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A preliminary investigation of the role of self-control in behavioral weight loss treatment

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Abstract

Self-control is associated with positive health outcomes; however, there is limited information on self-control and weight loss. Thus, the purpose of this preliminary research was to examine how objectively measured self-control operates within the context of a behavioral weight loss program (BWL). Results showed that greater self-control and increases in self-control during BWL treatment were associated with greater weight loss (r 's 0.26; p 's<0.05), better treatment attendance (r 's 0.26, p <0.05), adherence to a low fat diet (r 's -0.37; p 's<0.05), and greater increases in physical activity (r 's 0.46; p 's<0.05). These preliminary findings suggest that self-control may play an important role in weight loss success.

Keywords

self-control; will power; weight loss; dietary fat intake; physical activity

Self-control is the ability to inhibit a desired, pre-potent response in service of goal attainment.[1, 2] Trait self-control is associated with reduced risk for obesity and substance abuse.[3] Similarly, cross-sectional studies have shown that high levels of self-control are associated with less consumption of high fat foods.[4] In addition, dietary restraint, a construct linked to self-control, is consistently associated with successful weight control.[5]

According to the Self-control Strength Model,[6] self-control can be enhanced through practice.[7, 8] For example, repeatedly engaging in acts of self-control, such as resisting tempting foods, increases self-control over time.[8] In a smoking cessation trial, participants who, prior to quitting, enhanced their self-control via practice (resisted sweets) achieved superior abstinence rates compared to active treatment controls.[9]

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Self-control has obvious implications for weight loss – the ability to resist calorically dense foods and persevere with physical activity, despite discomfort and fatigue, are important for weight loss success.[10] In this investigation, two preliminary studies were conducted to examine how self-control operates within the context of behavioral weight loss treatment (BWL). In Study 1, self-control was assessed at post-treatment; we hypothesized that self-control would be positively associated with weight loss and adherence metrics. Given the positive results from the first study, a second study was conducted in which self-control was measured at both pre- and post-treatment. Consistent with evidence that practicing acts of self-control increases self-control,[8] we hypothesized that adherence to treatment recommendations (i.e. behaviors that inherently require self-control, such as eating a low fat diet) and overall weight loss would be associated with increases in self-control from pre- to post-treatment.

Methods

Two studies were conducted to examine whether self-control is associated with weight loss and adherence parameters in BWL treatment. All participants (N=63) were recruited through advertisements placed in local newspapers or online. To be eligible, participants had to be obese (BMI 30kg/m²) with no history of recent weight loss and no medical conditions that would contraindicate weight loss or their likelihood to complete a weight loss trial (e.g., pregnancy, cancer, substance abuse, dementia). See Table 1 for baseline participant characteristics.

In Study 1, participants (N=40) received a 6 month BWL intervention consistent with traditional BWL programs.[11] Treatment was group-based; included weekly sessions led by dietitians, exercise physiologists, and/or behavioral psychologists; and involved private weigh-ins. All participants were given a reduced calorie, low-fat diet designed to produce a weight loss of 1 to 2 pounds per week; a physical activity prescription that involved a gradual increase from 50 minutes per week to 250 minutes per week, with a particular focus on brisk walking; and instruction in behavior change strategies, including self-monitoring of dietary intake and physical activity, stimulus control, goal setting, problem solving, assertiveness training, and relapse prevention. Weight, treatment attendance, dietary intake, and physical activity were assessed, and participants completed an objective measure of self-control at post-treatment.

Study 2 extended the findings from Study 1. In Study 2, we examined whether *changes* in self-control are associated with weight loss outcomes and treatment adherence. Participants (N=23) in a 6 month BWL program, similar to that in Study 1, had their weight, calorie intake, physical activity, and attendance assessed and completed the same objective measure of self-control used in Study 1 at both pre- and post-treatment.

Measures

All assessments were conducted by trained research assistants.

Demographics—Participants reported gender, age, race, and ethnicity.

Self-control—The handgrip task, a widely used objective measure of global self-control, [8, 9, 12] was used to assess self-control at post-treatment in Study 1 and at both pre- and post-treatment in Study 2. After accounting for individual grip strength, participants squeeze a handgrip for as long as possible, thereby enduring aversive stimuli (pain, muscle fatigue) and overriding the desire to end discomfort in service of goal attainment. This self-control task is consistently responsive to self-control manipulations.[e.g., 8, 12–15] Moreover, results from this task are strongly correlated with other self-control tasks, including cognitive measures of self-control.[16, 17]

The Lafayette Hand Dynamometer (Model 78010) was used in this study. This device contains a handgrip and a dial that indicates the force with which the handgrip is squeezed. The handgrip task consists of two trials. The first trial controls for individual differences in grip strength; participants squeeze the handgrip as hard as possible for 3 seconds (maximum grip strength). In the second trial, participants squeeze the dynamometer, with the goal of keeping the indicator above a line marked at 70% of their maximum grip for as long as possible (maintained grip). For both Study 1 and Study 2, maintained grip duration, or the amount of time elapsed (in seconds) that the participant persisted at or above the 70% threshold, was the measure of self-control.[12]

Height, weight, and treatment adherence—In both studies height was measured to the nearest millimeter using a wall mounted stadiometer and weight was measured to the nearest 0.1kg using a Tanita® Model BWB-800 digital scale. Attendance was recorded by intervention staff. All participants reported their calories and fat grams in their self-monitoring diaries throughout the intervention, and had an average of 87.6 ± 42.6 recording days. Using the daily diary data, the following formula was used to calculate average percentage of calories from fat per day: $((\text{total fat grams} \times 9\text{kcal}) / \text{total kcal}) \times 100$. The Paffenbarger Questionnaire, a widely used and well-validated measure of physical activity, [18] assessed overall time spent in physical activity per week. Specifically, participants report number of days per week and number of minutes per day spent in brisk walking and in all sport, recreation, and fitness activities. Minutes per week are calculated by multiplying daily minutes for each activity by times per week that the individual engaged in the activity and summing all products. Lifestyle activities, such as occupational and household chores, are not included in minutes of activity.

Analyses

The associations between post-treatment self-control and change in self-control and all baseline and dependent measures were examined with correlations. Regression analyses were used to test whether baseline self-control predicted weight loss and associated outcomes. Estimates of effect size are presented, where appropriate. Due to the strong directional nature of our hypotheses, one-sided tests were used. Baseline measures were included as covariates for change analyses. In analyses that combined Studies 1 and 2, study was included as a covariate. To ensure that time spent in the maintained grip task was not at all influenced by overall grip strength, maximum grip was included as a covariate, as is typically done in studies that have used this paradigm.[12]

Results

Study 1

Please see Table 1 for baseline participant characteristics. During treatment, participants lost $9.2 \pm 6.3\%$ of initial body weight, attended 88% of sessions, consumed $23.9 \pm 5.3\%$ of calories from fat, and increased their activity by 74.3 ± 252.0 mins/week. Consistent with average self-control scores in previous studies,[12] self-control at post-treatment ranged from 4.2 to 88.6-secs, with a mean of 35.3 ± 25.5 -secs.

Performance on the self-control task at post-treatment was significantly associated with treatment outcomes and adherence. Participants who achieved a 10% weight loss (optimal treatment outcome) had greater self-control compared to those who did not (42.4 ± 24.9 vs. 29.3 ± 25.1 , $p < 0.05$, $d = 0.52$). The association between overall weight loss and self-control was in the expected direction and marginally significant ($r = 0.23$, $p = 0.07$, $d = 0.47$). In addition, self-control was positively associated with increases in activity ($r = 0.31$, $p < 0.05$, $d = 0.65$). Moreover, individuals who consumed fewer calories from fat had greater self-control ($r = -0.39$, $p < 0.01$, $d = 0.85$).

Study 2

Participants in Study 2 ($N = 23$; Table 1) completed the self-control task at both pre- and post-treatment. The mean self-control score at baseline was 38.7 ± 24.7 -secs. Baseline self-control was not associated with baseline BMI ($r = 0.09$, $p = 0.66$), nor was it associated with baseline physical activity ($r = -0.23$, $p = 0.25$). During treatment, participants lost $8.6 \pm 7.0\%$ of initial body weight, attended 83% of treatment sessions, consumed $28.5 \pm 4.5\%$ of calories from fat, and increased their activity 90.0 ± 155.4 mins/week. Changes in self-control from pre- to post-treatment varied from -39.7 -secs to $+47.0$ -secs, with an average change of -1.4 ± 23.1 -secs ($p = 0.98$).

Results from Study 2 showed that greater improvements in self-control during BWL were associated with greater weight loss ($r = 0.39$, $p < 0.05$, $d = 0.85$), better attendance ($r = 0.48$, $p < 0.05$, $d = 1.1$), and greater increases in activity ($r = 0.51$, $p < 0.05$, $d = 1.1$). Moreover, participants who consumed fewer calories from fat had greater improvements in self-control ($r = -0.47$, $p < 0.05$, $d = 1.1$). Remaining effects, including the effects of baseline self-control on weight loss, fat intake, or physical activity, were not significant (p 's > 0.10).

Study 1 & Study 2 combined

Data from Studies 1 and 2 were combined ($N = 63$) to examine whether self-control (measured at post-treatment) is associated with intervention outcomes and treatment adherence in the entire, larger sample. Our results were consistent with those from the two separate studies. The average self-control score at post-treatment in the combined sample was 36.1 ± 24.7 -secs. Participants with greater self-control achieved a significantly higher percent weight loss ($r = 0.26$, $p < 0.05$, $d = 0.54$), and those who reached a 10% weight loss had greater self-control compared to those who did not (44.0 ± 23.1 -secs vs. 30.3 ± 23.1 -secs, $p < 0.05$, $d = 0.59$). Self-control was also positively associated with attendance ($r = 0.26$,

$p < 0.05$, $d = 0.54$), increases in physical activity ($r = 0.46$, $p < 0.05$, $d = 1.0$), and consuming fewer calories from fat ($r = -0.37$, $p < 0.05$, $d = 0.80$).

Discussion

We conducted two preliminary studies to examine whether objectively measured self-control is associated with weight loss and adherence in BWL treatment. Greater self-control was associated with superior weight loss and better adherence to diet and activity recommendations in both studies. Moreover, increases in self-control from pre- to post-treatment were associated with better weight loss and attendance, more minutes of activity, and consuming fewer calories from fat.

These preliminary findings add to the growing body of literature showing that self-control is an important determinant of health outcomes. Specifically, these results are consistent with previous studies showing that self-report and objective measures of self-control are associated with reduced risk for substance abuse, lower BMI, less frequent consumption of high fat foods, and smoking outcomes and with studies showing that dietary restraint, a construct likely associated with self-control, is associated with successful weight loss.[3, 4, 10] This study is unique in that it is the first to our knowledge to examine how self-control, assessed objectively, operates within the context of BWL treatment. Our findings show that self-control is associated with weight outcomes and adherence parameters. Moreover, our results are consistent with the Self-control Strength Model, which suggests that exercising self-control may build self-control resources,[6] and with findings showing that regular physical activity and dietary monitoring may improve self-control.[8, 19] Thus, future behavioral weight loss treatments may consider incorporating additional methods to increase self-control during treatment to thereby enhance participants' ability to resist tempting foods and/or engage in physical activity despite discomfort and fatigue and improve weight loss outcomes.

These preliminary results are provocative and suggest that further study of the effects of self-control on behavior change is warranted. Consistent with theory,[6] our data suggest that participants who persist with behavior change despite initial self-control depletion may experience an *increase* in self-control, which affects treatment outcomes. Thus, a better understanding of the time course during which behavior change depletes self-control but then starts to increase self-control may inform the development of intervention strategies that help participants endure during the critical period of self-control depletion and achieve self-control strength, which could increase the effectiveness of BWL interventions. In future studies it would also be interesting to examine other measures of self-control, such as persistence on unsolvable anagrams.

Study limitations include a predominantly female and White sample. In addition, this was a preliminary iterative investigation and, therefore, involved a smaller sample and the assessment of self-control at both pre-and post-treatment in Study 2 only. Also, given that self-control was assessed at the same time as weight and associated variables these data are correlational in nature. While we were able to examine whether baseline levels of self-control predict outcomes (Study 2), future studies should further explore the predictive or

mediating properties of self-control in BWL treatment. Despite these limitations, self-control was consistently and positively related to treatment outcomes. Additional strengths of this investigation include its prospective design and objective assessments of weight and self-control. Moreover, this study is responsive to recent calls for research investigating how self-control operates within the context of health behavior change.[20] Taken together, these results provide the foundation for a more in depth examination of the effects of self-control on weight loss, which may lead to the development of innovative interventions to improve self-control and, thereby, enhance BWL treatment outcomes.

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Table 1

Study 1, Study 2, and Study 1 + Study 2 combined participant characteristics.

	Study 1 (N=40)	Study 2 (N=23)	Study 1 + Study 2 (N=63)
Sex; Female n (%)	34 (85)	18 (78)	52 (83)
Age (years; M $\pm$ SD)	53.5 $\pm$ 4.3	44.1 $\pm$ 8.8	50.0 $\pm$ 7.7
Race n (%)			
Asian	1 (3)	0 (0)	1 (2)
Black/African American	1 (3)	1 (4)	2 (3)
White	38 (94)	18 (78)	56 (89)
Other	0 (0)	4 (17)	4 (6)
Ethnicity n (%)			
Hispanic/Latino	1 (2)	1 (4)	2 (3)
Not Hispanic/Latino	39 (98)	22 (96)	61 (97)
Baseline BMI (kg/m ² ; M $\pm$ SD)	35.6 $\pm$ 3.1	45.3 $\pm$ 4.0	39.2 $\pm$ 5.8