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Relationships between dietary intake and weight-related experiential avoidance following behavioral weight-loss treatment

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Abstract

Background—Interventions targeting weight-related experiential avoidance (EA) and disinhibited eating (DE) may also improve diet quality. Participants with overweight/obesity and DE who recently completed a behavioral weight-loss program were randomized to receive Acceptance and Commitment Therapy or continued behavioral weight-loss treatment. In this secondary analysis we explored (1) change in diet quality from baseline to 6-month follow-up (FU), and (2) whether weight-related EA at baseline and (3) change in weight-related EA during treatment were related to change in diet quality from baseline to FU.

Method—Veterans (*N*=68) completed food frequency questionnaires at baseline and FU, which were used to generate diet quality scores on the healthy eating index-15 (HEI-15). Weight-related EA was assessed using the Acceptance and Action Questionnaire for Weight-Related Difficulties-Revised (AAQW-R) at baseline, post-treatment, and FU. Aims were examined with mixed ANOVA analyses.

Results—Across both treatment groups, HEI-15 scores declined from baseline to FU. Women's HEI-15 decreased by about 5 times that of men. Baseline AAWQ-R was negatively associated with change in HEI-15. Neither AAWQ-R at post-treatment nor change in AAQW-R from baseline to post-treatment were significantly associated with change in HEI-15 at FU.

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Compliance with Ethical Standards:

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. This article does not contain any studies with animals performed by any of the authors.

Conclusions—Greater weight-related EA at baseline was associated with lower diet quality at FU, but change in weight-related EA during treatment did not predict change in diet quality at FU. Interventions targeting DE and weight-loss may require specific components to improve and sustain healthy dietary intake in Veterans with obesity and DE.

Keywords

Disinhibited Eating; Weight-related experiential avoidance; Diet quality; Obesity; Veterans

Obesity is a worldwide public health epidemic with significant disease burden [1]. In the United States, more than two-thirds of adults [2] and over three-quarters of Veterans served by the Veterans Health Administration Health Care System (VHA) have overweight or obesity (OW/OB) [3]. In addition, Veterans are more likely to have poorer diet quality than the general population [4] and are at higher risk of poor health outcomes [5]. A healthy diet is crucial for the prevention of many chronic conditions associated with OW/OB, including type 2 diabetes, cardiovascular disease, and some cancers [1]. Further, adherence to dietary recommendations is a foundation of behavioral weight-loss treatment (BWL) and long-term weight-loss maintenance [6]. However, the broad spectrum of disordered eating behavior that includes binge eating, overeating, loss of control eating, and emotional eating known as disinhibited eating (DE) [7] is common in Veterans with OW/OB and is associated with difficulty following a healthy diet [8].

One psychological factor that may influence diet quality among those with OW/OB is weight-related experiential avoidance (EA). EA is conceptualized as repeated attempts to change, control, or avoid undesirable thoughts, feelings, and sensations, despite adverse long-term consequences [4]. In the context of OW/OB and DE, weight-related EA may manifest as eating unhealthy foods or overeating to avoid unpleasant emotions, or restricting food intake to gain more perceived control over thoughts and emotions, which can perpetuate DE later [9]. Change in weight-related EA also could be one mechanism of treatment efficacy in behavioral treatments for weight-loss [10]. Weight-related EA is positively associated with binge eating, stress, and symptoms of depression and anxiety among adults with OW/OB [8]. Reducing weight-related EA may improve diet quality as individuals may be less likely to consume unhealthy “comfort foods” or engage in overeating to avoid unwanted emotions.

To our knowledge, no studies have examined weight-related EA as a psychological process underlying diet quality. Understanding the relationship between diet quality and weight-related EA may inform BWL treatment approaches to improve health outcomes. Food frequency questionnaires (FFQs) are commonly used to assess dietary intake among Veterans, but usually focus on calories or specific macronutrient intake rather than holistic diet quality [11].

Current Study

This secondary analysis examined change in healthy eating following behavioral treatment for DE or weight-loss to better understand the relationship between weight-related EA and diet quality. Veterans with OW/OB who recently completed the VHA’s standard BWL

intervention (*MOVE!©*) and endorsed DE were randomized to receive either Acceptance and Commitment Therapy (ACT) or continued BWL treatment [12]. Previously, we found significant improvements at post-treatment in binge eating, other DE patterns, and BMI, with minimal differences between treatment groups [12]. The current study explored: (1) change in diet quality from baseline (after completing *MOVE!©*) to 6 month follow-up (FU), and (2) whether weight-related EA at baseline and (3) change in weight-related EA during treatment were related to change in diet quality from baseline to FU. We hypothesized that less EA at baseline and greater improvement in EA, would be associated with better diet quality at 6 month FU.

Methods

Participants

Participants were U.S. military Veterans with OW/OB who endorsed DE and completed a 4-week adjunctive ACT or BWL intervention following participation in *MOVE!©*. DE was broadly defined and assessed via self-report of "stress-related eating." The ACT group used mindfulness and acceptance strategies to highlight the relationship between EA and DE, target unpleasant internal experiences underlying DE, and set goals consistent with self-identified personal values. The BWL group did not directly address DE, but included education on nutrition, physical activity, and strategies for weight-loss and maintenance, designed to reinforce relevant information from the medical, nutrition, and weight loss strategies taught in *MOVE! ©*, (see Supplemental Table 1). Inclusion criteria were: ages 18–75 years, BMI ≥ 25 kg/m^2, and participation in at least 5 of 8 *MOVE!©* sessions. Those with serious or unstable medical or psychiatric illness, psychosocial instability, conditions in which exercise or weight-loss could be detrimental to health, suicidality, concurrent participation in other interventions for obesity or DE, or prior ACT treatment were excluded. Participants who reported consuming less than 800 calories per day on average on the FFQ were considered as having invalid FFQ data [13]. Of the 88 participants who were randomized into the study, 69 completed valid FFQ assessments at both baseline and 6 months FU. The local Institutional Review Board and the Research and Development Committee approved the study. Informed consent was obtained from participants.

Measures

Demographic variables.—Participants reported demographic characteristics at baseline.

Dietary Intake.—Dietary intake was assessed using the General Nutrition Assessment Food Frequency Questionnaire (FFQ) produced by the Fred Hutchinson Cancer Research Center [14]. This FFQ asks participants to report the frequency of consumption and portion size of 125 line-items pertaining to a group of foods or beverages over the last month. The FFQ was analyzed using the University of Minnesota Nutrition Data Systems for Research software. FFQs demonstrate acceptable validity as a measure of dietary intake [14]. The FFQ was then coded to determine diet quality as measured by the Healthy Eating Index-2015 (HEI-15). The HEI-15 assesses adherence to the U.S. Dietary Guidelines and ranges from 0 to 100 and has a standard deviation of 11–12 in adults, with higher scores representing healthier diets [11].

Weight-related experiential avoidance.—The Acceptance and Action Questionnaire for Weight-Related Difficulties-Revised (AAQW-R), a 10-item measure assessing weight-related EA [15,16], was administered at baseline, post-treatment, and 6 month FU. Respondents rate how true six statements are, from 1 (*never true*) to 7 (*always true*), and how valid or believable four statements would be, from 1 (*not at all believable*) to 7 (*completely believable*). The AAQW-R has 3 subscales: food as control, weight as a barrier to living, and weight self-stigma. Total and subscale scores are formed by summing item responses. Higher scores indicate greater weight-related EA. In the current sample, internal consistency scores were acceptable (Table 1).

Data analysis

We conducted all analyses using SPSS Statistics, version 26 (IBM Corp., Armonk, N.Y., USA). A power analysis was not performed as this was a secondary analysis of already collected data [17]. We used bivariate correlations to examine relationships between AAQW-R total scales and subscales at baseline and HEI-15 at baseline and 6 months FU. We used a two-way mixed ANOVA (treatment group-by-time) to examine differences in HEI-15 between baseline and 6-months FU (HEI-15 change), and treatment group differences in HEI-15 change (Aim 1). Paired t-tests were used to examine change in AAQW-R total and subscale scores from baseline to post-treatment across both groups. We computed an AAQW-R change score by subtracting scores at baseline from scores at post-treatment. Then, mixed ANOVAs with time (baseline and 6-months FU) as a within-subject factor, and sex, race, and weight-related EA as between-subject factors predicting change in HEI-15 from baseline to 6-months FU were conducted. Sex and race/ethnicity were used as covariates because previous research shows women typically report higher diet quality than men, and some studies show African American/Black individuals report higher diet quality than non-Hispanic white individuals [18]. Race was coded as (1) white non-Hispanic or (2) non-white or white Hispanic. We ran two separate models. One model examined weight-related EA at baseline as a predictor of change in HEI-15 (Aim 2) and the other examined change in weight-related EA baseline to post-treatment as a predictor (Aim 3).

Results

On average, participants were 56.9 years old ($SD = 10.3$). Most participants were male (82.4%) and identified as White (73.5%); 14.7% identified as Black, and across all races 7.4% identified as Hispanic. About half of participants (48.5%) were married or living with a partner, and 36.8% had completed a bachelor's or graduate degree. Participants' average baseline BMI was 37.8 kg/m^2 ($SD = 7$). There were no significant group differences at baseline.

Because we did not find a significant treatment group-by-time interaction, the remaining analyses were conducted with the two treatment groups combined. Descriptive statistics and correlations among study variables are shown in Table 1. Participant's mean HEI-2015 score significantly decreased, from baseline to 6-month FU ($F(1,74) = 12.64$, $p < .001$). Mean AAQW-R total score decreased significantly from baseline to post-treatment [$t(75) = 3.59$, $p = .001$], as did subscale scores for Food as Control [$t(75) = 4.72$, $p < .001$], and Weight

as a Barrier to Living [t (75) = 2.06, p = .043]. Bivariate correlation analyses showed that at baseline the AAQW-R Weight Self-Stigma subscale was negatively associated with HEI-15. Further, AAQW-R Total, Weight as a Barrier to Living subscale, and Weight Self-Stigma subscale scores at baseline and post-treatment were each negatively related to HEI-15 at 6 months FU. Food as Control subscale scores were not associated with HEI-15 at any timepoint.

Table 2 presents results from the two ANOVA models for predicting change in HEI-15 from baseline to 6-months FU. In Model 1, lower AAQW-R at baseline was significantly associated with less reduction in HEI-15 from baseline to 6 months FU. Further, there was a significant interaction between time and sex on change in HEI-15 from baseline to 6-months FU. Women's HEI-15 decreased by 8.40 units ($M_{baseline}$ = 73.99, SE = 3.06; M_{6m} = 65.59, SE = 3.03) compared to a 1.72 unit decrease for men ($M_{baseline}$ = 69.33, SE = 1.47; M_{6m} = 67.71, SE = 1.46). In Model 2, change in AAQW-R from baseline to post-treatment was not associated with change in HEI-15, but the interaction of time and sex was significant.

Discussion

The purpose of this study was to explore the relationship between weight-related EA and diet quality among Veterans with OW/OB and DE who completed adjunctive treatment for DE and weight-loss. On average, diet quality decreased from baseline (which was post *MOVE!*©) to 6-months FU, and to a greater extent for women. Lower weight-related EA at baseline was related to better diet quality at 6-months FU but change in weight-related EA during treatment was not associated with change in diet quality.

As would be expected of individuals having completed a BWL intervention, the mean HEI-15 score in our sample was 69.8 at baseline, indicating better diet quality than American adults generally, which is 58.3 [19]. Diet quality decreased about 2-points from baseline to 6 months FU but remained higher than average American adults. Participants had recently finished *MOVE!*© and a 4-week adjunctive treatment, during which diet quality may have improved. Thus, our observations of diet quality decreasing might be part of an expected return to their pre-*MOVE!*© diet [20], particularly since the adjunctive treatments were more focused on maintenance of changes made in *MOVE!*© rather than additional weight-loss. On the other hand, there are no established cut-offs for interpreting within-person changes on the HEI-15, thus it is unclear if this reduction in HEI-15 score is clinically meaningful and might reflect that the adjunctive treatment further supported participants' efforts in maintaining higher diet quality. However, since we did not assess HEI-15 post-treatment, we cannot say whether the change in HEI-15 we observed occurred during or after adjunctive treatment.

Participants may have plateaued in diet quality or were unable to fully maintain improvements in diet quality following the *MOVE!*© program. This is consistent with our previously reported finding that participants in both groups gained weight at the 6-month FU after the adjunctive treatment [12]. Thus, the 4 week-dose of adjunctive treatment may have been too small, or more targeted self-regulatory skill training may be needed to influence

diet quality, such as self-monitoring [21], and continued reinforcement for healthy dietary intake.

Although likely underpowered, our results signal a larger decrease in diet quality for women than men from baseline to 6-month FU. Previous research suggests weight management strategies may have differing effects in Veterans based on sex [22]. Additional work with larger samples is needed to further understand the potential factors influencing gender, sex, racial and ethnic group differences in intervention targets to develop more culturally tailored treatments.

Consistent with our hypothesis, Veterans with lower weight-related EA at baseline had less reductions in dietary quality, suggesting lower weight-related EA may protect against reductions in diet quality following *MOVE!*©, or another BWL intervention. This aligns with other studies [e.g., 23] that found baseline EA moderated treatment efficacy. Perhaps participants with lower weight-related EA were better able to engage in behavioral change techniques promoted by both adjunctive treatments, including goal setting and social support from group members. Bivariate correlations showed that higher perception of weight as a barrier to living and greater weight self-stigma (at baseline and post-treatment) were related to lower diet quality at 6-months FU, suggesting these aspects of weight-related EA may be particularly important treatment targets for dietary habits. Although there was a significant bivariate correlation between weight-related EA and diet quality at 6-months FU, we did not find that change in weight-related EA was related to change in diet quality. Additional research on specific components of weight-related EA among Veterans, their relation to actual eating behavior, and their relationship to dietary intake may be warranted. Future research can also examine both the moderating and mediating role of EA in improving diet quality in behavioral interventions.

Strengths of the current study include its use of a unique sample of mostly male Veterans, validated measures for weight-related EA and diet quality, and active treatment within a randomized controlled trial. Diet quality was assessed using FFQs, which have a low response burden compared to other dietary assessments [24]. However, FFQs do not capture day-to-day variation in diet and are influenced by recall and social desirability biases [24]. Using 24-hour diet recall or calibrating FFQs with a subsample of 24-hour recall data would reduce biases [26]. Our sample was small, and findings should be interpreted only as preliminary signals to test with larger samples. In particular, our time by sex interaction should not be used to inform firm conclusions regarding sex differences.

In sum, this study addresses gaps in the literature assessing and relating diet quality and weight-related EA among Veterans with OW/OB and DE who participated in VHA behavioral treatment for weight-loss and DE. Results suggest that among Veterans with OW/OB, lower baseline levels of weight-related EA are associated with higher diet quality at 6-months post-adjunctive treatment. Future research is needed to examine weight-related EA and other characteristics that may influence response to treatment in larger samples, and to understand psychological processes that lead to changes in and long-term maintenance of diet quality.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Means, Standard Deviations, Internal Consistency, Scale Range, and Correlations among Study Variables

Variable (α)	Mean (SD)	Scale Range	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. HEI-15 Baseline	69.83 (10.28)	0–100	1									
2. HEI-15 6 months[1]	67.37 (10.13)	0–100	.65**	1								
3. AAQW-R total Baseline (α = .85)	32.36 (11.58)	10–70	−.23	**−.26***	1							
4. AAQW-R total post-treatment	28.93 (11.19)	10–70	−.19	**−.25***	.73**	1						
5. AAQW-R Food as control Baseline (α = .63),	10.76 (3.74)	3–21	−.13	−.16	.80**	.61**	1					
6. AAQW-R Food as control Post-treatment[2]	9.07 (3.55)	3–21	−.05	−.09	.57**	.79**	.65**	1				
7. AAQW-R Weight as a barrier to living baseline (α = .70),	11.32 (4.36)	3–21	−.23	**−.25***	.90**	.67**	.61**	.46**	1			
8. AAQW-R Weight as a barrier to living Post-treatment[2]	10.37 (4.43)	3–21	−.14	**−.24***	.67**	.89**	.50**	.56**	.69**	1		
9. AAQW-R Weight self-stigma Baseline (α = .78)	10.21 (5.27)	4–28	−.22	**−.25***	.89**	.62**	.54**	.41**	.71**	.59**	1	
10. AAQW-R Weight self-stigma Post-treatment	8.94 (4.65)	4–28	**−.27***	**−.28***	.63**	.90**	.46**	.57**	.57**	.70**	.60**	1

HEI-15 = Healthy Eating Index 2015, AAQW-R = Acceptance and Action Questionnaire for Weight-Related Difficulties-Revised

Significance level was set at α = .05.

*$p < .05$

**$p < .001$

[1]Mixed ANOVA indicated significant change from baseline to 6 month FU.

[2]*t*-test indicated significant change from baseline to post-treatment.

Significant correlations between HEI-15 and AAQW-R variables are bolded.

Table 2.

Summary of mixed ANOVA between-subjects effects models

Model 1. Baseline variables predicting change in HEI-15 from baseline to 6-months FU

	Predictor Variable (Units/scale range)	Sum of Squares	*df*	Mean Square	*F*	*P* value	*Partial eta* ^{2}
Between-Subject Summary	Intercept	83486.45	1	83486.45	501.30	<.001	.887
	Sex	31.38	1	31.38	0.19	.670	.003
	Race	9.35	1	9.35	0.06	.810	.001
	AAQW-R (Baseline)	762.00	1	762.00	4.58	.036	.067
	Error	10658.49	64	166.54			
Within-Subject Summary	Time	50.03	1	50.03	1.46	.231	.022
	Time × Sex	223.65	1	223.65	6.54	.013	.093
	Time × Race	14.78	1	14.78	0.43	.513	.007
	Time × AAQW-R (Baseline)	7.02	1	7.02	0.21	.652	.003
	Error (Time)	2188.19	64	34.19			

Model 2. Change in AAQW-R from baseline to post-treatment predicting change in HEI-15 from baseline to 6-months FU

	Predictor Variable (Units/scale range)	Sum of Squares	*df*	Mean Square	*F*	*P* value	*Partial eta* ^{2}
Between-Subject Summary	Intercept	26423.06	1	26423.05	148.45	<.001	.669
	Sex	51.76	1	51.76	0.29	.592	.005
	Race	52.17	1	52.17	0.29	.590	.005
	AAQW-R change	29.10	1	29.10	0.16	.687	.003
	Error	11391.30	64	177.99			
Within-Subject Summary	Time	70.74	1	70.74	2.07	.155	.031
	Time × Sex	221.66	1	221.66	6.48	.013	.092
	Time × Race	8.24	1	8.24	0.24	.625	.004
	Time × AAQW-R change	4.75	1	4.75	0.14	.711	.002
	Error (Time)	2190.46	64	34.23			