Associations between Parent Behavior and Adolescent Weight Control*

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Objective To evaluate associations between parent behaviors (i.e., parent weight change, self-monitoring of their behavior, and feeding practices and attitudes) and changes in adolescent BMI and weight following 16-weeks of behavioral weight control (BWC) intervention. **Method** Adolescents ($N = 86$) 13–16 years old and 30–90% overweight ($M = 60.54\%$, $SD = 15.10\%$) who completed BWC intervention and their parents. Adolescents were randomized to 1 of 2 interventions involving 16 consecutive weeks of active treatment with 4 biweekly maintenance sessions. Adolescent weight and BMI were measured at baseline and 16-weeks. Feeding practices were measured at baseline. Parent self-monitoring was measured during the intervention. **Results** The only independently significant predictor of adolescent BMI change ($p < .01$) was parent BMI change. Greater parent self-monitoring ($p < .01$) predicted greater adolescent weight loss. Greater parent pressure to eat predicted less adolescent weight loss ($p < .01$). **Conclusions** Findings highlight the potential importance of parent weight-related behaviors and feeding practices in the context of adolescent BWC.

Key words adolescents; obesity; parents; weight management.

There has been a well-documented increase in the prevalence of pediatric obesity during the last 30 years, with ~34% of adolescents (ages 12–19 years) now either overweight or obese [body mass index (BMI) ≥ 85 th percentile for age and gender; Ogden, Carroll, Curtin, Lamb, & Flegal, 2010]. Pediatric obesity increases the risk of negative physical consequences, including metabolic, cardiovascular, and respiratory comorbidities (Weiss et al., 2004), and is also associated with increased risk for negative psychosocial outcomes, such as impaired quality of life (Zeller, Roehrig,

Modi, Daniels, & Inge, 2006), decreased self-concept and body image (Israel & Ivanova, 2002), and impairments in social functioning (Janssen, Craig, Boyce, & Pickett, 2004). Furthermore, youth who are obese are at increased risk of being obese as adults, with greatest risk for adolescents (Guo et al., 2000).

Family-based behavioral weight control (BWC) programs have demonstrated efficacy in the treatment of overweight children (ages 8–12 years), with some promise for long-term outcomes (Oude Luttikhuis et al., 2009;

Willfley et al., 2007; Young, Northern, Lister, Drummond, & O'Brien, 2007). Notably fewer BWC interventions have been conducted with adolescents, and outcomes are variable (Jelalian et al., 2008). A recent review concludes that while comprehensive interventions involving behavioral strategies combined with attention to diet and physical activity show promise in decreasing adolescent obesity, there is a need for further development of effective interventions (Tsiros, Sinn, Coates, Howe, & Buckley, 2008). Variables associated in previous trials with better weight loss outcomes have included male gender and greater attendance at group sessions (Jelalian et al., 2008). However, it is unclear what role parental involvement plays in predicting weight loss success, with a review finding mixed evidence for a positive association between greater parent involvement and greater weight loss outcomes in primarily school-age samples (Kitzmann & Beech, 2006).

Relatively few studies have explicitly examined the role of parents in adolescent BWC. In an early study, adolescents demonstrated comparable decreases in percent overweight (~8%) regardless of whether they participated in a BWC intervention alone or with a parent (Coates, Killen, & Slinkard, 1982). This is consistent with findings from a recent randomized intervention for rural overweight youth that did not find any difference in BMI *z*-score decrease between parent-only versus family-based interventions, either at posttreatment or at 10-month follow-up (Janicke et al., 2008). In contrast, Brownell, Kelman, and Stunkard (1983) demonstrated superior outcome when adolescents and parents attended separate group sessions, compared to adolescents participating alone or in the same group as parents. However, a replication of this study with 36 African-American adolescent girls showed no significant difference in outcome regardless of whether parents were seen together with adolescents, in separate groups, or not included in treatment (Wadden et al., 1990).

Consistent with social learning theory (Bandura, 1977), parents serve as role models for their children and shape their children's habits, including those contributing to obesity risk. Parents serve as a child's first model of eating behavior and have the opportunity to present healthy eating and physical activity habits (Golan & Weizman, 2001). Children's dietary intake patterns (e.g., food preference, intake of fruits and vegetables, etc.) tend to resemble their parents' patterns (Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002), and parental dietary and physical activity behaviors appear to have a lasting effect on children's dietary and physical activity patterns and BMI trajectory (Davison, Francis, & Birch, 2005). Although parent modeling has been discussed as an

important component for pediatric obesity intervention (Golan & Crow, 2004; Golan & Weizman, 2001), relatively little research has explored how parent modeling may be associated with BWC intervention outcome.

We propose that parent adherence to weight control strategies (e.g., self-monitoring of their own dietary intake) and parent weight change are key behaviors through which parent modeling may be associated with adolescent weight loss. The importance of parent self-monitoring is consistent with previous research. Germann and colleagues (2007) found that ethnic minority youth whose parents self-monitored throughout the first 3 months of treatment were more likely to lose weight compared to those whose parents did not self-monitor. Furthermore, in a second study, daughters of mothers with better treatment attendance demonstrated significantly greater weight loss than those whose mothers attended less often (Wadden et al., 1990). Finally, indirect support for parent modeling is provided by research demonstrating positive correlations between child and parent weight loss in the context of BWC for school-age children (e.g., Epstein, McCurley, Wing, & Valoski, 1990; Wrotniak, Epstein, Paluch, & Roemmich, 2004). These associations have not been explored in the context of an adolescent BWC trial.

Parent-feeding attitudes and practices have also received attention. Some of the research has focused on controlling feeding practices, such as parent restriction of their children's eating during meals, inclination to pressure their child to eat more food, and monitoring of their child's food intake (Birch et al., 2001; Faith, Scanlon, Birch, Francis, & Sherry, 2004). These types of feeding practices may hinder the child's opportunities for the development of self-control with respect to eating (Birch et al., 2001). Cross-sectional research among school-age children has linked parental restriction of children's eating with child weight status (Webber, Hill, Cooke, Carnell, & Wardle, 2010) and weight gain (Clark, Goyder, Bissell, Blank, & Peters, 2007).

The transition into adolescence is characterized by greater independence in food choices, which may limit the direct impact of parents on their adolescent's intake at mealtimes, in comparison to younger children. However, parental-feeding attitudes and practices likely continue to exert an important role among adolescents. First, parents typically continue to have involvement in food purchasing and preparation for adolescents and may be present during a portion of adolescent mealtimes. Nearly 50% of adolescents eat at least five meals per week with their family, with younger adolescents reporting more frequent family meals compared to older adolescents (Fulkerson, Neumark-Sztainer, & Story, 2006). Second, parental-

feeding attitudes and practices are by no means limited to mealtimes and could consist of critical comments or suggestions made at any time of the day (Kluck, 2008).

The objective of the current study was to examine associations between parent behaviors (parent weight change, parent self-monitoring of their own dietary intake, and feeding practices and attitudes) and changes in adolescent BMI and weight following 16 weeks of BWC intervention. We hypothesized that greater parent weight loss and higher levels of parent self-monitoring would be associated with greater teen weight loss. We also sought to explore associations between parent-feeding practices/attitudes and adolescent weight loss. Data for this study were drawn from a randomized adolescent BWC trial, involving 16 weeks of active intervention followed by 4 bi-weekly maintenance sessions, in which parent weight was not an intervention target. See Jelalian et al. (2010) for a detailed description of the treatment conditions and primary outcomes and Hart et al. (2010) for an examination of dietary intake in this sample.

Methods

Study Participants

Participants were overweight adolescents randomized to a BWC intervention. One parent for each adolescent participated in this study. Adolescent eligibility criteria at the time of study entry included: (a) 30–90% overweight, with respect to median BMI (kg/m^2) for gender and age (percent overweight = $\text{BMI}/50\text{th percentile BMI for age and gender} \times 100$); (b) 13–16 years old; (c) English-speaking; and (d) at least 1 parent available to participate in the intervention. Adolescents were excluded if they were already enrolled in a weight control program; met criteria for a major psychiatric disorder; had a medical condition that interfered with the prescribed dietary or exercise plan; or were developmentally delayed such that intervention materials would not have been appropriate.

As described by Jelalian et al. (2010), of the 152 adolescents who met basic eligibility criteria via a phone-screen and then attended an in-person family evaluation, 20 were found to be ineligible. Of the remaining 132 eligible adolescents, 123 completed the dietary run-in period. Five adolescents were then no longer interested following the dietary run-in, and a total of 118 adolescents were randomized to intervention. Parent diet records were not available for the first treatment cohort ($n = 22$). Thus, this cohort was not included in analyses. Participants in this cohort did not differ from the remaining 5 cohorts ($n = 96$) on demographic characteristics (age, gender, and ethnicity), treatment condition, baseline adolescent and

parent BMI, or adolescent weight and BMI change over the course of treatment. Of the 96 possible adolescents who were randomized to intervention and had parent diet records available, 86 (89.6%) completed treatment. Thus, a total of 86 adolescents were included in the present analyses.

Procedure

Adolescents were recruited from area pediatrician's offices and through local newspaper advertisements. Baseline assessments, including a baseline assessment battery and a 1-week dietary record run-in period, were conducted between August 2003 and May 2006. Following the baseline assessment, adolescents and their parents were randomized to one of two group-based BWC conditions that differed only in the physical activity component. An urn randomization procedure (Stout, Wirtz, Carbonari, & Del Boca, 1994), with percent over BMI and gender as covariates, was used to assign participants to intervention conditions by systematically biasing assignment to provide optimal equivalency across groups.

Both treatment conditions included 16 consecutive weeks of active treatment during which adolescents and parents attended separate concurrent 1-hr meetings (Sessions 1–16), and then 4 bi-weekly maintenance sessions (Sessions 17–20). The outcome time point for this study was end of treatment (16 weeks). Group treatment sessions were gender mixed (boys and girls together in the same group), conducted in a hospital clinic setting, and led by a doctoral or masters level clinical psychologist with periodic nutrition content presented by a nutritionist. The first condition: group-based cognitive behavioral treatment (CBT) with aerobic exercise (CBT + EXER), involved CBT plus 1 $\times$ week supervised aerobic activity. The second condition: group-based CBT with peer-enhanced adventure therapy (CBT + PEAT), involved CBT plus peer-based activity sessions similar to the Outward Bound adventure therapy model (e.g., group activities aimed at developing self-confidence). Adolescents in both conditions were prescribed a balanced deficit diet and gradual increases in physical activity. The CBT component remained consistent across both conditions and included a range of behavioral (BWC) topics (i.e., self-monitoring, motivation, goal setting, stimulus control, and relapse prevention). For both conditions, the co-occurring parent groups met once weekly. All of the BWC topics mentioned above were presented to parents in relation to the teen's weight loss efforts, and topics were presented parallel to material covered in the adolescent groups. The majority (14 out of 16 sessions) of adolescent and parent groups for both treatment conditions were conducted separately.

Adolescents were targeted for weight loss, with parents participating in a supporting role for adolescent weight management. Parent weight management was not an intervention target. Parents were asked to support positive eating and physical activity habits in their adolescents and to implement family-level change (e.g., remove high fat and high calorie foods from the home). Written informed consent was obtained from parents of all adolescents, and adolescents provided assent for study participation. Participants received monetary compensation for completing baseline and follow-up assessments. The hospital institutional review board approved this study.

Measures

Anthropometric Variables

Trained research assistants obtained adolescent and parent weight and height at baseline and at the end of the active intervention (Session 16). Participants' height was measured using a wall-mounted stadiometer (Perspective Enterprises). Weight was measured on a balance beam scale. Participants' height and weight were measured while dressed in hospital gowns and without shoes, whereas parent height and weight were measured in light clothes and without shoes. Weight and height were used to calculate BMI (kg/m^2).

Adolescent Self-monitoring

Adolescents were asked to complete weekly self-monitoring records to keep track of their daily dietary intake (including food consumed, preparation and portion size, calorie estimates, fat grams, and time of day for each item recorded) and number of minutes of daily physical activity. Adolescents were given self-monitoring records from Weeks 1 to 15 of treatment, for a total of 15 possible adolescent self-monitoring records.

Parent self-monitoring

During the first 3 weeks of the intervention, parents were also asked to complete the same weekly self-monitoring records to keep track of their own dietary intake and physical activity (three possible 7-day food records). Parent self-monitoring was implemented in order to increase parents' awareness of their adolescents' weight control efforts and the calorie content of foods. A completed parent record was defined as one that was turned in and had at least 4 out of 7 days of recorded food intake and physical activity. The primary variable of interest for this study is the number of weekly self-monitoring records completed by parents, scored 0–3.

Parent-Feeding Practices

Parents completed a modified version of the self-report Child Feeding Questionnaire (CFQ; Birch et al., 2001) at baseline. The CFQ measures current parental-feeding practices, attitudes, and beliefs related to obesity proneness in children (e.g., "How concerned are you about your teen eating too much when you are not around?"). The CFQ was minimally adapted in this study to be appropriate for parents of adolescents. Specifically, the word "child" was replaced with "teen." Scales of the CFQ have established reliability ($\alpha = 0.70$ – 0.92 ; Birch et al., 2001). In this sample, internal consistency was unacceptable ($< .60$) for the Restriction subscale, which was subsequently excluded from further analyses. Alpha reliability ranged from acceptable to good for the remaining CFQ subscales used in this study: Concern About Overweight ($\alpha = .65$), Perceived Teen Weight ($\alpha = .65$), Perceived Responsibility ($\alpha = .65$), Pressure to Eat ($\alpha = .67$), and Monitoring ($\alpha = .86$).

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, version 13.0. Preliminary univariate analyses (i.e., Pearson correlations and *t*-tests) were calculated to evaluate the effect of treatment condition and a range of adolescent and parent variables (i.e., adolescent and parent baseline BMI, adolescent and parent BMI change from baseline to end of treatment, adolescent age, race/ethnicity, CFQ subscales, and parent diet records) on adolescent BMI change. Variables significantly related to adolescent BMI change were entered into a hierarchical linear regression predicting adolescent BMI change. Because adolescents experienced two distinct treatments, treatment condition was included in the first step of all multivariate analyses followed by significant baseline variables in the second step and parent intervention-related behaviors in the third step. Minimal progress for adolescent success was defined as 1/2 lb. per week weight loss over the course of intervention. Based on this criterion, we then ran logistic regression to predict minimally "successful" weight loss using an 8 lb. cut off (1/2 lb. per week $\times$ 16 weeks). Treatment condition and variables significantly associated with ≥ 8 lb. weight loss were simultaneously entered into the logistic regression. For ease of interpretation, subscales of the CFQ were dichotomized using median splits, and parent weight loss was categorized according to whether or not the parent had lost ≥ 2.2 lb. (1 kg) during the 16-week intervention. A cutoff of 2.2 lb. weight change has been utilized in previous adult research in which weight change was measured but not a target of intervention (Lloyd-Richardson, Bailey, Fava, Wing & the Tobacco Etiology Research Network, 2009).

Because this study did not specifically target parent weight loss, a cutoff of 2.2 lbs. was deemed appropriate for classifying parent weight change. Parents who “maintained or gained weight” (i.e., lost <2.2 lb. or gained weight) were compared to those who “lost weight” (i.e., lost ≥ 2.2 lb.) during the intervention. Conceptually, these categories represent parents who were likely to have made a deliberate weight loss effort compared to those who did not. Finally, to more carefully examine associations between adolescent and parent weight change, chi-squared analysis was calculated “pairing” adolescent and parent weight change. For this, adolescents were again classified as those who successfully achieved the goal of ≥ 8 lb. weight loss versus those who lost <8 lb. and parents were classified using the previously established cutoff of 2.2 lbs. (Lloyd-Richardson et al., 2009).

Results

Please see Table I for a summary of the sample baseline characteristics.

Adolescent and Parent Weight Loss

Significant decreases were observed in adolescent BMI over time, $F(1,84) = 97.10$, $p < .01$, with no effect of treatment condition (baseline BMI $M = 31.22$, $SD = 3.21$; end of treatment BMI $M = 29.62$, $SD = 3.52$). Adolescent BMI change did not differ by gender or ethnicity. Parent BMI also showed significant decreases over time, $F(1,80) = 16.15$, $p < .01$, with no effect of treatment condition (baseline BMI $M = 30.38$, $SD = 6.86$; end of treatment BMI $M = 29.75$, $SD = 7.01$). A significant relationship was observed between decrease in parent and adolescent BMI from baseline to end of treatment ($r = .40$, $p < .001$). A greater number of parent diet records was associated with more adolescent weight loss ($r = -.23$, $p < .05$). Higher baseline levels of parental concern about adolescent weight ($r = .28$, $p < .05$) and pressure to eat ($r = .25$, $p < .05$) were associated with smaller decreases in adolescent BMI. Neither adolescent nor parent baseline BMI was significantly correlated with adolescent BMI change. See Table II for a summary of these correlations.

Predictors of Adolescent BMI Change

Hierarchical linear regression was used to examine the proportion of variance in adolescent BMI change explained by parent variables (Table III). Controlling for treatment condition, parent pressure to eat, and concern about weight at baseline accounted for 11% of adolescent BMI change (Step 2). An additional 15% of the variance was explained

Table I. Sample Baseline Characteristics

Adolescents ($N = 86$)	
Age, M (SD) (years)	14.29(0.98)
Gender, female, n (%)	61 (70.9)
Weight, M (SD) (range) (lbs.)	186.29 (29.81) (133.0–261.5)
Height, M (SD) (cm)	164.28 (8.04) (143.75–183.63)
Waist circumference, M (SD) (range)	103.04 (9.06) (84.47–123.00)
BMI, M (SD) (range)	31.22 (3.21) (25.81–39.21)
z-BMI, M (SD) (range)	1.59 (1.55) (0.92–2.52)
Percent overweight, M (SD) (range)	60.54 (15.10) (31.36–95.09)
Adolescent race	
Caucasian, n (%)	65 (76)
African-American, n (%)	13 (15)
Other/Multi-racial, n (%)	8 (9)
Adolescent ethnicity	
Latino, n (%)	6 (7)
Non-Latino, n (%)	80 (93)
Parents	
Gender, mothers, n (%)	81 (94)
Weight, M (SD) (range) (lbs.)	181.47 (41.61) (106.88–339.00)
Height, M (SD) (cm)	164.57 (6.47) (148.80–181.67)
BMI, M (SD) (range), percentage of parents with BMI ≥ 25	30.49 (6.88) (19.61–58.43) (76.5)
Parent education (mother; father)	
Eighth grade to high school education, n (%)	14 (16); 28 (36)
Some college to 4 year college, n , (%)	60 (70); 35 (44)
Graduate degree, n (%)	12 (14); 16 (20)

with the addition of parent intervention-related behaviors, specifically parent BMI change and number of completed parent diet records. The complete model accounted for 26% of the variance in adolescent BMI change from baseline to end of treatment, with parent BMI change emerging as the only significant independent predictor of adolescent BMI change ($t = 3.20$, $p < .01$).

Predictors of 8 Pound Weight Loss

Logistic regression was utilized to examine the unique contribution of the independent variables in predicting 8 lbs. or greater adolescent weight loss. Thirty-nine adolescents (45.3%) lost 8 lb. or more from baseline to end of treatment. Adolescents who were randomized to CBT + PEAT were significantly more likely ($OR = 4.03$; 95% CI 1.09–14.90; $p = 0.037$) than adolescents in the CBT + EXER group to achieve ≥ 8 lbs. weight loss. Adolescents of parents with higher scores on the Pressure to Eat scale were less likely to lose ≥ 8 lbs. ($OR = 0.16$; 95% CI 0.05–0.51; $p = 0.002$). Forty-seven parents (57.3%) lost

Table II. Correlations between Adolescent and Parent BMI Change and Parent Weight-Related Behaviors

	1	2	3	4	5	6	7	8	9
1. Adolescent baseline BMI									
2. Parent baseline BMI	0.23*								
3. Adolescent BMI change ^a	-0.01	0.07							
4. Parent BMI change ^a	0.09	0.00	0.40**						
5. CFQ—Concern about teen weight	0.13	0.01	0.28*	0.20					
6. CFQ—Pressure to eat	-0.04	0.03	0.25*	0.09	0.21 ^b				
7. Number of parent self-monitoring records	-0.06	-0.10	-0.23*	-0.22*	-0.08	-0.09			
8. Number of adolescent self-monitoring records	-0.13	-0.08	-0.46**	-0.34**	-0.26*	-0.21	0.47**		
9. Adolescent group attendance	0.01	-0.17	-0.44**	-0.28*	-0.21	-0.28*	0.34**	0.46**	
Mean (SD)	31.22 (3.21)	30.49 (6.88)	-1.59 (1.49)	-0.64 (1.44)	3.90 (0.85)	1.67 (0.80)	1.65 (1.16)	9.16 (4.00)	12.60 (2.83)

* $p < .05$; ** $p < .001$ (2-tailed).^aNegative BMI change values represent weight loss.^bTrend $p < .06$.

Table III. Hierarchical Regression Analysis Predicting Change in Adolescent BMI

Variable	B	SE	β	t	R ²	ΔR^2
Step 1					0.01	
Treatment condition	0.48	0.30	0.16	1.60		
Step 2					0.12*	0.11*
CFQ—Pressure to eat	0.25	0.20	0.13	1.29		
CFQ—Concern about teen weight	0.34	0.18	0.20	1.90		
Step 3					0.26**	0.15**
Parent BMI change	0.34	0.11	0.34	3.20**		
Number of parent diet records	-0.20	0.13	-0.16	-1.51		

* $p < .05$; ** $p < .01$.

at least 2.2 lbs. from baseline to end of treatment. Adolescents whose parent lost at least 2.2 lb. were significantly more likely than adolescents whose parent lost <2.2 lbs. or gained weight to achieve at least 8 lbs. weight loss (OR = 3.34; 95%CI 1.01–11.04; $p = .048$). For each additional parent diet record that was completed, adolescents were nearly 3 times as likely to achieve ≥ 8 lbs. weight loss (OR = 2.71; 95% CI 1.51–4.86; $p = .001$).

Adolescent–Parent Weight Change Dyads

Given that parent weight loss emerged as a significant predictor of adolescent weight change in both the linear and logistic regression models, post hoc chi-squared analysis was run to further examine this association. Table IV outlines the results of the chi square analysis, which highlights the association between parent and adolescent weight change. The Pearson chi-squared statistic of the number of dyads in each of the 4 cells was 5.46, $p < .05$, indicating significant differences in the number of parent–adolescent dyads in each of the 4 cells.

Discussion

This study examined the role of parent weight-related behaviors and feeding practices within the context of adolescent BWC intervention, in which parents played a supportive role but were not themselves an intervention target. This study adds to the literature by examining the role of baseline levels of parent feeding practices and attitudes as well as parent involvement over the course of intervention (parent self-monitoring, parent weight change) as dimensions that may enhance adolescent weight control.

Overall, findings from this study suggest that even when parents are not directly targeted for weight control, greater parent weight loss is positively associated with

Table IV. *Adolescent Weight Loss Success and Parent Weight Change*

Parent weight change	Adolescent weight loss success	
	Not successful (lost <8 lbs.)	Successful (lost ≥8 lbs.)
Parent maintained weight or gained (Lost <2.2 lbs.)	<i>n</i> = 24 Adolescent weight Δ = -0.73 lb (4.84 lb) Parent weight Δ = 3.43 lb (5.43 lb)	<i>n</i> = 11 Adolescent weight Δ = -13.53 lb (6.07 lb) Parent weight Δ = 2.47 lb (5.42 lb)
	<i>n</i> = 20 Adolescent weight Δ = -2.39 lb (3.85 lb) Parent weight Δ = -6.12 lb (3.34 lb.)	<i>n</i> = 27 Adolescent weight Δ = -16.46 lb (7.77 lb) Parent weight Δ = -10.92 lb (7.96 lb)

greater teen weight loss. Parent BMI change emerged as the only independently significant predictor of adolescent BMI change in the linear regression. In addition, adolescents whose parents lost weight during the intervention were over 3 times as likely to lose at least 8 lb., as compared to adolescents whose parents either maintained or gained weight. This is notable, given that the criterion for parent weight loss over 4 months in analyses was modest (i.e., 2.2 lb.). Observations of adolescent weight change based on the “pairing” of adolescent and parent weight change (Table IV) further support the hypothesis that parent weight management is important for adolescent BWC. Adolescents were the most successful with weight loss when both the adolescent and parent lost weight. While the observed associations between parent weight loss/self-monitoring and adolescent weight loss may have been due to the effects of parent behavior on adolescent weight loss, the opposite may also be true (i.e., adolescent weight loss may have led to parent weight loss).

Findings also supported the second hypothesis, in that adolescents whose parents completed a greater number of diet records during the first month of intervention tended to lose more weight. For each additional parent diet record that was completed, adolescents were 2.7 times as likely to lose at least 8 lb. (the minimum clinical goal). These results are consistent with previous findings of Germann and colleagues (2007) linking any parental self-monitoring of their own eating and exercise behaviors during the beginning months of intervention to greater adolescent weight loss (Germann, Kirschenbaum, & Rich, 2007). Results are also consistent with research suggesting the importance of parental adherence to BWC strategies for school-age youth (Wrotniak, Epstein, Paluch, & Roemmich, 2005).

There are a couple of potential mechanisms through which parent self-monitoring may have facilitated adolescent weight loss. Given the positive correlation we observed between parent and adolescent self-monitoring, it is reasonable to consider that parent modeling of

self-monitoring may have facilitated adolescents’ acquisition of their own self-monitoring behavior, thereby supporting greater adolescent weight loss. This hypothesis is consistent with social learning theory (Bandura, 1977) and studies suggesting the importance of parent modeling for adolescent eating patterns (e.g., Lee & Reicks, 2003). It is also possible that parents who self-monitored made healthier changes at home as a result of their self-monitoring, and that these environmental changes further supported adolescent weight loss. The current study did not include assessment of the home food and physical activity environment, which could be examined in subsequent research on parent and family factors in the context of adolescent weight control. Causal inferences cannot be drawn from this study. It is important to consider that parent self-monitoring may have simply been a sign of greater overall parent motivation and investment in the intervention. On the other hand, it is also possible that parents who self-monitored may have gained perspective regarding the challenges of self-monitoring, which may have helped to facilitate a more supportive yet firm parenting style (i.e., authoritative), which could play a protective role for adolescent BMI over time (Berge, Wall, Loth, & Neumark-Sztainer, 2010).

The third aim of this study was to examine associations between baseline levels of parent-feeding practices and attitudes, and adolescent weight change over the course of intervention. Overall, findings suggest that parental pressure to eat, and to a lesser extent concern about adolescent overweight, are associated with less favorable adolescent weight loss. Adolescents lost less weight if parents reported greater levels of pressuring them to eat and being concerned about their weight prior to beginning treatment. Together these two feeding practices predicted 11% of the variance in adolescent BMI change over the course of treatment. This study did not examine potential changes in specific parent feeding practices (e.g., pressure to eat) over the course of the intervention, although this could be examined in future research.

Pressure to eat is one dimension of parent control related to child feeding (Birch et al., 2001). Examples of items on the Pressure to Eat subscale were “My teen should always eat all of the food on his/her plate” and “I have to be especially careful to make sure my teen eats enough.” A pattern of controlling feeding practices is thought to interfere with the development of eating self-regulation (Birch et al., 2001), and one could imagine that poor self-regulation may make weight loss efforts more difficult. It is quite possible that parents in this study who scored high on the Pressure to Eat subscale at baseline may have been the ones who benefited the most from the BWC intervention, in terms of learning how best to support their teen’s weight loss efforts (i.e., that it is important not to pressure their teen to eat). This relatively minor change could, potentially, have a substantial impact for an adolescent’s weight loss effort. It is important to keep in mind that this study measured parent feeding attitudes and practices at *baseline* and did not evaluate potential changes in this variable over time. In addition, psychometric issues associated with low alpha reliability of the Concern about Weight and Pressure to Eat subscales may have introduced error variance that affected study findings.

This study should be considered in light of its limitations. First, it did not capture the full range of parent behaviors that may influence the course of adolescent BWC, including behaviors specific to parent weight control strategies (e.g., self-weighing) and nonspecific to weight control (e.g., parent–teen communication). Measuring these additional domains of parent behavior could be helpful in elucidating the ways in which parent behavior affect adolescent weight control. The study sample consisted of primarily Caucasian and female adolescents who successfully completed a 1-week dietary run-in period prior to randomization, and the outcome is limited to adolescent weight change immediately posttreatment. Long-term follow-up data would contribute to an understanding of how these parent variables affect adolescent weight change over time (e.g., 12- or 24-month follow-up). In addition, the adapted version of the CFQ used in this study has not been validated with adolescents, although subsequent to this study a highly similar version of the CFQ was validated in adolescents (Kaur et al., 2006). Finally, parents participating in this study were almost exclusively mothers. There is a need for research examining the influence of fathers with respect to adolescent weight control.

In summary, despite increased autonomy in adolescence, study findings suggest that parents can still play an important role for promoting adolescent weight loss

success. Findings suggest that parents play a role in BWC both through their own weight control behaviors (e.g., self-monitoring) over the course of the intervention and through their pre-existing feeding attitudes and behaviors. Future research is needed to more directly examine the role of parents in adolescent BWC, while attempting to disentangle the direction of the effect between parent and adolescent weight loss. For example, future research could evaluate specific mechanisms (e.g., parental attitudes about food and eating, parent modeling or promotion of stimulus control) linking parent involvement and teen weight loss success. As future research explores how to best involve parents in a supportive role for teen weight loss, another future research direction may involve directly targeting both the parent and adolescent simultaneously for weight loss.

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