

Eating Behavior Associated With Weight Regain after Dietary Intervention in Obese Female

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Abstract

The aim of this study was to test the association of eating behavior with weight loss and weight regain after dietary intervention in obese females. Twenty-nine obese females were included in this study. Eating behavior using the Three-Factor Eating Questionnaire (TFEQ), which measures uncontrolled eating, emotional eating, and cognitive restraint eating, was tested for its association with weight loss (baseline to 3 months) and weight regain (3 to 15 months). Uncontrolled and emotional eating at the baseline was associated with weight regain, although cognitive restraint eating was associated with weight loss. Information on eating behavior may help to identify people who require additional support to maintain a reduced body weight after dietary intervention in obese females.

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Introduction

The increase of obesity is a serious problem throughout the world since obesity is a risk factor for various diseases, such as diabetes mellitus, cardiopulmonary disorder, osteoarthritis, and cancer^[1]. Weight management modifies the risk of these diseases^[1-3], while the methods remain to be established^[4-6]. Eating behaviors is referred to as one of the components of weight management. In fact, psychological variables were reported to be associated with weight loss^[7,8].

Clinical studies are limited using objective scores of eating behavior in association with weight management. The three-Factor Eating Questionnaire (TFEQ) measures uncontrolled eating, emotional eating, and cognitive restraint eating behavior^[9-11]. The TFEQ is a psycho-marker of weight loss^[12].

The aim of this study was to investigate the association of eating behavior using the TFEQ score with weight changes during dietary intervention among obese females.

Materials and Methods

Participants

Subjects who met the following criteria were recruited: 1) Japanese adults aged 20 - 70 years, 2) female sex, and 3) obese (defined based on ≥ 25 kg/m² body mass index (BMI) using the WHO Western Pacific Regional Office criteria^[13,14]). Those with the following criteria were excluded: 1) past history of allergic reaction to soy products and dietary supplementation products, 2)

advised against a low-calorie diet because of disease, 3) alcoholism, 4) a smoking habit, 5) pregnancy, 6) lactating state, and 7) inadequate state because of clearly severe diseases (i.e., heart diseases). The study originally included a weight-loss phase and a weight maintenance phase (this phase was directly after the prior weight-loss phase), and, this time, participants recruited in both phases were analyzed.

Diet intervention

Intervention program contents were described in detail previously^[15]. Briefly, all subjects received a low-calorie diet for weight loss, replacing one daily meal with a soy-based drink (180 kcal of calories; total fat: 1.5 g, carbohydrate: 16 g, and protein: 25 g) for 2 months (dietary intervention in the weight-loss phase). Those who showed $\geq 5\%$ weight loss following the low-calorie diet were followed up with supplements for 1 month (supplementary intervention in the weight loss phase). From 3-month intervention to 15 months, subjects did not receive any dietary intervention (follow-up period in the weight maintenance phase).

Parameters and outcomes

The body weight was measured with a standardized protocol in the morning at the baseline (0 months), after the weight loss phase (3 months after baseline) and after the weight maintenance phase (15 months after the weight-loss phase). The height was measured at the baseline. The BMI was calculated as the weight (in kilograms) divided by the height (in meters) squared. Eating behaviors were measured using the TFEQ 18 (TFEQ-R18)^[16].

Sample-size estimation

With power (1-beta level) of 80% at an alpha (significance) level of 5% to detect a difference of 0.5 in the correlation coefficient with a change of the BMI, a sample size of 16 was estimated.

Statistics

Changes in parameters from the baseline to weight-loss phase or weight maintenance phase were examined using the paired t-test for continuous variables. The correlation between eating behaviors and weight changes in each phase was examined using the Pearson correlation test. Multiple linear regression analysis for weight changes was performed to examine the correlation between eating behaviors and weight changes in each phase. The adjusted factors included the age and eating behaviors. We selected eating behavior variables of the cognitive restraint score in the weight-loss phase and emotional eating score in the weight maintenance phase because each score was correlated with other scores and these scores were most significantly correlated with weight changes in each phase. STATA version 13 (Stata ORp., College Station, TX, USA) were used for sample size and data analyses. $P < 0.05$ was considered significant.

Results

In total, there were 29 study subjects (mean age: 50.1 ± 8.8 years, mean BMI: 28.3 ± 3.3 kg/m²). The mean weight loss in the weight-loss phase was -4.6 ± 2.3 kg and the mean weight gain in the weight maintenance phase was 1.6 ± 3.6 kg (Table 1).

Table 1: Variables at baseline, and in post-intervention and follow-up periods.

Variables	Baseline (0 months)	Weight-loss phase (0 to 3 months)	Weight maintenance phase (3 to 15 months)
Bodyweight, kg	69.2 (8.0)	64.6 (7.5)	66.2 (9.3)
Difference from the prior state	-	-4.6 (2.3)*	1.6 (3.6)
Body mass index, kg/m ²	28.3 (3.3)	26.4 (3.2)	27.1 (4.0)
Difference from the prior state	-	-1.9 (0.9)*	0.7 (1.5)*
Eating behaviors			
Uncontrolled eating (out of 36)	20.3 (5.0)	18.8 (4.2)	19.9 (4.0)
Difference from the prior state	-	-1.6 (5.0)	1.1 (3.4)
Emotional eating (out of 12)	6.6 (2.4)	6.6 (2.2)	6.8 (2.8)
Difference from the prior state	-	0.0 (1.9)	0.2 (2.1)
Cognitive restraint eating (out of 24)	13.8 (2.6)	17.0 (2.4)	14.5 (2.3)
Difference from the prior state	-	3.2 (3.1)*	-2.5 (2.2)*

N = 29. Data are presented as the means (standard deviations). * $p < 0.05$

At the baseline, uncontrolled eating scores were positively associated with the emotional eating score, but negatively associated with the cognitive restraint score (not shown). The average cognitive restraint score was significantly decreased after dietary intervention, but increased during the follow-up period. Cognitive restraint eating scores were positively correlated with weight loss (Table 2). Uncontrolled eating and emotional eating scores at the baseline and in the follow-up period were positively correlated with weight regain, while at post-intervention they were not correlated with regain. In multiple linear regression analysis, the age

was negatively correlated with weight change in the weight-loss phase, while the emotional eating score was positively associated with the weight maintenance phase (Table 3).

Table 2: Correlation of variables measured and initial bodyweight, weight loss, and weight regain.

Variables	Weight-loss phase (baseline to 3 months)	Weight management phase (3 to 15 months)
Age, years	0.581*	-0.424*
Initial bodyweight, kg	-0.340	0.389*
Initial body mass index, kg/m ²	-0.117	0.385*
Weight loss (baseline to 3 months)	N.A.	-0.242
Eating behavior		
Uncontrolled eating		
Baseline	-0.344	0.486*
Post-intervention	0.332	0.178
Follow-up	N.A.	0.469*
Emotional eating		
Baseline	-0.321	0.531*
Post-intervention	0.117	0.204
Follow-up	N.A.	0.401*
Cognitive restraint eating		
Baseline	0.381*	-0.310
Post-intervention	-0.270*	0.036
Follow-up	N.A.	-0.098

*P < 0.05. NA, not applicable.

Table 3: Multiple linear regression analysis of weight changes.

Variables	Variables in weight-loss or weight maintenance phase	Standardized regression coefficient	t	P-value
Weight changes	Weight-loss phase: age	0.581	3.708	0.001
	Weight maintenance phase Emotional eating	0.531	3.256	0.003
BMI changes	Weight-loss phase: age	0.534	3.281	0.003
	Weight maintenance phase Emotional eating	0.537	3.309	0.003

Variables include age, initial BMI, and cognitive restraint eating score in weight-loss phase.

Variables include age, initial BMI, weight loss, and emotional eating score in weight maintenance phase.

Discussion

This study shows that high uncontrolled and emotional eating scores predicted weight regain after weight loss in obese females. Dalle et al. reported that successful weight loss was associated with increased dietary restraint and reduced disinhibition in obese patients seeking weight-loss treatment^[17]. However, uncontrolled and emotional eating at post-intervention did not predict weight regain. Therefore, we must assess eating behavior before starting a weight-loss program to identify people who may gain weight. The strength of this study included the use of a validated questionnaire. There are several limitations of this study. The study included a small sample-size and a 1-year follow-up.

Conclusion

In summary, high uncontrolled eating and emotional eating scores predict weight regain after weight loss in obese females. Further research including a large sample, different population, and varying genetic backgrounds are needed to clarify these issues.

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