.</p>	<p>Changes in weight-for-height z (WHZ) scores presented a significant trend, with WHZ scores decreasing in the PS and increasing in the OPPS group.</p> <p>Energy intake was also significantly decreased among children in the OPPS group.</p>	<p>Focusing on changing lifestyle behaviors and improving parenting skills showed promise for obesity prevention in high-risk children.</p> <p>***Change from week 0 to 16:</p> <p>PS: WHZ score: 0.31±1.1; Weight (kg): 1.5±3.2</p> <p>OPPS group: WHZ score: -0.27±1.1; Weight (kg): 0.9±2.4</p>
Wardle <i>et al.</i> 2003 [59] United Kingdom	<p>Objective: Evaluate effectiveness of in-home parent intervention to increase child preference for previously disliked vegetable.</p> <p>Intervention type: Prevention, exposure-based randomized controlled trial</p> <p>Intervention duration: 14 consecutive days taste test; 6 weeks follow-up (no quantitative follow-up)</p> <p>Participants: 156 parents of 2 to 6 years old children</p> <p>Study design: Parents assigned to one of three groups: (a) training in 'exposure' feeding (encourage tasting target vegetables and not offering a reward), (b) general nutritional information, or (c) no treatment. Target vegetable selected based on low ranking on preference test. Parents assigned to the exposure group given guidance on offering child a taste of target vegetable for 14 consecutive days.</p>	<p>Daily exposure to previously disliked vegetable increases child's liking and consumption of target vegetable.</p> <p>The effect is strongest in the exposure group (showed a significant increase), weakest in the information group and intermediate in the control group. Anecdotally, parents and children enjoyed the 'tasting games' and frequently used the exposure technique for other foods after the study.</p>	<p>Increase children's liking and consumption of that vegetable</p> <p>*** Means (SEM) of consumption of target vegetables:</p> <p>Exposure group: Pre-intervention: 4.1 (1.4) ; Post-intervention: 9.0 (1.7)</p> <p>Information group: Pre-intervention: 5.7 (2.1); Post-intervention: 7.3 (1.8)</p> <p>Control group: Pre-intervention: 5.7 (1.5); Post-intervention: 7.7 (1.6)</p> <p>Effects on preference ranking: Exposure group: 30% ranked their target vegetable as the most liked vs. Control group: 5% vs. Information group: 2%</p>
Golan and Crow 2004 [60] Israel	<p>Objective: Evaluate long-term change in child overweight in a parent-only vs. child only health-centered intervention.</p> <p>Intervention type: Treatment, randomized family-based, health-centered study</p> <p>Intervention duration: 1 year; 7 years follow-up (at years 2, 3, and 8)</p> <p>Participants: 2 parent-only groups (15 families each), 2 child-only groups (15 children each). Children age 7-12 in original intervention</p> <p>Study design: Parent-only Group: 14 1-hour support and educational group sessions. Topics included setting limits, nutrition education, eating and activity behavior modification, decreasing stimulus exposure, parental modeling, etc. Child-only Group: 30 1-hour group sessions. Topics included physical activity, eating behavior modification, stimulus control, self-monitoring, etc.</p>	Over the long term, targeting parents improved child weight outcomes better than targeting children. Mean reduction in percent overweight is greater at all follow-up points in children of the parent-only group compared with those in the children-only group.	<p>Reduction in percent overweight in children of the parent-only group after 7 years</p> <p>*** 7 years after the program terminated, mean reduction in children's overweight:</p> <p>Parent-only group: 29% (p<0.05)</p> <p>Children-only group: 20.2% (p<0.05)</p>

Study, country	Objective, Type, Duration, Participants, Study design	Findings	Results summary / *** Quantitative results
Golan et al. 2006 [61] Israel	<p>Objective: Evaluate relative efficacy of targeting parents alone v. parents and obese children together to treat childhood obesity</p> <p>Intervention type: Treatment, randomized health-centered intervention</p> <p>Intervention duration: 6 months; 1 year follow-up</p> <p>Participants: 32 families, with at least one child age 6 to 11 years more than 20% overweight</p> <p>Study design: Parents encouraged fostering authoritative parenting style. 16 1-hour support/education group sessions for each group. In addition, 40–50 min individual sessions once per month for each family, during the 6 month intervention.</p>	Children (6–11 years) who attended intervention sessions with parents lost less weight than children whose parents were targeted alone. Parents-only produced significant reduction in the child % overweight at 6 and 12 months.	Reduction in percent overweight of children in the parent-only group *** Parents-only group (BMI z): Baseline: 2.0 to termination (after 6 months): 1.6 (change: 0.4, P<0.05); Overweight percentage: 47±22.1 to 37.5±22.0 (change: -9.5, P<0.05) Parent and child group (BMI z): Baseline: 2.1 to termination: 2.0 (NS); Overweight percentage: 48.5±18.1 to 46.1±17.8 (change: -2.4, NS)
Golley et al. 2007 [62] Australia	<p>Objective: Evaluate relative effectiveness of parenting-skills training as a key strategy for the treatment of overweight children.</p> <p>Intervention type: Treatment, assessor-blinded, randomized controlled trial</p> <p>Intervention duration: 6 months; 6 months follow-up (at months 6 and 12)</p> <p>Participants: 111 overweight, children age 6 to 9 years</p> <p>Study design: 3 Parenting-skills training alone (P): parents participate in the Positive, Parenting Program (Triple P), 4 weekly 2-hour group sessions followed by 4 weekly, then 3 monthly, 15- to 20-minute individual telephone sessions. Parenting-skills training + intensive lifestyle education (P+DA): Complete the Triple P program plus an additional 7 intensive lifestyle support group sessions following completion of the 4 weekly parenting sessions (every 2 weeks at first, then monthly). Children in the P+DA group attend structured activity sessions developed by physical activity experts.</p>	3 groups (P, P+DA, and control group) have a significant reduction in BMI z score over 12 months. Significant reductions in BMI seen in intervention boys, but not intervention girls or waitlisted controls. After 12 months, the BMI z score reduced by ~10% in P+DA versus ~5% P or waitlist controls	Reduction in BMI z score for both parenting-skills training groups (more reduction in P+DA) *** BMI z score change between 12 months and baseline: P+DA: -0.24 ± 0.43 P: -0.15 ± 0.47 Control group: -0.13 ± 0.40 BMI z score decrease of children over 12 months: P+DA: 45% P group: 24% WLC group: 19%
Burrows et al. 2008 and 2010 [63, 64] Australia	<p>Objective: To assess the impact of a best practice dietary modification program, Hunter Illawarra Kids Challenge Using Parent Support, on overweight and obese children</p> <p>Intervention type: Treatment, randomized controlled trial</p> <p>Intervention duration: 6 months; 6 and 18 months follow-up</p> <p>Participants: 165 overweight children (5-7 years) in the 2008 study; 159 in the 2010 follow-up study</p> <p>Study design: A multicenter intervention with allocation to one of three arms: (1) parent-centered nutrition lifestyle program; (2) child-centered physical activity skill development program; or (3) both the programs. The dietary modification program was aimed at the parent only, with parents having responsibility for attending sessions and implementing family dietary and eating habit changes.</p>	A significant decrease in child feeding questionnaire domain scores were sustained at 24 months for all groups, in the domain of pressure to eat, with increases in degree of monitoring. The domain of parental restriction of foods high in sugar and/or fat showed significant decreases in dietary intervention groups only.	The effectiveness of interventions for child obesity may be enhanced by a better understanding of parent child-feeding practices may. ***Mean changes in scores of parent child-feeding domains: Pressure to eat: 0-6 month: 0.20 (0.08, 0.32); 0-12 month: 0.24 (0.11, 0.36); 0-24 month: 0.27 (0.12, 0.42) Monitoring: 0-6 month: -0.25 (-0.39, -0.11); 0-12 month: -0.23 (-0.37,-0.09); 0-24 month: -0.20 (-0.36,-0.05)
Haire-Joshu et al. 2008 [65] United States	<p>Objective: Test effectiveness of a home-based intervention for parents to foster a positive fruit–vegetable (FV) environment for their preschool child; examine whether changes in parent behavior are associated with improvements in child intake.</p> <p>Intervention type: Prevention, group randomized nested cohort</p> <p>Intervention duration: 7 months (range of 6 to 11 months)</p> <p>Participants: 1,306 parents and children (ages 2 to 5 years)</p> <p>Study design: High 5 for Kids (H5-KIDS) developed in partnership with Parents As Teachers (PAT). Parent educators deliver a standardized curriculum (social cognitive theory-based) via at least five home visits, on-site group activities, and a tailored newsletters and materials for families.</p>	H5-KIDS parents and normal weight children increased FV intake. Overweight children more likely to consume high calorie snack foods or sweetened drinks which may limit intake and preference for FV.	Increase of FV servings in normal weight children but not overweight children *** Mean change of daily FV intake (children): Both overweight and normal weight Control group: -0.05 (p=0.2); Intervention group: 0.01 (p=0.2) Mean change of FV intake: Overweight children only, Control group: 0.09 (p=0.48); Intervention group: -0.07 (p=0.48) - Mean change of FV intake: Normal weight children only, Control group: -0.11 (p=0.02); Intervention group: 0.23 (p=0.02)

Study, country	Objective, Type, Duration, Participants, Study design	Findings	Results summary / *** Quantitative results
Janicke et al. 2008 and 2009 [66, 67] United States	<p>Objective: Assess effectiveness of parent-only vs family-based interventions for pediatric weight management in underserved rural setting in the 2008 study; compare the costs of parent-only and family-based group in the 2009 study</p> <p>Intervention type: Treatment, three-arm randomized controlled clinical trial</p> <p>Intervention duration: 4 months; 6 months follow-up (at months 4 and 10)</p> <p>Participants: 93 families with overweight/obese 8 to 14 years old children</p> <p>Study design: Study arms: (1) a behavioral family-based (FB) intervention: Parent and child dyads participated in simultaneous but separate groups, (2) a behavioral parent-only (PO) intervention: Only the participating parent(s) attended group meetings, or (3) a waitlist control. In the cost analysis study, only program costs data for the PO and FM arms are reported.</p>	Both PO and FB interventions demonstrated improvement in weight status compared with control. Children <11 years, those in the PO had about 50% greater decrease in weight status at follow-up relative to those in FB. Parent-only interventions may be more cost-effective, especially for families in medically underserved settings.	<p>Decrease in BMI z score of children in PO group; Not significant difference in weight status change between PO and FB</p> <p>*** An overall mean decrease of BMI z score: Children in the PO intervention: 0.090 (0.039) Children in the FB intervention: 0.115 (0.046)</p> <p>Total program costs: PO: \$13,546; FB: \$20,928; Total cost per child: PO: \$521; FB: \$872</p>
Munsch et al. 2008 [68] Switzerland	<p>Objective: Investigate whether treatment of mothers only is as effective as a mother-child treatment in a randomized controlled clinical trial to reduce child overweight.</p> <p>Intervention type: Treatment, cognitive behavioral therapy (CBT) randomized controlled trial.</p> <p>Intervention duration: 10 weeks; 6 months follow-up</p> <p>Participants: 31 families in the mother-child (MC) group and 25 families in the mother-only (MO) group (child age 8 to 12 years)</p> <p>Study design: In both conditions mothers receive CBT. Children in MO attend relaxation training of equal frequency/duration to the child CBT training in MC. Mothers encouraged to follow basic food rules for family meals, model physical activity, and focus on coping with social stigmatization of obesity for their child.</p>	Overweight percentage between baseline and 6-month follow-up is reduced by 1.9% (MC) and 4.5% (MO) based on a linear mixed model. Both treatments are efficacious with respect to the reduction of overweight in children between baseline and 6-month follow-up and that these reductions are similar between the two treatments.	<p>Reduction in child percent overweight; no difference between the parent-only and parent-child interventions</p> <p>*** Child BMI (MO): Baseline: 27.34 (SE=1.69); End of treatment: 27.40 (SE=1.69); End of follow-up: 27.21 (SE=.70)</p>
Resnick et al. 2009 [69] United States	<p>Objective: Pilot an easy-to-use parent outreach model that could ultimately be used by school nurses, pediatricians, community health agencies, and community health workers to reduce child overweight/obesity.</p> <p>Intervention type: Treatment, pilot parent-directed randomized trial with a nonrandomized control group</p> <p>Intervention duration: Six educational materials over 30 weeks (group M), personal encounters over 18 weeks (group M+PE); 1 year follow-up from program inception</p> <p>Participants: 46 parents of overweight/obese elementary school students</p> <p>Study design: Parents from two schools randomly assigned to either Materials Group (M) or Materials plus Personal Encounters Group (M + PE). M receives mailed educational materials and P+PE receive educational materials through interactions with community health workers. Parents in both groups receive identical materials.</p>	<p>About 50% parents reported confidence in knowing ways to improve child's nutritional habits, and about 66% reported confidence in knowing/ talking about ways to increase child's activity at baseline.</p> <p>Modest reductions in BMI found for children who watched <2 hr TV/day after study completion compared with children who watched>2 hr TV/day at baseline.</p>	<p>Reduction in BMI for children</p> <p>*** Post-Intervention Overall: child BMI percentile: 90.6 ± 10.0 (p = .005) Baseline Overall: child BMI percentile: 94.1 ± 4.3</p> <p>There are no significant between-group differences in the reduction of BMI (between M and M + PE groups).</p>
Okely et al. 2010 [70] Australia	<p>Objective: To evaluate a child-centered physical activity program and a parent-centered dietary program in preventing unhealthy weight-gain in overweight children.</p> <p>Intervention type: Prevention, an assessor-blinded randomized controlled trial</p> <p>Intervention duration: 10 weeks sessions and 3 months phone calls; 6 and 12 months follow-up from the inception</p> <p>Participants: 165 overweight/obese 5.5 to 9.9-year-old children</p> <p>Study design: Participants were randomly assigned to one of the three groups: a parent-centered dietary program (Diet); a child-centered physical activity program (Activity); or a combination of both (Diet + Activity). All groups received 10 weekly face-to-face sessions followed by 3 monthly relapse-prevention phone calls.</p>	The Diet and Activity programs, both in isolation and combined, were efficacious in reducing relative BMI in overweight prepubertal children at 1-year follow-up. Compared with the Activity program in isolation, the two programs that included the dietary component resulted in about twice as great a reduction in BMI z-score.	<p>Parent-centered dietary program (Diet) had the greatest effect</p> <p>*** BMI z-score: Diet: month 12: -0.39 (-0.51, -0.27) Activity: month 12: -0.17 (-0.28, -0.06) Diet + Activity: month 12: -0.32 (-0.42, -0.22)</p>

Study, country	Objective, Type, Duration, Participants, Study design	Findings	Results summary / *** Quantitative results
West et al. 2010 [71] Australia	<p>Objective: Evaluate the effects on child weight of a parent-only parenting and child weight-related behavior intervention, relative to a waitlist control.</p> <p>Intervention type: Treatment, randomized clinical trial</p> <p>Intervention duration: 12 weeks; 1 year follow-up</p> <p>Participants: 101 families with overweight/obese children age 4 to 11</p> <p>Study design: The lifestyle-specific parenting program consists of nine 90-min group sessions to enhance parents' commitment to change and three 20-min telephone sessions to review parents' implementation of strategies, and address challenges. All sessions use an active skills training process within a self-regulation framework (e.g., goals and progress evaluation).</p>	<p>The intervention has significant effects on child body size, weight-related problem behavior, parenting self-efficacy, and ineffective parenting. 25% of parents report reductions in child weight-related problem behavior. 33% of families show significant decreases in ineffective parenting, and 14% children show clinically significant decreases in weight. 10% of children move from obese to overweight.</p>	<p>Reductions in children BMI z score and weight-related problem behavior</p> <p>*** Intervention group: child BMI z-score: 2.15 (pre) to 2.04 (post) and 1.96 (after 1 year)</p> <p>Control group: child BMI z-score: 2.11(pre) to 2.10 (post)</p>
Boutelle et al. 2011 [72] United States	<p>Objective: Determine whether a Parent-only (PO) intervention is not inferior to a parent and child (PC) treatment for childhood obesity.</p> <p>Intervention type: Treatment, randomized clinical trial</p> <p>Intervention duration: 5 months; 6 months follow-up</p> <p>Participants: 80 parent-child dyads (overweight/obese children age 8 to 12 year, 40 pairs PO; 40 pairs PC)</p> <p>Study design: 60-min separate child and parent sessions. Parents in the PO group coached on how to assist children in weight monitoring and behavior change. Program included dietary modification (traffic-light diet), increased physical activity, behavioral change skills, and parenting skills specific for children who are overweight.</p>	<p>Child weight loss and physical activity in PO group not inferior to PC group. PO potentially more cost-effective and easier to disseminate. Weight reductions in both groups were significant at post-treatment (BMI, BMI-Z, and BMI-P) and only BMI-Z at follow-up.</p>	<p>Decrease in BMI-z score of children in PO and PC groups; PO child weight loss, parent weight loss and child physical activity not inferior to the PC.</p> <p>*** Child BMI-Z score in PO: Pre-treatment: 2.29 (0.38); Post-treatment: 2.16 (0.54); Follow-up: 2.10 (0.68)</p> <p>Child BMI-Z score in PC: Pre-treatment: 2.25 (0.34); Post-treatment: 2.06 (0.40), n=28; Follow-up: 2.08 (0.41), n=28</p>
Collins et al. 2011 [73] Australia	<p>Objective: Evaluate the impact of a child-centered physical-activity plus parent-centered dietary-modification program on child BMI-z score</p> <p>Intervention type: Treatment, three-arm assessor-blinded randomized control trial</p> <p>Intervention duration: 6 months; 18 months (at months 6, 12, and 24)</p> <p>Participants: 165 overweight prepubertal children (68 boys) age 5.5 - 9.9 years</p> <p>Study design: 3 arm intervention (1) parent-centered dietary-modification program (Diet), (2) child-centered physical-activity skill-development program (Activity), and a combination of programs (Activity + Diet). Each arm: 1) 10 weekly 2-hour face-to-face session with homework activities; 2) 3-monthly relapse-prevention telephone sessions to review parent goals.</p>	<p>All groups achieved clinically significant reductions in BMI z score and waist circumference at 24 months.</p> <p>Parent Diet program is more efficacious than child Activity program, although not different from Activity + Diet suggesting childhood obesity treatment could focus exclusively on parental modification of child dietary intake.</p>	<p>All groups reduction BMI z score (greatest effects through inclusion of a parent-centered diet program)</p> <p>*** BMI z score, adjusted for gender, 24-month - difference from baseline by treatment group (P<0.001): Diet: -0.35 (-0.48 to -0.22); Activity: -0.19 (-0.30 to -0.07); Activity + Die: -0.24 (-0.35 to -0.13)</p> <p>- BMI z score, adjusted for gender, between-group differences from baseline (P=0.04): Diet: -0.17 (-0.34 to 0.01); Activity: -0.05 (-0.21 to 0.11) Activity + Die: 0.11 (-0.06 to 0.28)</p>
Golley et al. 2011 [74] Australia	<p>Objective: To describe the impact of a parent-led, family-focused child weight management program on the food intake and activity patterns of pre-pubertal children</p> <p>Intervention type: Prevention, an assessor-blinded, randomized controlled trial</p> <p>Intervention duration: 6 months; 6 months follow-up</p> <p>Participants: 11 (64% female) overweight, pre-pubertal children age 6 to 9 years</p> <p>Study design: The parenting-skills training alone (P) and P + activity education (DA) groups attended an eight-week standardized general parenting program. Parents in the P + DA arm attended additional seven lifestyle education sessions based on the Australian food selection guide. Parents in the P and wait list control groups (WLC) received a 'lifestyle recommendations' pamphlet.</p>	<p>Intake of extra foods (i.e., energy-dense nutrient-poor foods) was lower in both intervention groups at 6 and 12 months. Intervention achieved a reduction in children's intake of extra foods without compromising intake of nutrient-rich foods.</p>	<p>Reduction in children's intake of energy-dense, nutrient-poor foods and an increase in the time reported spent in active play</p> <p>*** Reducing children's intake of extra foods: P + DA: Baseline: 3.5 (2.5-4.5); 6 months: 2.0 (1.5-2.5); 12 months: 2.0 (2.0-3.0)</p> <p>P: Baseline: 3.0 (2.4-3.4); 6 months: 1.5 (1.5-2.0); 12 months: 2.3 (1.5-3.0)</p> <p>WLC: Baseline: 3.0 (2.0-3.5); 12 months: 2.5 (1.9-4.0)</p>

Study, country	Objective, Type, Duration, Participants, Study design	Findings	Results summary / *** Quantitative results
Jansen et al. 2011 [75] Netherlands	<p>Objective: Evaluate whether a treatment aimed solely at obese children's parents results in positive effects on the children's weight status</p> <p>Intervention type: Treatment, a randomized controlled trial</p> <p>Intervention duration: 10 weeks; 3 months</p> <p>Participants: Parents of 98 overweight or obese children, age 7 to 13 years</p> <p>Study design: Parents attended eight sessions spread over 10 weeks. The purpose of the sessions was to teach parents to think of alternatives and possible solutions, rather than to purely present information. A substantial part was devoted to enhancing parenting tactics.</p>	Child BMI percentile decreased 2.4% in the treatment group, whereas there was no change in the waiting-list control group.	<p>The parents' treatment had significant effects on child and parent BMI.</p> <p>*** BMI percentile child:</p> <p>Treatment group (n = 59): Pre-treatment: 96.8±2.93; Post-treatment: 94.5±6.52; 3 Month follow-up: 94.7±6.58</p> <p>WLC group (n = 39): Pre-treatment: 95.9 ±3.38; Post-treatment: 96.0 ±3.64; 3 Month follow-up: 95.7±3.90</p>
Magarey et al. 2011 [76] Australia	<p>Objective: Evaluate a healthy lifestyle (HL) intervention to reduce adiposity in children aged 5 to 9 years; assess effect of added parenting skills training.</p> <p>Intervention type: Treatment, single-blinded randomized controlled trial</p> <p>Intervention duration: 6 months; 18 months follow-up (at months 6, 12, 18, and 24)</p> <p>Participants: 169 pre-pubertal moderately obese children, age 5 to 9 years</p> <p>Study design: Both arms parent-only: 12 (P+HL group) or 8 (HL group) 90- to 120-minute group sessions (and 4 telephone sessions, delivered over 6 months with tapered frequency (weekly, bimonthly, then monthly). The Positive Parenting Program (Triple P) was delivered in 4 sessions to P+HL parents before the lifestyle (HL) component (to encourage parents to anticipate and manage high-risk situations with respect to a positive energy balance). HL sessions focused on information only.</p>	10% reduction in BMI z scores from baseline to 6 months (maintained at 24 months with no additional intervention.)	<p>Reduction in BMI scores in pre-pubertal children</p> <p>*** Mean BMI z Score:</p> <p>P+HL: Baseline (n=85): 2.77±0.58 After 24 month (n=52): 2.38 ±0.67</p> <p>HL: Baseline (n=84): 2.68±0.65 After 24 month (n=54): 2.26±0.84</p>
Wyse et al. 2011 [77] Australia	<p>Objective: Examine efficacy of a brief telephone-based parent intervention to increase fruit/vegetable consumption in children aged 3–5 years' examine feasibility of intervention delivery and parent acceptability.</p> <p>Intervention type: Prevention, randomized pilot study with no comparison group</p> <p>Intervention duration: 4 weeks; 1 week follow-up</p> <p>Participants: 34 parents of children age 3 to 5 years</p> <p>Study design: Four 30 minute weekly telephone calls plus instructional resources. Three focus areas: availability and accessibility of foods within the home, role modeling fruit/vegetable consumption, and supportive family eating routines.</p>	Variety and/or frequency of children's fruit/vegetable consumption significantly increased. Increased vegetable/fruit consumption corresponded with non-significant decrease in the variety and frequency of children's consumption of non-core foods. Parents willing to receive and continue with an intervention.	<p>Increase of variety and/or frequency of children's fruit and vegetable consumption</p> <p>*** CDQ, Children's dietary questionnaire, fruit and vegetable subscale (P=0.027): Pre-intervention: 15.5 (5.1) Post-intervention: 18.1 (4.1)</p>
Moens and Braet 2012 [78] Belgium	<p>Objective: Evaluate a parent-led intervention to reduce child BMI.</p> <p>Intervention type: Treatment, a cluster-randomized controlled trial</p> <p>Intervention duration: 6 months; 6 months follow-up (at months 6 and 12)</p> <p>Participants: 50 families with overweight children, age 6 to 12 years</p> <p>Study design: Six 2-hour group sessions over 5-months. Dietician and a psychologist provide lifestyle education behavior.</p>	<p>Children in the intervention group: decrease in adjusted BMI of 7% post-intervention; weight loss maintained at the one-year follow-up.</p> <p>For the obese children more intensive treatment is required.</p>	<p>Positive changes in children's eating behavior and positive increase in familial health principles</p> <p>*** The decrease in adjusted BMI</p> <p>Intervention group: baseline=147.57% and 6-month=142.55%; Waitlist group: baseline=139.45% and 6-month=135.92%</p>

Study, country	Objective, Type, Duration, Participants, Study design	Findings	Results summary / *** Quantitative results
Ostbye et al. 2012 [79] United States	<p>Objective: To evaluate the immediate post-intervention results of Kids and Adults Now, Defeat Obesity! program to enhance healthy lifestyle behaviors in mother–preschooler dyads</p> <p>Intervention type: Prevention, randomized controlled trial</p> <p>Intervention duration: 8 months; 14 months follow-up</p> <p>Participants: 308 mother-preschooler (2-5 years) dyads</p> <p>Study design: Subjects in the intervention group received eight monthly mailed interactive kits, followed each month by a telephone coaching session for 20–30 minutes. Kits contained child activities and incentives reinforcing the month's topic (e.g., a rewards chart, yoga mat, pedometer, portion plate).</p>	Compared to the control arm, mothers in the intervention arm reduced instrumental feeding and TV snacks. Further improvements in emotional feeding, mother's sugary beverage and fruit/vegetable intake, and dinners eaten in front of TV were also observed. There were no group differences in the primary outcomes, but differences were observed in the parenting and maternal outcomes—trends toward improvement in the preschoolers' diets were observed.	Mothers as agents of change improved several channels of maternal influence. ***BMI z-score: Intervention Group: Baseline: 0.35 (0.08) Change: 0.03 (0.05) Control Group: Baseline: 0.47 (0.08) Change: -0.02 (0.05)
De Bock et al. 2013 [80] Germany	<p>Objective: To assess whether a participatory parent-focused approach using parents as agents of behavioral change enhances the efficacy of a preschool physical activity (PA) intervention</p> <p>Intervention type: Prevention, a cluster randomized controlled trial</p> <p>Intervention duration: 9 months; 3 months follow-up (at months 6—before the end of the program—and 12)</p> <p>Participants: parents of 433 preschool children age 4 to 6 years</p> <p>Study design: In control group, parents received a state-sponsored program consisting of twice-weekly 1-hour gym classes over 6 months. In intervention group, parents are motivated to develop and implement their own project ideas for promoting children's PA. The external gym trainers in intervention group received additional training and served as intervention facilitators helping to coordinate parent activities, encouraging participation, and documenting the intervention implementation.</p>	Compared to children enrolled in the standard, expert-driven program alone, children who received a combination of the participatory intervention and the expert-driven non-participatory program were significantly less sedentary and more physically active after 12 months. Half a year after program termination, children in the participatory arm had 4% more accelerometry counts and spent 11 (1.7%) fewer minutes in sedentary behavior during wake times.	Promote PA and reduce sedentary behavior in preschoolers *** Sedentary behavior, minutes/day Intervention Group: Baseline: 631.3±68.3; 6 months: 629.9±62.6; 12 months: 623.9±66.8 Control Group: Baseline: 631.4±63.2; 6 months: 633.3±63.5; 12 months: 628.1±67.1 Mean accelerometry, counts/15 seconds/day Intervention Group: Baseline: 31.4±8.1; 6 months: 32.2±8.7; 12 months: 32.95±10.78 Control Group: Baseline: 31.8±9.7; 6 months: 31.8±9.4; 12 months: 32.6±11.6
Fletcher et al. 2013 [81] Australia	<p>Objective: To assess the effectiveness of a telephone-based intervention in reducing child consumption of non-core foods, and to examine parent and home food environment mediators of change in child consumption</p> <p>Intervention type: Prevention, a clustered randomized controlled trial</p> <p>Intervention duration: 1 month; 5 months follow-up (at months 2 and 6)</p> <p>Participants: 394 parents of preschool-aged children, age 3 to 5 years</p> <p>Study design: Parents in the intervention group received four telephone contacts and print materials targeting parent and home food environment characteristics, while parents in the control group received generic print materials only.</p>	Child consumption of non-core foods was reduced at 2 months, however this was not maintained at 6 months. Child access to non-core foods in the home, and child feeding strategies are significant mediators, which representing the primary causal pathways by which the intervention influenced the consumption of non-core foods.	Improve short-term dietary behavior in preschool age children *** Child non-core food consumption: Intervention Group: Baseline: 2.48±0.08; 2 months: 2.24±0.07; 6 months: 2.29±0.09 Control Group: Baseline: 2.59±0.08; 2 months: 2.57±0.11; 6 months: 2.47±0.10
Janicke 2013 [82] United States	<p>Objective: To describe behavioral parent-only intervention to promote healthier lifestyle habits and reduce weight status in an obese 12-year-old female participant.</p> <p>Intervention type: Treatment, case example of a randomized controlled trial</p> <p>Intervention duration: 4 months; 6 months follow-up (at months 4 and 10)</p> <p>Participants: A 12-year-old girl with her mother</p> <p>Study design: The intervention included 12 group sessions over 4 months. Behavioral strategies such as including self-monitoring, goal setting, performance feedback, reinforcement, stimulus control, and instruction in behavioral parenting strategies were applied.</p>	The child lost 17 pounds and grew 1.7 inches in height. Her quality of dietary intake was improved. She also experienced a drop in the number of self-reported unhealthy weight control behaviors.	Improvement in the child's quality of dietary intake and a drop in the number of self-reported unhealthy weight control behaviors ***BMI z-score decrease: At 6-month follow-up: 0.6 Mean daily caloric intake: Baseline: 2,066; At 6-month follow-up: 1,664

Study, country	Objective, Type, Duration, Participants, Study design	Findings	Results summary / *** Quantitative results
McGowan et al. 2013 [83] United Kingdom	<p>Objective: To promote habit formation for three parental feeding behaviors: serving fruit/ vegetables, serving healthy snacks, and serving non-sweetened drinks</p> <p>Intervention type: Prevention, a cluster-randomized, controlled exploratory trial</p> <p>Intervention duration: 8 weeks; follow-up measures were completed at the final home visit</p> <p>Participants: 126 parents of children age 2 to 6 years</p> <p>Study design: The intervention was delivered over the course of 4 visits to the family in home. Researchers worked through an intervention booklet in each visit, lasting about an hour. The booklet introduced the concept of habit formation along with tips for habit formation.</p>	<p>Significant effects on children’s intake of vegetables, healthy snacks and water were reported in all three groups. Changes in parental automaticity of feeding behaviors correlated with children’s food intake.</p>	<p>Modification in parental feeding behaviors, change children’s diets positively, and well acceptance by parents</p> <p>*** Change in children’s serving of vegetables per day: Intervention Group: +0.8±1.3; Control Group: +0.1±0.8</p> <p>Change in Healthy snack occasions per day: Intervention Group: +1.0±2.1; Control Group: -0.2±2.1</p> <p>Change in Water occasions per day: Intervention Group: +0.6±1.0; Control Group: +0.1±0.9</p>