Research and Best Practice

Contrasting university-based and older-age samples on weight-loss effects and their behavioral and psychosocial predictors associated with the Weight Loss For Life protocol

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Abstract

Background Behavioral weight-loss treatments have generally been unsuccessful, and young-adult participants have been underrepresented in related research. This investigation assessed effects of the new Weight Loss For Life protocol in a university sample of young women through contrasts with older-age women.

Methods Women with class 1 and 2 obesity from either a university (n = 37, M_{age} = 20.4 years) or a community wellness setting (n = 37, M_{age} = 45.0 years) were volunteer participants. The same cognitive-behavioral weight-loss protocol was administered to both groups. One-on-one physical activity-support sessions supported self-regulatory skills, self-efficacy, and mood improvements so they would carry-over to controlled eating during bi-weekly group nutrition sessions.

Results The university group consumed fewer fruits/vegetables and completed more physical activity at baseline than the older group. However, significant improvements over 6 months in those variables, sweets intake, and weight (-4.5% and -6.1%, respectively) did not significantly differ. Age group also did not affect the significant prediction of 6-month changes in physical activity and fruit/vegetable intake, by 3-month changes in self-regulation, self-efficacy, and mood (R^2-values = .26 and .35, respectively).

Conclusion Tenets of social cognitive theory that formed the basis of the Weight Loss For Life curriculum were supported for both age groups, and were associated with similar positive effects over 6 months. Extensions of the research require testing over longer periods.

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Introduction

The health risk of obesity is prevalent in United States women at 37% for ages 20–39 years, and 45% for ages 40–59 years (1). Behavioral weight-loss treatments have overwhelmingly been unsuccessful beyond their initial several weeks or months (2;3). In fact, some behavioral scientists recently suggested that corresponding research should be terminated due the consistency of unfavorable results for decades (4). However, 2 trials of an experimental cognitive-behavioral protocol entitled Weight Loss For Life demonstrated atypical success by maintaining a 6.1–6.3% mean loss in body weight over 2 years in mostly middle-age women with obesity (5). Weight Loss For Life is a low-cost, community-based treatment grounded in tenets of social cognitive theory (6). Social cognitive theory assumes that individuals can gain control over their behaviors through purposeful use of self-management, feelings of ability (i.e., self-efficacy), and positive psychological states (6).

A major departure of Weight Loss For Life from other behavioral weight-management treatments is that its first aim is to increase physical activity – the most salient predictor of long-term weight loss (7;8) – to improve self-regulation, self-efficacy, and mood. Those psycho-

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social improvements are then carried over to facilitate controlled eating (e.g., increased fruit and vegetable intake, reduced sweets). Conversely, almost all other behaviorally based weight-loss programs have dealt with physical activity as an (often optional) adjunct to a near-singular focus on energy-intake restriction (2;4). Within Weight Loss For Life, the considerable challenge of adherence to physical activity (9) has been addressed through incorporation of the validated Coach Approach curriculum (10) for 8 weeks prior to any change in the diet. Emotional eating was also focused upon through physical activity-induced improvements in mood (11). Emotion-based eating has been associated with an overconsumption of sweets, fats, and mostly unhealthy foods (11). Even modest amounts of physical activity (e.g., 3 moderate sessions/week) might be as useful as greater volumes for improving psychosocial factors (10).

Consistent with most weight-loss treatment trials, however, younger adults were minimally represented in the initial research on Weight Loss For Life (12). Little was known of its effects on younger-age women, and/or specific sample types (e.g., enrollees of a university) that might pose yet-unknown challenges. Thus, within this short-term (6 month) research, findings from college-age women with obesity were contrasted with results from older-age (but still below the "old age" category) women – each participating in the Weight Loss For Life treatment (5). Results could clarify the salience of the proposed treatment model, determine age-related effects, and assess whether longer-term studies (which are difficult to conduct in transient university samples) are warranted. Ultimately, findings could inform administrators and practitioners concerned with reducing health risks in young adults and other individuals across age ranges (13).

Hypotheses were as follows:

- There will be significant overall improvements in weight, physical activity, nutrition, and each of the psychosocial measures tested. No hypothesis was given, however, regarding whether these changes would differ by age group.
- Changes in physical activity and fruit/vegetable intake will predict weight change.
- 3-month changes in physical activity- and eating-related self-regulation, self-efficacy, and mood will significantly predict 6-month changes in physical activity and fruit/vegetable intake, respectively.
- Emotional eating change will significantly mediate the relationship between changes in mood and consumption of sweets.

It was also of interest to determine if weight reduction would be better-predicted by attaining a mean of 3 moderate physical activity sessions/week, or by absolute volume of physical activity/week (i.e., more physical activity-more weight loss).

Methods

Participants

Women volunteered to participate in a weight-loss trial that incorporated physical activity. Enrollment was conducted separately within a large university (UNIV; age range 18–25, M_{age} = 20.4 years, SD = 2.0, n = 37) and a community (COMM; age range 26–55, M_{age} = 45.0 years, SD = 7.9, n = 37) in the southeast United States. Inclusion criteria were: (1) body mass index (BMI) 30–40 kg/m² (class 1 and 2 obesity), (2) not presently participating in any weight-loss program, and (3) no known health-related contraindications for participation. Institutional review board approval, and written informed consent from all participants, was obtained. Principles of the Declaration of Helsinki were followed throughout.

Measures

Weight

Body weight (kg) was measured by a recently calibrated digital scale using the mean of 2 consecutive measurements.

Behavioral measures

Measures of self-reported daily servings of fruits/vegetables and sweets (11), and weekly physical activity (converted to metabolic equivalents [1 MET = 3.5 ml of O^2/kg/minute] using the Leisure-Time Physical Activity Questionnaire) (14), previously demonstrated acceptable–strong reliability and validity across the age ranges within this research (14;15). Within those validated behavior recall surveys, previously used in related research (16), examples of fruit/vegetable servings (e.g., 1 small apple; 118 mL fruit juice; 118 mL carrots) and physical activity intensities (3 METs [mild activity; e.g., easy walking] to 9 METS [vigorous activity; e.g., running]) were given.

Psychosocial measures

Each self-report measure had acceptable–strong internal consistency (Cronbach's α ≥ .70) and test-retest reliability (≥ .70 over 1–2 weeks).

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The self-regulation for physical activity and self-regulation for eating scales each had 10 items that assessed use of specific self-regulatory skills (e.g., "I make formal agreements with myself to be physically active"; "I keep a record of my eating") using a scale of: 1 = never to 5 = often (16). Self-efficacy for physical activity was measured by the 5-item Exercise Self-Efficacy Scale (e.g., "I can persist with exercising when I have more enjoyable things to do") using a scale of: 1 = not at all confident to 11 = very confident (17). Self-efficacy for controlled eating was measured by the 20-item Weight Efficacy Lifestyle Scale (e.g., "I can resist eating when I am depressed or feeling down") using a scale of: 0 = not confident to 9 = very confident (18). Both self-efficacy measures assessed confidence for overcoming specific behavioral barriers. Overall negative mood was measured by the Profile of Mood States Short Form (19). Reflecting on the past 2 weeks, its 30 items asked the respondent to evaluate the presence of affective states (e.g., "sad"; "tense"; "annoyed") using a scale of: 0 = not at all to 4 = extremely. Emotional eating was measured by 15 items of the Emotional Eating Scale (20). It addressed feelings that might prompt emotion-based eating (e.g., "irritated"; "on edge"; "blue") using a scale of: 0 = no desire to eat to 4 = an overwhelming urge to eat.

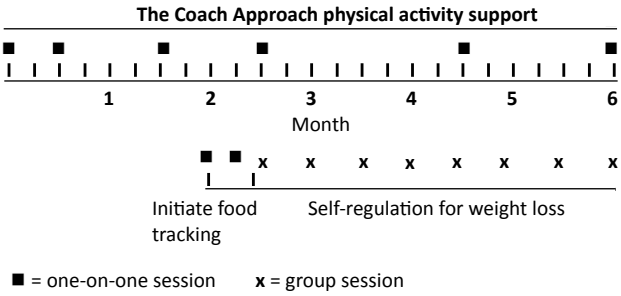
Procedure

All Weight Loss For Life treatment components were administered by wellness professionals with national certification(s) and/or an advanced degree(s) related to health promotion, and 16 hours of training specific to the present treatment protocols.

Physical activity support consisted of 6, 45–60-minute one-on-one sessions over 6 months using The Coach Approach curriculum of instruction in self-regulatory skills (e.g., goal-setting, relapse prevention, cognitive restructuring) to counter barriers to physical activity (e.g., slow progress), leveraging social supports, and minimizing impediments (e.g., exercise-induced discomfort) (10). Although the internationally recommended volume of physical activity for health promotion (i.e., 150 minutes/week of moderate-intensity activity) was indicated to participants, exercise plans were mostly based on their individual preferences and tolerances.

After 8 weeks, participants were instructed in recording daily energy intake, and provided a daily kilocalorie (kcal) limit based on present weight (e.g., 1500 kcal/day limit for 79–99 kg). Beginning at week 10 of the 6-month trial, 60-minute group nutrition sessions were held every 2 weeks that adapted the learned physical activity-related self-regulation skills for use in controlling eating – especially focusing upon increasing fruit/vegetable intake and minimizing sweets. Figure 1 displays a timeline of treatment processes.

Figure 1 Treatment Timeline



Advancement of self-efficacy through overcoming barriers, and leveraging exercise-induced mood improvements to counter emotional eating, were additional foci. Participants were instructed to weigh themselves at home at least once per week. Fidelity checks on approximately 15% of treatment sessions indicated few protocol violations that were easily rectified by study staff.

Data analyses

To avoid inflation of treatment effect sizes found in weight-loss studies that inappropriately retained data from only treatment "completers" (21), the conservative intention-to-treat approach was instead used. Thus, data from all individuals who initiated the treatment components were included. Statistical significance was set at $\alpha \leq .05$, 2-tailed, unless otherwise noted. Analyses were conducted using SPSS version 22.0 (IBM, Armonk, NY).

Data preparation

Based on suggested criteria (22), missing data were found to be missing-at-random (i.e., absent of systematic bias) so imputation of the 9% of overall missing scores, and scores deleted because they met suggested criteria for being an outlier (23), was conducted using the expectation maximization algorithm (24). Under the present research conditions, application of the expectation maximization algorithm is considered, "... the most accurate estimate of means or co-variances..." (25, p 41). To normalize distributions where needed, the Box-Cox transformation (26) was applied.

For the primary analysis of multiple regression models with 5 predictors, the anticipated effect size of $f^2 = .25$ (estimated from pilot research) at the statisti-

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cal power level of .80 (α = .05) required a minimum overall sample size of 57 (27). Variance inflation factors of 1.08–1.54 indicated a low and acceptable degree of multicollinearity in the data. The 2 variables that at baseline demonstrated a significant group difference (physical activity and fruits/vegetables) were controlled for throughout the analyses.

Assessing changes over time

One-way analysis of variance (ANOVA) was used to assess differences between the UNIV and COMM groups at baseline. Mixed-model repeated measures ANOVAs then assessed overall changes over time, and whether those changes differed between the UNIV and COMM groups. These were followed-up by paired t tests to contrast within-group effects. Effect sizes for repeated measures ANOVAs were calculated as partial eta-squared ($\eta^2_p = SS_{effect}/[SS_{effect} + SS_{error}]$), and for paired t tests as Cohen's d ($(M_{post} - M_{pre}]/SD_{pre}$), where .02, .13, .26, and .20, .50, .80 are, by convention, small, moderate, and large effects, respectively.

Predicting behavioral changes from psychosocial changes

Because the planned multiple regression analyses inferred directionality (i.e., changes in the psychosocial variables predicting changes in the behavioral variables), 2 separate theory-based models were specified that entered 3-month changes in physical activity- and eating-related self-regulation, self-efficacy, and mood as predictors of 6-month changes in physical activity and fruit/vegetable intake. Group was then entered in step 2 of those models. Considering previous research and suggestions (16), and an absence of floor and ceiling effects, unadjusted change scores were used rather than residualized change values or analysis of covariance. Using a bootstrap procedure with 20,000 resamples (28), additional regression models were specified that separately assessed the mediation of relationships between mood change and changes in consumption of sweets and fruits/vegetables, by change in emotional eating. Mediation is significant if a 95% confidence interval (95% CI) does not include 0.

Assessing the effect of physical activity on weight change

The predictive value of weight change over 6 months by either the continuous variable of participants' change in physical activity/week, or the dichotomous variable of completion of at least (the equivalent of) 3 moderate-vigorous sessions of physical activity/week (M ≥ 21 METs/week on the Leisure-Time Physical Activity Questionnaire (11); coded no = 0, yes = 1), was contrasted using 1-tailed bivariate analyses.

Results

Assessing changes in weight, weight-loss behaviors, and psychosocial factors

Baseline score on fruit/vegetable intake was significantly greater in the COMM group, and consumption of sweets was significantly greater in the UNIV group. No other significant baseline difference was found (Table 1). There were significant changes in the favorable direction on all measures, but they did not significantly differ by group (Table 1). Within-group effect sizes were larger on weight reduction from baseline in the COMM group (-6.1%) vs. the UNIV group (-4.5%). That was also the case for increase in physical activity. Effect sizes on changes in psychosocial variables were similar between groups (Table 1).

Predicting changes in weight, physical activity, and eating behaviors

Changes in physical activity and fruit/vegetable intake, together, significantly predicted weight change, R^2 = .19, p = .001. Change in fruit/vegetable intake, beta (β) (standard error [SE]) = -.32 (.49), p = .009, but not physical activity volume, β = -.19 (.07), p = .116, independently contributed to the variance explained. Subsequent entry of group into the multiple regression equation did not significantly improve its explanatory power, ΔR^2 = .01, p = .353.

Changes in physical activity-related self-regulation, self-efficacy, and mood significantly predicted change in physical activity, R^2 = .26, p < .001. β-values were .11 (.32), .19 (.19), -.21 (.12), respectively, p-values > .08. Changes in eating-related self-regulation, self-efficacy, and mood significantly predicted change in fruit/vegetable intake, R^2 = .35, p < .001. β-values were .20 (.04), .12 (.01), -.17 (.01), respectively, p-values ≥ .08. Entry of group did not significantly improve the above equations' explanatory power, ΔR^2-values ≤ .03, p-values > .06.

Change in emotional eating significantly mediated the total effect, β = .04 (.01), p = .008, of mood change on change in the intake of sweets, β=.01 (.01), 95% CI = .002, .023. The effect of group was not significant, β = .06 (.43), p = .882, however the overall model was significant, R^2 = .14, p = .014. Change in emotional eating did not significantly mediate the total effect, β = -.03 (.01), p = .012, of mood change on change in the intake of fruits/vegetables, β = -.0002 (.01), 95% CI = -.011, .013. The effect of group was, however, significant, β = .94 (.47), p = .049, suggesting a greater degree of mediation in the COMM group. The overall model was significant, R^2 = .32, p < .001.

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Table 1 Changes in study measures, by group

Measure	Baseline		Month 3		Month 6		Change score		Effect for time		Time ×group		Within-group change	
Group	M	SD	M	SD	M	SD	M	SD	F(1, 72)	[η^2_p]	F(1, 72)	[η^2_p]	t(36)	[d]
Weight (kg)														
University group	96.47	13.70	94.59	13.21	92.09	12.76	-4.38	5.08					5.25**	[.32]
Community group	94.42	11.43	91.29	11.97	88.68	11.48	-5.75	3.16					11.06**	[.57]
									105.96**	[.60]	1.92	[.03]		
Physical activity/week (METs)														
University group	14.88	9.71	34.18	16.42	34.05	18.32	19.18	19.08					6.11**	[1.97]
Community group	8.27	6.74	29.74	13.34	32.80	14.46	24.53	14.39					10.37**	[3.64]
									123.72**	[.63]	1.86	[.03]		
Fruit and vegetable servings/day														
University group	2.88	1.66	4.45	2.14	4.65	2.00	1.77	2.05					5.25**	[1.11]
Community group	3.84	2.24	5.59	2.63	6.07	2.23	2.23	2.47					5.49**	[1.00]
									57.43**	[.44]	0.76	[.01]		
Sweets servings/day														
University group	2.24	1.78	1.10	0.92	1.15	1.49	-1.19	2.16					3.35*	[.67]
Community group	2.19	1.86	1.43	0.99	1.14	0.81	-1.05	1.72					3.73*	[.57]
									24.41**	[.25]	0.09	[.001]		
Self-regulation for physical activity														
University group	21.70	6.57	31.49	4.69	...	...	9.78	6.78					8.78**	[1.49]
Community group	22.73	6.23	32.22	3.81	...	...	9.48	6.57					8.79**	[1.52]
									154.21**	[.68]	0.04	[.001]		
Self-regulation for eating														
University group	22.11	4.80	29.47	5.60	...	...	7.36	5.63					7.96**	[1.53]
Community group	23.49	5.27	31.14	4.49	...	...	7.65	6.69					6.96**	[1.45]
									109.15**	[.60]	0.04	[.001]		
Self-efficacy for physical activity														
University group	26.38	7.83	30.89	9.84	...	...	4.51	11.65					2.36*	[.58]
Community group	25.84	9.47	33.14	10.07	...	...	7.30	10.93					4.06**	[.77]
									20.22**	[.22]	1.12	[.02]		
Self-efficacy for controlled eating														
University group	98.62	19.74	122.05	31.49	...	...	23.43	20.35					16.65**	[.82]
Community group	90.19	30.69	115.68	26.83	...	...	25.49	31.71					4.89**	[.83]
									63.38**	[.46]	0.11	[.002]		
Overall negative mood														
University group	27.39	15.73	13.11	15.30	...	...	-14.28	18.85					-4.61**	[.91]
Community group	24.49	14.60	8.15	13.77	...	...	-16.07	15.49					-6.31**	[1.10]
									57.26**	[.44]	0.20	[.003]		
Emotional eating														
University group	24.20	11.12	16.51	9.60	...	...	-7.69	10.92					-4.28**	[.69]
Community group	27.05	10.29	22.04	9.53	...	...	-5.01	8.38					-3.64*	[.49]
									31.53**	[.31]	1.40	[.02]		

Abbr: M = mean; SD = standard deviation. The symbol ... denotes scores at month 6 were not obtained. University group n = 37. Community-based group n = 37. For weight, physical activity, fruit/vegetable intake, and intake of sweets, change score was calculated from baseline-month 6; for all psychosocial measures, change scores were calculated from baseline-month 3. Effect sizes for ANOVAs, $\eta^2_p = SS_{effect}/(SS_{effect} + SS_{error})$. Effect sizes for t tests, Cohen's d = $(M_{post} - M_{pre})/SD_{pre}$.
*p < .01. **p < .001.

The bivariate inverse relationship between changes in physical activity/week and weight did not reach statistical significance, β = -.12 (.10), p = .148; whereas the inverse relationship between completion/non-completion of the equivalent of 3 moderate-vigorous sessions of physical activity/week and weight change was significant, β = -.21 (2.19), p = .039.

Discussion

Findings suggest that the Weight Loss For Life protocol administered to university women with obesity was associated with significant improvements in weight, physical activity and eating behaviors, and their psychosocial correlates over 6 months, as they were with older women. This occurred even though the university sample completed more physical activity and consumed less fruits and vegetables at baseline, which was consistent with previous research (29;30). Participants' age group also had little effect on the prediction of physical activity and fruit/vegetable changes by changes in self-regulatory skill use, self-efficacy, and mood. The relationships of psychosocial and behavioral changes supported propositions extrapolated from social cognitive theory (6) and previous research with

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older women (5;16). The finding of the modest-volume threshold of physical activity (i.e., 3 moderate sessions/week) being associated with weight loss might be beneficial for adherence by not over-burdening participants (29).

A limitation of this research, however, was the 6-month duration of this investigation that did not allow analyses of longer-term maintenance of lost weight. Based on the present findings, this warrants attention in extensions of this research, even given the difficulties with college students residing in multiple locations throughout the year. Also, because psychological factors such as body image, social physique anxiety, and expectations might particularly affect young women, future research should better-account for them and their possible interactions with emotional eating and weight. Generalization of findings to men, and those who are overweight or with class 3 obesity, also require testing. Consistent with most weight-loss treatment research, the motivation to participate might have yielded self-selected samples that affected both the psychological and behavioral changes. Although this is difficult to address in studies requiring volunteers, replications might seek to incorporate individuals who were assertively "prescribed" enrollment in a behavioral weight-loss program by a medical professional. Finally, although physical activity was a key aspect of the tested treatment, physical activity plans were largely left up to the individual participant. Effects of professionally prescribed physical activity regimens, and/or ones that include resistance training (which might have different effects on body composition than aerobic activity (31)), should also be tested.

Conclusion

Based on these and earlier findings, and after replications over longer periods, health promotion professionals and administrators should consider offering the Weight Loss For Life protocol within the college/university and other settings with young adults. Its theoretical foundation for behavioral changes remained sound across the present samples, and its administration could have low costs by incorporating graduate students and faculty members, as well as practitioners such as community health workers, nurses, and fitness facility staff members to administer the standardized methods to large numbers of individuals in need. Although continued evaluation is warranted, effective use of this and other treatments with similar theoretical bases and uses of physical activity might finally help to reliably reduce obesity-related health risks across age ranges.

Contribution details

All authors read and met the ICMJE criteria for authorship and agree with the results and conclusions. JJA designed the study, analyzed the data, and wrote the report. PHJ contributed to the design and interpretation of the report.

Competing interests

None declared.

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