

The association between previous success with weight loss through dietary change and success in a lifestyle modification program

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Abstract Prior work has yielded mixed results regarding the association between previous weight loss and success in a current weight loss attempt. The present study evaluated differences in baseline psychosocial processes, changes in these over time, and weight loss during a yearlong behavioral weight loss program between individuals who have and have not previously been successful losing weight through self-regulating dietary intake. Individuals with prior success had greater weight losses over time than those without. Differences in baseline and change over time in some facets of motivation and self-efficacy were observed, but only differences in attendance accounted for differential weight loss. Prior success with dietary self-regulation may predict better adherence to and success in behavioral weight control programs. Evaluating the type of weight control efforts that have previously helped induce weight losses may help to better match individuals to treatments likely to yield success.

Keywords Obesity · Behavioral weight loss · Dietary change · Attendance · Psychosocial predictors

Introduction

Many overweight and obese individuals repeatedly attempt weight loss throughout their lifespan (Ciao et al., 2012; Marchesini et al., 2004; Teixeira et al., 2004). This is unsurprising, as individuals often remain overweight or

obese even after clinically significant weight losses (i.e., >10%; Wadden et al., 2004), and also because weight regain is common. Thus, people have likely experienced weight loss success when entering a lifestyle modification program and it is important to understand the relationship between prior weight loss successes and treatment outcome. In particular, it is common for individuals to use dietary self-regulation strategies during self-guided or structured weight loss attempts, which may require skills and strategies taught in standard clinician-led lifestyle modification programs. Whether weight losses in a lifestyle modification program differ between individuals who have and have not had prior success using dietary self-regulation skills and strategies for weight loss is unknown.

Several prior studies have attempted to explore the relationship between prior weight loss attempts and current weight loss success with mixed results. In one group-based, self-help lifestyle modification program, prior weight loss attempts predicted better weight loss outcomes at all follow-up points (Latner & Ciao, 2014). However, in several studies of clinician-guided lifestyle modification programs, greater numbers of prior weight loss attempts have predicted poorer rates of treatment completion (Teixeira et al., 2004), poorer weight loss (Teixeira et al., 2004), and weight regain (Pasman et al., 1999). Another study observed no relationship between dieting history and weight losses in a lifestyle modification treatment (Fabricatore et al., 2008). One limitation of existing research is that weight loss history is often operationalized as number of previous weight loss attempts or presence of any attempt, failing to account for the method attempted (i.e., whether any skills or changes experienced during that method may transfer to a current attempt) or whether the method was successful at inducing weight loss. No work has yet evaluated differences in the outcome of a lifestyle

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modification treatment between individuals with and without experience successfully losing weight through dietary self-regulation.

It is plausible that prior success with dietary self-regulation may predict better or worse weight loss outcomes in subsequent lifestyle modification attempts. The familiarity with self-regulation skills taught in behavioral programs may help individuals to more quickly and easily initiate these strategies, yielding greater success and engagement with treatment. Prior success may also be a marker of a relatively greater ability to self-regulate eating behavior. Alternatively, individuals may be less engaged given the repetition of skills and strategies with which they are already familiar, leading to poorer outcomes.

Any differences in treatment outcome that could exist may be related to differences in psychosocial processes between those who have and have not had success with dietary self-regulation. Prior work has suggested that self-efficacy (Anderson-Bill et al., 2011; Guglielmo et al., 1985; Teixeira et al., 2010; Wamsteker et al., 2005) and motivation (Cresci & Rotella, 2009; Webber et al., 2010), which are constructs underlying many theories of behavioral change, are higher in individuals who are successful in weight control programs. Prior success with dietary change may impact self-efficacy or motivation for behavioral weight control. Self-efficacy may be greater in those with previous success, as they have learned that they are able to successfully regulate eating behavior. Alternatively, self-efficacy may be lower if individuals have been unsuccessful with long-term weight management. Motivation may be greater in individuals who have previous success as they are persisting in a similar type of attempt and may have a better understanding of the commitment required of a lifestyle modification program. Alternatively, motivation may be lower because the material is less novel or compelling. Whether differences in psychosocial processes exist between those entering a treatment study who have and have not had prior weight loss success is unknown. Understanding the differences in self-efficacy and motivation that may be associated with prior experience will help researchers to better understand differences in treatment outcome.

The current study evaluated differences in weight loss during a lifestyle modification program between participants who have and have not previously successfully lost weight through self-regulating eating behavior. Additionally, the study will evaluate baseline differences and differential change over time between groups in motivation and self-efficacy, as well as differences in treatment dose (i.e., attendance) between groups. Finally, the study will evaluate whether any existing differences between groups in these process variables at baseline or over time account for differential change in weight.

Methods

Participants

Participants were 283 adults recruited from the community through radio, newspaper, local websites, and postcards to participate in a study of behavioral weight loss treatment. Eligible participants had a BMI between 27 and 45 kg/m², were between 18 and 70 years old, were able to engage in physical activity, and completed a 7-day food diary and all pre-randomization procedures. Participants were excluded if they had a weight loss of $\geq 5\%$ in the previous 6 months, recently began a course or changed the dose of a medication that could cause significant weight change, were pregnant, or had any medical or psychiatric condition that may have limited their ability to participate in the trial. All participants provided written informed consent, and the study was approved by the Drexel Institutional Review Board.

Procedures

Detailed enrollment procedures are given elsewhere (Butryn et al., 2017). Briefly, prior to enrollment, participants completed measures and were weighed at a baseline visit before treatment began. Participants were randomized to one of three conditions, all of which were based on standard behavioral treatments adapted from the Diabetes Prevention Program (Diabetes Prevention Program (DPP) Research Group, 2002) and Look AHEAD (Look Ahead Research Group, 2013). Treatment consisted of 26 group meetings over the course of 1 year. Each meeting was 90 min long and included private measurement of weight, a group check-in on behavioral goals, and a group-based didactic presentation and discussion of new skills or strategies (e.g., planning) to aid in adhering to these behavioral goals. Each condition was given identical behavioral goals, including calorie goals based on the standard balanced deficit diet guidelines and physical activity prescription increasing gradually to 250 min per week. The program weight loss goal was 10% of initial weight for all participants. There were no differences in weight loss between conditions at treatment end (Butryn et al., 2017), and participants were collapsed across condition for the present study.

Measures

Body weight was measured using a Seca scale accurate to 0.1 kg (measured in street clothes). Participants were weighed at two visits prior to treatment start and at assessments 6 months (mid-treatment) and 12 months

(end-of-treatment) after baseline. Height was measured at baseline using the built-in height rod.

Weight and Lifestyle Inventory (Wadden & Foster, 2006). As part of enrollment, all individuals completed a historical record of their weight loss experiences, noting all efforts where they successfully reduced weight by at least 10 lb; weight loss experiences resulting in less than a 10-pound loss were not obtained. Participants indicated the method of weight loss for each separate attempt. These experiences were coded as including a dietary change that required regulatory control or not. Examples of those experiences coded as a dietary change were Weight Watchers, portion control, reducing calories. Examples of experiences coded as not involving dietary change were medical treatment (e.g., prescription medication), liquid diets, exercise-only, and meal replacements (without other dietary change). Participants were divided, based on this information, into those who had, at some point, reduced weight by at least 10 lb through self-regulated dietary change and those who had not. Thus, the category of individuals who did not have previous success with self-regulated dietary change included: individuals who have never attempted weight loss, individuals who had no weight losses of at least 10 lb, and individuals who have had success with other methods of weight loss. The category of individuals who have had prior success with self-regulated dietary change is inclusive of individuals endorsing success with these methods, regardless of whether they also endorse success with other methods of weight control. Maintenance of previous lost weight at enrollment (i.e., weight suppression) was also derived using a single item asking for self-reported highest weight and weight at baseline.

The Treatment Self-Regulation Questionnaire (TSRQ) was used to measure motivation to lose weight (Levesque et al., 2007). The questionnaire asks about reasons an individual might be motivated “to control weight through diet and exercise,” thus making it specific to behavioral weight control attempts. The 15-item measure has adequate internal consistency among all four subscales (autonomous motivation, external motivation, introjected motivation, and amotivation). Responses were answered on a seven-point Likert scale, ranging from 1 (not true at all) to 7 (very true).

The Weight Efficacy Lifestyle Questionnaire assessed self-efficacy for self-regulating food intake across several situational factors (negative emotions, availability, social pressure, physical discomfort, and positive activities; (Clark et al., 1991)). Participants answer questions pertaining to their ability to resist the desire to eat when confronted with specific situations. The WEL has demonstrated good validity and test–retest reliability (Navidian et al., 2009). Each subscale was comprised of four items,

measured on a 10-point scale from 0 (not confident) to 9 (very confident).

Statistical analysis

Weight data were missing for 17.0% of participants at mid-treatment and 21.6% of participants at end-of-treatment. Missing data were handled using multiple imputation and five imputed datasets, as has been suggested elsewhere (Batterham et al., 2017; Elobeid et al., 2009; Gadbury et al., 2003). Weight data taken at each treatment session were included in the imputation to help improve the models. Results were pooled across the five datasets. Differences between groups in demographic information and maintenance of previous weight losses were evaluated to determine covariates for inclusion in analyses. Differences between groups in baseline motivation and self-efficacy and attendance were evaluated using ANCOVA. Initial weight was the weight obtained at the first treatment session, as has been suggested elsewhere (Kerrigan et al., 2016; West et al., 2011), and change over time was evaluated using repeated-measures ANOVAs. Mediation analyses using the bootstrapping technique developed by Preacher and Hayes (Preacher & Hayes, 2004) were conducted to determine whether baseline differences in motivation and self-efficacy or differences in changes in motivation and self-efficacy between baseline and mid-treatment or attendance explained any observed relationship between prior dietary change success and treatment outcome.

Results

Most participants were white (65.8%), female (78.9%), and had an average age of 53.2 ± 9.7 years. Average baseline BMI was 35.1 ± 4.8 kg/m² and participants were, on average 3.1 ± 8.7 kg weight suppressed (i.e., maintaining lost weight). Individuals without prior success comprised 39.2% of the sample. A significantly higher proportion of those without, compared to those with, prior success was male; thus, gender was included as a covariate in subsequent analyses (see Table 1). No other baseline demographic or weight characteristics were different between those with and without prior success. Among those without prior success, 34.2% reported no weight loss efforts that resulted in at least 10 lb of weight loss, while the remaining 65.8% reported at least one other method of weight loss. Of those endorsing another method of weight loss, 53.4% reported attempting to lose weight through exercise only, 21.9% through supplements, 31.5% through meal replacements or liquid diets, and 12.3% through medical providers (together, these total more than 100% as

Table 1 Between-group differences

	Success (n = 172)	No success (n = 111)	χ^2 or <i>F</i> value
Age (years)	53.80	52.31	1.58
BMI (kg/m ²)	35.32	34.98	0.33
Male (%)	15.7	29.7	7.95**
Caucasian (%)	69.8	59.5	3.18
Weight suppression	−3.28	−2.79	0.21
Weight efficacy and lifestyle			
Negative emotion	16.38	18.92	5.01*
Food available	15.74	16.25	0.35
Social pressure	21.52	21.40	0.04
Physical discomfort	21.58	24.05	7.36**
Positive emotion	22.83	23.05	0.17
Total score	104.35	97.95	2.68
Treatment self-regulation questionnaire			
Autonomous motivation	6.53	6.35	2.87
Introjected motivation	4.29	4.05	1.15
External motivation	2.98	2.99	0.09
Amotivation	1.84	2.16	5.34*
Attendance (treatment dose, 26 sessions possible)	23.65	21.51	8.88**

Comparisons of psychosocial variables and attendance include gender as a covariate

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

individuals listed all efforts and some individuals reported more than one method of weight loss).

Prior success significantly moderated weight changes over time during treatment ($F = 5.81$, $p < .01$). Evaluation of differences at each time point showed significant differences at mid-treatment, where mean weight loss for those without prior success was 8.6% of initial weight and those with prior success was 10.3% ($F = 8.44$, $p < .01$), and at end-of-treatment, where mean weight loss for those without prior success was 9.4% and those with prior success was 11.4% ($F = 5.58$, $p = .02$). At mid-treatment, 50.3% of participants who had previously been successful had met the 10% weight loss goal while only 38.0% of those who had not previously been successful with dietary change had reached 10% weight loss ($F = 2.33$, $p = .06$).

At baseline, compared to those with prior success, those without prior success had significantly higher levels of amotivation (i.e., a lack of motivation). Individuals with prior success displayed lower levels of self-efficacy for weight control in the context of negative emotion and physical discomfort than individuals without prior success. Differences between other motivation and self-efficacy subscales were not observed (see Table 1). Between groups, change in self-efficacy and motivation was largely similar (see Table 2). However, self-efficacy for weight

control in the context of physical discomfort increased more quickly in those with prior success. A similar, but non-significant, pattern was observed for self-efficacy for weight control in the context of negative emotion.

Attendance at treatment sessions also significantly differed between groups such that those with prior success had a higher average treatment dose (see Table 1). We additionally evaluated whether this effect may have been driven by differential treatment dropout. At 6 months, those with prior success had a significantly lower rate of treatment dropout than those without prior success (12.2 vs. 22.5% respectively, $p = .03$). Attendance rate was significantly correlated with changes in self-efficacy for weight control in the context of negative emotion ($r = .20$, $p = .003$) and physical discomfort ($r = .22$, $p = .001$).

The baseline variables that differed between groups were not significant mediators of the relationship between prior success and weight loss outcome (see Table 3). When change in self-efficacy for weight control in the context of negative emotion, change in self-efficacy for weight control in the context of physical discomfort, and attendance were entered simultaneously as mediators, only attendance emerged as a significant mediator of the relationship between prior success with dietary change and end-of-treatment weight loss.

Table 2 Change in self-efficacy and motivation

	Baseline	Mid-treatment	End-of-treatment	<i>F</i> value
<i>Weight efficacy and lifestyle^a</i>				
Negative emotion				
Success	16.41	23.12	23.51	2.43†
No success	19.16	23.58	25.15	
Food available				
Success	15.45	21.40	21.95	1.95
No success	17.58	22.03	24.10	
Social pressure				
Success	21.85	26.02	26.74	.63
No success	21.89	25.94	27.67	
Physical discomfort				
Success	21.61	26.14	27.27	4.16*
No success	24.10	26.37	27.37	
Positive emotion				
Success	23.45	27.70	28.22	.52
No success	23.34	26.87	27.69	
Total score				
Success	99.52	124.65	129.31	1.43
No success	105.58	124.14	131.29	
<i>Treatment self-regulation questionnaire^b</i>				
Autonomous motivation				
Success	6.53	6.65	6.61	.16
No success	6.40	6.54	6.46	
Introjected motivation				
Success	4.26	4.58	4.61	.54
No success	4.01	4.51	4.35	
External motivation				
Success	3.04	3.02	3.08	.85
No success	2.87	3.00	3.14	
Amotivation				
Success	1.82	1.69	1.74	.46
No success	2.05	1.82	1.86	

All models include gender as a covariate

^a Higher scores indicate greater confidence in ability to control eating in specific situations

^b Higher scores indicate greater level of motivation subtype for controlling diet and exercise behavior

† $p < .01$; * $p < .05$

Discussion

Findings from the present study suggest that individuals with prior success losing weight through self-regulation of eating behavior may have greater success in a standard behavioral weight control program than those without similar previous success, and that this success may be due to better attendance. Differences between these groups in some facets of motivation and self-efficacy were observed at baseline and in how they changed over the course of treatment, but did not account for differences in weight

loss. Results indicate that weight loss history, including the type and success of attempts, is an important predictor of treatment outcome.

Demographic characteristics were largely similar between those who had and had not previously succeeded at weight loss through dietary change. However, a significantly higher proportion of those without prior success were male compared to those with prior success. This is perhaps unsurprising given that research has evidenced higher rates of dieting to lose weight among women than men (Kruger et al., 2004). Notably, weight suppression was

Table 3 Bootstrapped confidence intervals (CIs) for each variable as mediators of the relationship between prior success with dietary change and end-of-treatment outcome

	95% CI	<i>p</i> value
Model 1 (Baseline variables)		
TSRQ—Autonomous motivation	(−0.19, 0.34)	.79
TSRQ—Amotivation	(−0.38, 0.26)	.89
WEL—Negative emotion	(−0.74, 0.23)	.39
WEL—Physical discomfort	(−0.20, 0.87)	.29
Model 2 (Change during treatment)		
WEL—Negative emotion	(−1.36, 0.13)	.16
WEL—Physical discomfort	(−0.88, 0.51)	.53
Attendance	(−1.81, −0.17)	.03

All models include gender as a covariate. Model 2 utilizes change from baseline to mid-treatment (6 months) as a mediator of end-of-treatment (1 year) outcome

small and did not differ between groups at baseline; thus, differences in weight loss during treatment were not due greater difficulty losing additional weight.

Motivation and self-efficacy are often identified as important predictors of treatment outcome. Individuals with prior success have more well-defined reasons for engaging in weight loss treatment, as evidenced by their lower levels of amotivation. It may be that prior success with dietary change helped individuals to clarify and internalize motivations for specific behaviors (i.e., dietary change and physical activity increases) associated with this weight loss approach. Individuals with prior success also had lower self-efficacy for weight control when confronted with negative emotions or physical discomfort. It may be that individuals who have repeated attempts to lose weight through dietary self-regulation experience greater levels of eating-related or other pathology (Marchesini et al., 2003, 2004), leading to lower self-efficacy for confronting physically and emotionally distressing situations. No other facets of motivation or self-efficacy differed between groups at baseline.

While participants in both groups decreased amotivation over the course of treatment, rates of change were similar and those without prior success did not “catch up” to those with prior success. Individuals with prior success had a trend-level greater increase over the course of treatment in self-efficacy when experiencing negative emotion and a significantly greater increase over the course of treatment in self-efficacy when experiencing physical discomfort. Thus, participants with prior success experienced a greater benefit and treatment likely addressed specific relative baseline weaknesses in self-efficacy experienced by this group. Other facets of motivation and self-efficacy did not change differentially between groups.

Attendance, which may capture ongoing motivation for, commitment to, or persistence in treatment differed sig-

nificantly between groups. Treatment completion has been evaluated in only one prior study of the association between previous weight losses and outcome, observing that individuals with a greater number of weight loss attempts were less likely to complete treatment (Teixeira et al., 2004). However, the type or success of weight loss methods were not evaluated, and success with a specific method of weight loss represents a distinctly different construct. Attendance was highly positively correlated with change in self-efficacy for weight control in the contexts of negative emotion and physical discomfort. It is likely that this relationship is bidirectional. Thus, it is possible that because those with prior success experienced larger improvements in certain facets of self-efficacy, they felt more engaged in treatment, yielding higher attendance; it is also possible that the greater increases in self-efficacy experienced by this group are due to higher levels of attendance.

Compared to individuals without prior success with eating self-regulation, individuals with prior success had greater weight losses over time. Previous literature has been mixed on the association between previous attempts and current weight loss, often finding that a greater number of weight loss attempts may predispose individuals to poorer weight loss in clinician-guided programs (Pasman et al., 1999; Teixeira et al., 2004, 2010). The present study is the first to investigate the association between prior attempts of a specific method where individuals were successful. Results underscore that multiple efforts to engage in dietary change do not necessarily constitute an inability to benefit from treatment. In fact, individuals who have previously exhibited success with dietary change are better able to benefit from treatment, perhaps because they are practicing and refining familiar behavioral strategies from their past efforts. Finally, attendance was the only variable to significantly explain the relationship between

prior success and treatment outcome. Thus, increasing engagement and attendance of individuals without a history of success in dietary self-regulation may be an important target of treatment.

Individuals without prior success with dietary self-regulation may benefit from greater emphasis on developing foundational behavior change strategies that will aid in self-regulation. Alternatively, individuals without prior success may benefit from increased emphasis on methods that reduce reliance on self-regulation already standard in lifestyle modification programs (e.g., stimulus control) or that may augment treatment (e.g., meal replacements). Increasing and clarifying motivation may be an important treatment target with this group as well given their greater levels of amotivation throughout treatment. Thorough assessment of prior successful treatment efforts, and targeting treatment to increase engagement, may help to personalize treatment by capitalizing on relative individual strengths.

Several limitations should be noted. First, the coding of lifestyle modification history required the development of a coding scheme for participants' answers. While we established rules regarding coding of weight loss method, results are limited by a lack of previously-validated methods of coding. We are also unable to determine whether individuals without prior success using dietary self-regulation have never attempted weight loss through this strategy, or have attempted but failed. This distinction will be important to address with future research, as it seems plausible that those with repeated failed attempts at dietary self-regulation are at a disadvantage in lifestyle modification treatments. We were also limited by the lack of follow-up data. Whether individuals with success in a previous program have better long-term outcomes is unclear, and future research should aim to evaluate weight loss history as a predictor of weight loss maintenance. Finally, it is noted that these results are correlational in nature, and we are not able to make causal claims regarding the effect of previous treatment on current treatment.

Taken together, results indicate that prior success with weight loss utilizing dietary change indicates greater engagement in future treatment that emphasizes similar skills. Individuals with prior success with dietary change may be better able to anticipate treatment difficulty and to persist in treatment targeting behavioral change, allowing them to more fully benefit from the intervention. It is unclear whether more intensive psychoeducation and training in skills to help eating self-regulation may help to enhance weight losses for those who have not experienced prior success. These individuals may be able to benefit more from treatments that de-emphasize the need to independently self-regulate eating (e.g., through meal replacements). It is also possible that those who have prior

success need less intensive treatments, given that they likely are familiar with many of the skills being taught and perhaps benefit most from the accountability treatment provides. Future research should explore whether tailoring treatment to previous weight loss experiences may improve treatment outcomes and what effect prior success with dietary change may have on long-term outcomes from behavioral treatment.

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Compliance with ethical standards

Conflict of interest Stephanie G. Kerrigan, Margaret Clark, Alexandra Convertino, Evan Forman and Meghan L. Butryn declare that they have no conflicts of interest.

Human and animal rights and Informed consent All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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