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Comparison of Two Models of Family-Based Treatment for Childhood Obesity: A Pilot Study

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Abstract

Background: Family-based weight loss treatment (FBT) for childhood obesity, the current "gold standard," is typically provided in weekly groups for 6 months. Although this program is considered effective, it poses limitations to treatment engagement, due to time commitment and lack of widespread availability. A guided self-help version of FBT (gshFBT; eleven 20-minute sessions and one 1-hour over 5 months) was developed to circumvent such limitations. The current study examined the comparative efficacy of a 5-month FBT and gshFBT program.

Methods: Participants included 50 parent–child dyads enrolled in FBT between 2011 and 2013 and 50 parent–child dyads enrolled in gshFBT between 2009 and 2010. Data were collected at baseline, posttreatment, and 6-month follow-up. Noninferiority analyses were conducted to assess comparative efficacy of changes in parent and child weight status, child nutrition, child physical activity, and drop-out.

Results: Results indicated that gshFBT was noninferior to FBT in changes in child BMI z-score, overweight parent BMI, child nutritional intake, child vigorous physical activity, and drop-out. Results did not support noninferiority for changes in moderate to vigorous physical activity.

Conclusions: gshFBT is less intensive, more flexible, and may be similarly effective to FBT and could reach a greater proportion of the pediatric overweight population. Further research, including a randomized clinical trial, is needed to confirm these results.

Keywords: child; family-based treatment; guided self-help; obesity; parent

Introduction

Childhood obesity is a major public health concern in the United States with over 30% of children having overweight or obesity.[1] Children with overweight or obesity are at an increased risk for many medical comorbidities,[2–4] bullying by peers, lower self-esteem, decreased quality of life, and higher rates of body dissatisfaction.[5–7] They also have significantly higher health care costs relative to children with healthy weight.[8]

These factors underscore the need for interventions to treat a greater majority of children with overweight and obesity.

The current "gold standard" treatment for childhood obesity is family-based weight loss treatment (FBT). FBT provides nutrition and physical activity advice, along with behavior therapy and parenting skills.[9] Treatment includes weekly child and parent group sessions as well as individual behavioral coaching to target personalized family goals and barriers.[10–12] Overall, families receive over

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36 hours of treatment over 6 months. In addition, when treatment is provided in groups, the schedule is fixed (*i.e.*, offered on one night a week), which prevents some families from participating. Although shown to be effective,[13] FBT is time and cost intensive and not feasible for all families. When FBT was adapted for delivery in primary care, only 28% of the families who were offered the treatment enrolled, and only 63% of enrolled families completed the intervention.[14] Research is needed to develop interventions for families for whom FBT is not feasible.

A guided self-help model of FBT (gshFBT) could provide the major components of FBT while being more appropriate for dissemination.[15] In gshFBT, families are given manuals that cover the major topics provided in group-based FBT, and attend bimonthly 20-minute one-on-one meetings to track weight, assist in adherence to the program, and problem-solve barriers to treatment success. The gshFBT model can be provided by someone with little training, requires less frequent and intense visits than FBT, and resembles the Medicare coverage for adults with obesity (www.cms.gov). Initial data on this model showed that gshFBT, relative to a waitlist control group, resulted in significant decreases in child BMIz.[15] A gsh treatment was also as effective as more intensive treatment for adolescents with overweight and obesity.[16] Based on previous research showing that the increased number of contacts is associated with better outcomes in adult weight loss programs,[17] the outcomes of FBT should exceed those in gshFBT (FBT, twenty 90-minute sessions over 6 months; gshFBT, twelve, 20-minute sessions over 5 months). Yet, if gshFBT produces similar weight losses to FBT, this could increase access to care and potentially allow earlier intervention in the disease process.

Little is known about the comparative outcomes of FBT and gshFBT for childhood obesity. Thus, we conducted a quasi-experimental study to get an initial indication of how these two treatments compare. This study examined whether gshFBT was noninferior to FBT on changes in child weight, nutrition, physical activity, parent weight status, and treatment completion rates.

Methods

Overall Study Design

Participants came from two independent studies conducted at the University of California San Diego (UCSD).[15,18] The gshFBT study was conducted between 2009 and 2011 and the FBT study was conducted between 2011 and 2014. Outcome measures were assessed at baseline (month 0), posttreatment (month 5), and 6 months follow-up (month 11). Both studies were approved by the UCSD Institutional Review Board.

Participants

All participants were recruited through print advertisements, email advertisements, pediatrician referrals, and direct mailing. Inclusion criteria for both studies included the following: (1) participating parent who could read English ≥6th grade level, and (2) parent and child willing to commit to treatment and assessment attendance. Exclusion criteria included the following: (1) current psychiatric or eating disorder, (2) current serious physical illness, (3) medication regiment that may impact weight, (4) dietary restrictions, or (5) physical difficulties that would prevent participants from engaging in physical activity. Unique to the gshFBT study, enrolled children were limited on the upper end for weight status (BMI percentile ≤98th%) and parents were not required to be overweight to participate.

For the original gshFBT study,[15] 50 children (BMI 85th% to ≤98th%) and their parents were recruited and randomized to either intervention (gshFBT) or delayed treatment control. Children randomized to delayed treatment control participated in treatment following the completion of treatment for the immediate group. For the original FBT study,[18] 150 children (BMI percentile: 85th% to 99th%) and their overweight parents were recruited and randomized to a parent-only or a parent and child treatment.

Because this was a nonrandomized study, systematic matching procedures were used to reduce the number of variables that could influence outcomes. Children enrolled in the parent and child arm of the FBT study ($n = 75$) were reviewed and matched to the 50 gshFBT children. Considering the weight difference in recruitment, we first selected children in the FBT study who were 98th% BMI or lower ($n = 55$) before matching them to the gshFBT children by gender and age (*see* Table 1 *for baseline demographics of the resulting samples included in this study*).

Treatment Arms

Guided self-help version of FBT. gshFBT families attended eleven 20-minute sessions and one 1-hour session (session 2) to allow for time to discuss dietary recommendations over 5 months.[15] Families received three manuals (*i.e.*, parent, child, and activities) covering the major components of FBT. Individual gshFBT sessions assisted the family in understanding and implementing the topics and strategies outlined in their manuals. Perfect attendance in gshFBT equated to 4.67 hours of treatment. Mean treatment attendance for the gshFBT group was 4.19 ± 1.07 hours (two families did not complete the 1-hour session).

FBT. FBT families attended twenty 90-minute sessions over 6 months.[18] Sessions included 60-minute child and parent separate group sessions, and a 30-minute parent and child individual session with a behavioral coach. The parent group sessions covered topics on nutrition, physical activity, behavior therapy skills (*e.g.*, stimulus control), and parenting skills. The child group sessions provided the same information (without the parenting skills) in a developmentally appropriate manner. Perfect attendance in FBT equated to 28.5 hours of direct contact. Mean

	gshFBT (*N* = 50)	FBT (*N* = 50)
Table 1. Baseline Demographic Characteristics in gshFBT and FBT (Means and Standard Deviations)		
Child		
Gender		
% Female	64.0	66.0
Age (mean)	10.38 (1.32)	9.46 (1.10)*
BMIz (mean)	1.71 (0.28)	1.84 (0.29)
Ethnicity, %		
Caucasian	56.0	54.0
Latino	12.0	12.0
African American	2.0	10.0
Other	30.0	24.0
Parent		
Gender		
% Female	80.0	88.0
Age (mean)	42.76 (5.61)	43.10 (6.63)
BMI (mean)	27.77 (6.12)	31.78 (6.36)*
Ethnicity, %		
Caucasian	64.0	60.0
Latino	12.0	12.0
African American	4.0	8.0
Other	20.0	20.0
Income, %		
<$20,000	2.0	6.0
$20,001–$40,000	12.0	8.0
$40,001–$60,000	4.0	12.0
>$60,000	72.0	72.0
Not reported	10.0	2.0

*$p < 0.01$.

FBT, family-based weight loss treatment; gshFBT, guided self-help version of FBT.

attendance for the FBT group was 20.25 ± 6.54 hours at the 5-month time point and 22.32 ± 7.37 hours at the 6-month time point (end of treatment).

Measures

Child measurements

Child BMI standardized. Child height and weight were obtained at baseline, posttreatment, and follow-up. Height and weight were taken in duplicate using a portable Schorr height board (Schorr, Inc., Olney, MD) and Tanita Digital Scale (model WB-110A). The average of the two values was used in analyses. BMI was calculated (kg/m^2) and

translated to BMIz score.[19] In FBT, since the treatment was longer, child BMIz was calculated using weight at month 5.

Child nutrition. Child nutrition was measured at baseline and posttreatment using three 24-hour dietary recalls conducted by trained dietary assessors on three nonconsecutive days using a multiple pass method. This method of dietary assessment is valid for children.[20–22] Recalls were scored using the Nutrition Data Systems for Research (NDS-R) nutrient calculation software (www.ncc.umn.edu/products/ndsr.html). Dietary information was analyzed for average daily caloric intake from baseline to mid-treatment, percent of the child's estimated energy requirements consumed each day,[23] and mean daily caloric intake at posttreatment. A low activity level was used to calculate estimated energy requirements consumed each day.

Child physical activity. Child physical activity was assessed at baseline and posttreatment using ActiGraph Accelerometers (model GT1M, www.theactigraphy.com), which are small ($3.8 \times 3.7 \times 1.8$ cm), lightweight (27 g), uniaxial accelerometers worn on a belt around the waist. The ActiGraph technology is valid for quantifying activity levels in laboratory and field settings.[24] Moderate to vigorous physical activity (MVPA) intensities were determined from the Freedson age adjusted equation.[25,26] Activity categories were summed to calculate minutes of valid days (>10 hours). We report MVPA and vigorous physical activity as a percent of total ActiGraph wear-time to adjust for differences in the amount of time the children wore the accelerometers.

Parent measurements

Parent BMI. Parent height and weight were measured in the same manner of the child and translated to BMI.

Treatment completion. Treatment completion was defined as attending posttreatment and 6-month follow-up assessments.

Demographics. Demographics included parent and child age, parent and child gender, parent marital status, ethnicity, and income.

Statistical Analyses

Statistical analyses were performed using SPSS version 22.[27] Descriptive analyses were calculated to examine demographic characteristics of the families (see Table 1). Increasingly complex unconditional means regression models were created to determine the most appropriate model to use for analysis. For each variable, the simplest model, which included a fixed effect, was chosen. Noninferiority was determined by examining effect sizes, 95% confidence intervals (CIs) for effect sizes, and means.[28–30] These analyses were chosen to reduce type I error. Effect

Table 2. Outcomes across Time Points for gshFBT and FBT (Means and Standard Deviations)

	gshFBT			FBT		
	Month 0	**Month 5**	**Month 11**	**Month 0**	**Month 5**	**Month 11**
Child						
Weight						
BMIz	1.71 (0.28)	1.52 (0.3)	1.51 (0.38)	1.84 (0.29)	1.61 (0.42)	1.63 (0.43)
Nutrition (kcal)	1572 (395)	1502 (381)	—	1669 (338)	1449 (298)	—
Physical activity (% wear time)						
MVPA	11.73 (4.6)	11.64 (4.7)	—	20.36 (5.5)	20.42 (5.7)	—
Vigorous	1.37 (1.1)	1.57 (1.2)	—	0.82 (0.82)	0.84 (0.96)	—
Parent						
BMI	27.7 (6.1)	27.1 (6.1)	27.7 (6.2)	31.8 (6.4)	30.3 (6.1)	30.2 (5.9)
Drop out			10%			14%

MVPA, moderate to vigorous physical activity.

sizes were calculated for each treatment and for each time point (baseline to posttreatment and baseline to follow-up). Effect sizes, CIs, and predetermined bounds were compared between FBT and FBTgsh. Noninferiority was determined if FBTgsh fell within the lower bound of the 95% CI for FBT. Due to lack of published effect sizes of treatment on other outcome variables (physical activity, nutrition intake, self-monitoring, and parenting), means between FBT and FBTgsh were compared to determine if means fell within preset bounds.[31] Preset bounds were set according to a prior noninferiority publication. Linear regressions were conducted for variables with significantly different baseline values. Analyses were considered significant at the $p < 0.05$ level (*see* Table 2 *for means of outcome variables in both groups*).

Missing Data

Missing data ranged from 3% to 20% of the values per variable. Higher frequency of missing values was a result of assessment drop-out and a "prefer not to answer" option in the surveys. Little's Missing Completely at Random (MCAR) Test confirmed that the data were missing at random, $p = 0.458$. Variables missing more than 5% of the data ($N = 5$) were corrected using maximum likelihood estimation as this is an inherent process in unconditional means regression models. Mean imputation was implemented for the Eating in the Absence of Hunger (EAH) posttreatment variables.

Results

Child Outcomes

Child BMIz. For child BMIz score, both unconditional means regression models for FBT and gshFBT were significant [$F(1, 49.22) = 1170.52$, $p < 0.001$; $F(1, 50.35) = 1374.61$, $p < 0.001$]. Treatment effect sizes on child BMIz

score for FBT and gshFBT were moderate from baseline to posttreatment (FBT $d = 0.65$, 95% CI = 0.33–0.98; gshFBT $d = 0.62$, 95% CI = 0.31–0.93) and posttreatment to 6-month follow-up (FBT $d = 0.57$, 95% CI = 0.28–0.85; gshFBT $d = 0.58$, 95% CI = 0.29–0.88), and similar to previously published studies on FBT.[9] A linear regression controlling for baseline child BMIz score was also conducted, since baseline child BMIz score was found to be significantly different between FBT and gshFBT ($p = 0.02$). Results of the regression indicated that treatment group did not significantly predict child BMIz score at posttreatment ($b = 0.079$, $t = 1.546$, $p = 0.126$) and 6-month follow-up ($b = 0.009$, $t = 0.144$, $p = 0.886$; see Fig. 1). Thus, noninferiority for overall treatment outcome was assumed.

Child nutrition. When comparing average daily caloric intake from baseline to posttreatment, the unconditional means models were significant for FBT [$F(1, 47.56) = 1980.14$, $p < 0.001$] and gshFBT [$F(1, 49.89) = 1087.11$,
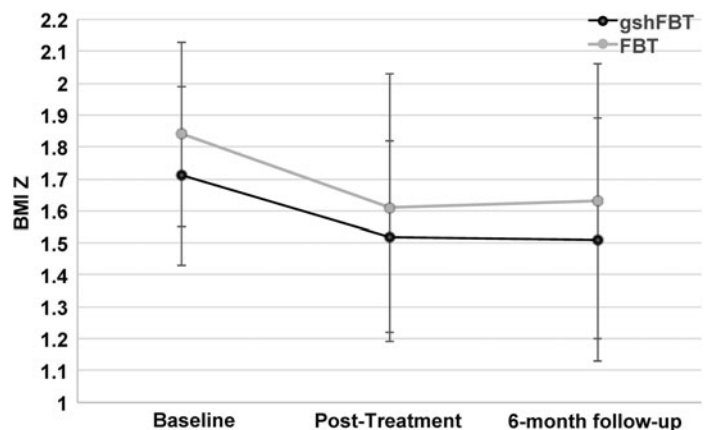

Figure 1. Child weight changes in gshFBT and FBT at baseline, posttreatment and 6-month follow-up.

$p < 0.001$]. Moreover, despite differences in effect sizes between groups for average daily caloric intake from baseline to posttreatment (FBT: $d = 0.69$, 95% CI $= 0.34–1.03$, gshFBT: $d = 0.18$, 95% CI $= 0.09–0.27$) and percent of the child's estimated energy requirements consumed each day (FBT: $d = 0.66$, 95% CI $= 0.33–0.99$, gshFBT: $d = 0.20$, 95% CI $= 0.10–0.30$), posttreatment means for both treatments fell within the preset bound of 300 calories. Thus, gshFBT seemed to have a comparable effect on caloric intake relative to FBT. Thus, noninferiority was assumed.

Child physical activity. Unconditional means models were significant for FBT and gshFBT for MVPA [$F(1, 48.43) = 1040.67, p < 0.000; F(1, 48.58) = 353.61, p < 0.001$], and vigorous activity [$F(1, 49.36) = 70.19, p < 0.001; F(1, 49.06) = 98.55, p < 0.001$]. Due to significantly different baseline values, linear regression analyses were used to determine noninferiority for MVPA and vigorous activity. Outcomes were found to be significantly different for MVPA ($b = -3.655$, $t = -2.650$, $p = 0.010$). Yet, child vigorous physical activity was not significantly different between groups ($b = 0.359$, $t = 1.372$, $p = 0.175$). Thus, noninferiority was assumed. Although the researchers set initial bound of 90 minutes per physical activity category, data from each category were compared based on percentage of time spent in each category due to a large variability in total wear time. Thus, the initial bound could not be utilized.

Parent Outcomes

Parent BMI. Due to a significant difference between treatment groups on parent BMI at baseline, a linear regression was conducted. When examining whether treatment group could predict parent BMI, results showed a trend toward significance at posttreatment ($b = 0.512$, $t = 1.754$, $p = 0.083$) and were statistically significant at follow-up ($b = 0.873$, $t = 1.99$, $p = 0.05$). Since not all parents in gshFBT met criteria for overweight at baseline, we also compared the weight change of the overweight and obese parents in gshFBT ($N = 25$) to those in FBT ($N = 50$). Although these two groups were unequal in participant size, parent BMI means at baseline were no longer significantly different, and parent weight loss in FBT and gshFBT was comparable across time points. With only overweight parents included in the gshFBT sample, noninferiority, as determined by a bound of 1 BMI point, was assumed at posttreatment and follow-up time points.

Family Drop Out

The bound for noninferiority for treatment compliance was set at 6% or 3 participants. Treatment drop out was similar between FBT ($N = 5$) and gshFBT ($N = 7$).

Discussion

This study provided an initial comparison of two models for the treatment of childhood obesity; FBT and a less intensive program, gshFBT. Results showed that gshFBT was noninferior to FBT on child BMIz, parent BMI, child dietary intake, child vigorous physical activity, and treatment completion (10% dropout in gshFBT vs 14% in FBT). Noninferiority was not found for changes in MVPA.

In this study, gshFBT resulted in child weight loss that was noninferior to FBT over the 11 months of the study. Although weight maintenance is also seen as a success in child weight-loss treatments as children are still growing, both treatments resulted in significant weight loss. These results are similar to published outcomes comparing a gsh version of a lifestyle modification program (six 45-minute individual sessions) and a group lifestyle modification program (six 45-minute individual sessions + 17 group sessions) for adolescents with overweight or obesity.[16] Despite initial differences on sample age and race/ethnicity, both studies suggest that gsh may be a promising model for treatment of youth with overweight and obesity. Relative to FBT, the gshFBT model is more efficient and simpler to implement, while maintaining the focus on parenting skills and key behavioral strategies necessary for lifestyle change. Furthermore, compared to FBT, gshFBT can more easily accommodate the family's busy schedule (*i.e.*, does not require group attendance at a specific time), is less time intensive for the family, and requires less interventionist time (15 families in gshFBT require 65 hours of interventionist time vs 190 hours of interventionist time in FBT [includes group and individual coaching time]). Thus, there would be a greater opportunity to disseminate the gshFBT model. Our preliminary findings support the need for future randomized control studies to examine the efficacy of gshFBT in child weight loss.

When comparing parents with overweight or obesity from each group (FBT and gshFBT), our results also found that gshFBT was noninferior to FBT on parent weight loss at posttreatment and 6-month follow-up. Although preliminary due to differences in group size, if repeated, these findings could have great implications for family health and could impact more than just the target child and participating parent.

Furthermore, this study provided preliminary evidence of the noninferiority of gshFBT on child daily caloric intake, relative to FBT. Twenty-four hour dietary recalls are currently the most widely used self-report method to assess nutrition and caloric consumption as participants are randomly polled and caloric intake is calculated using standardized data bases.[32] Yet, this measure also is limited by the potential for biased reporting of dietary intake[33–35] due to participant forgetfulness, estimation of portion sizes, and reliance on child report of food consumed during school hours. Thus, future studies should replicate and further test this hypothesis.

Results were less conclusive for child physical activity. Our study showed that gshFBT was noninferior to FBT on changes in child vigorous physical but not MVPA. However, although accelerometers are currently the most accurate way to assess physical activity, there are some

indications that this instrument can be unreliable due to lack of sufficient wear time in children.[36,37] Wear time in this study was variable, which is why we used percent of time spent in each physical activity category. Future studies, including accelerometer data, should use additional incentives to increase child wear time and reduce measure variability.

To our knowledge, this is the first study to compare gshFBT to FBT among 8–12-year-old children with overweight and obesity and their parents. Despite the non-randomized nature of this pilot, both treatments were conducted in the same research laboratory with the same recruitment procedures, and numerous steps were taken to reduce sources of bias. Limitations include the non-randomized design, relatively small sample size, lack of inclusion of children with higher BMIz, differences in inclusion criteria (parent BMI), baseline differences in child MVPA between groups, and potential differences in parent–child interactions depending on parental weight status. Also, there was a difference in interventionist credentials between treatment group; gshFBT treatment sessions were led by graduate students in clinical psychology while FBT group leaders were licensed psychologists or postdocs. However, all gshFBT interventionists attended a 4-hour training regarding behavioral intervention for the study and were supervised by Kerri Boutelle (last author) weekly during treatment. Despite differences in credentials, gshFBT proved to be noninferior to FBT in most of the study main outcomes, further speaking to the use of gshFBT in other settings and by other professionals besides psychologist. Thus, despite these limitations, this study suggests that gshFBT was noninferior to FBT on measures of child and parental weight loss, child dietary intake, and child physical activity except MVPA. These preliminary results could have significant implications for the dissemination of effective treatments of childhood obesity in numerous settings (*i.e.*, community centers and primary care clinics) and support the need for future research on gshFBT. Although the comparative effects and the cost-effectiveness of FBT and gshFBT should be further explored in randomized controlled trials with longer follow-ups, these data suggest that gshFBT is a promising model for future research.

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Author Disclosure Statement

No competing financial interests exist.

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