

# Binge Eating and Weight Loss Outcomes in Overweight and Obese Individuals With Type 2 Diabetes

## Results From the Look AHEAD Trial

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**Context:** Binge eating (BE) is common in overweight and obese individuals with type 2 diabetes mellitus, but little is known about how BE affects weight loss in this population.

**Objective:** To determine whether BE was related to 1-year weight losses in overweight and obese individuals with type 2 diabetes participating in an ongoing clinical trial.

**Design, Setting, and Participants:** The Look AHEAD (Action for Health in Diabetes) trial is a randomized controlled trial examining the long-term effect of intentional weight loss on cardiovascular disease in overweight and obese adults with type 2 diabetes. A total of 5145 overweight and obese individuals aged 45 to 76 years with type 2 diabetes participated in this study.

**Interventions:** Participants were randomly assigned to an intensive lifestyle intervention or to enhanced usual care (a diabetes support and education control condition).

**Main Outcome Measures:** At baseline and 1 year, participants had their weight measured and completed a fitness test and self-report measures of BE and dietary intake. Four groups were created based on BE status at baseline and 1 year (yes/yes, no/no, yes/no, and no/yes).

Analyses controlled for baseline differences between binge eaters and non-binge eaters.

**Results:** Most individuals (85.4%) did not report BE at baseline or 1 year (no/no), 7.5% reported BE only at baseline (yes/no), 3.7% reported BE at both times (yes/yes), and 3.4% reported BE only at 1 year (no/yes), with no differences between intensive lifestyle intervention and diabetes support and education conditions ( $P = .14$ ). Across intensive lifestyle intervention and diabetes support and education, greater weight losses were observed in participants who stopped BE at 1 year (mean [SE] weight loss, 5.3 [0.4] kg) and those who reported no BE at either time (mean [SE] weight loss, 4.8 [0.1] kg) than in those who continued BE (mean [SE] weight loss, 3.1 [0.6] kg) and those who began BE at 1 year (mean [SE] weight loss, 3.0 [0.6] kg) ( $P < .001$ ). Post hoc analyses suggested that these differences were due to changes in caloric intake.

**Conclusion:** Overweight and obese individuals with type 2 diabetes who stop BE appear to be just as successful at weight loss as non-binge eaters after 1 year of treatment.

**Trial Registration:** clinicaltrials.gov Identifier: NCT00017953

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**B**INGE EATING (BE) IS COMMON among overweight and obese individuals seeking weight loss treatment,<sup>1,2</sup> and there is some indication that it is associated with poor treatment compliance.<sup>3-6</sup> Some have suggested that BE needs to be addressed prior to weight loss,<sup>7,8</sup> but empirical support for this recommendation is lacking. Research indicates that behavioral weight loss treatment does not exacerbate or precipitate BE,<sup>9,10</sup> that BE status is not associated with weight loss out-

comes,<sup>5,11,12</sup> and that BE may in fact improve with weight loss treatment.<sup>13,14</sup>

Binge eating is prevalent in overweight and obese individuals with type 2 diabetes mellitus,<sup>13,15,16</sup> with rates of binge eating disorder (BED) in this population ranging from 1.4% to 9%.<sup>17-19</sup> A recent study<sup>17</sup> examining 845 overweight and obese individuals with type 2 diabetes seeking entry into weight loss treatment found that 5.6% of individuals reported 8 or more objective BE episodes in the prior month and 1.4% met full diagnostic criteria for BED. Despite the

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Group Information: The Look AHEAD Research Group members are listed on page 1452.

frequency of BE in overweight and obese individuals with type 2 diabetes, little is known about how this behavior affects weight loss outcomes in this high-risk population. Gaining a better understanding of this relationship is clinically relevant and may have implications for future treatment recommendations.

The Look AHEAD (Action for Health in Diabetes) trial provides a unique opportunity to examine BE in overweight and obese individuals with type 2 diabetes because of its large and demographically diverse patient population. Look AHEAD is a randomized controlled trial examining the long-term effects of interventions designed to produce weight loss on cardiovascular morbidity and mortality in more than 5000 individuals with type 2 diabetes followed for up to 11.5 years.<sup>20</sup> In this study, we examined whether Look AHEAD participants who reported BE at study entry differed from those who did not on baseline demographics, anthropometrics, health-related and lifestyle variables, and psychosocial factors. We examined the stability of BE and whether weight loss treatment was associated with the development of BE during the first year of study participation. We also assessed whether 1-year weight loss outcomes were related to baseline BE status or changes in BE status during the first year of treatment.

## METHODS

### PARTICIPANTS

The Look AHEAD trial design and study participants have been described in detail elsewhere.<sup>20</sup> Briefly, individuals with type 2 diabetes interested in weight loss were recruited from 16 clinical centers in the United States. To participate, individuals had to be aged 45 to 76 years and have a body mass index (calculated as weight in kilograms divided by height in meters squared) of 25 or higher ( $\geq 27$  if receiving insulin). Individuals with inadequate diabetes control (ie, a glycosylated hemoglobin level  $>11\%$ ) or with factors likely to affect intervention adherence, safety (eg, underlying serious medical or psychological conditions), or retention (eg, plans to move out of the area) were excluded from the trial. All of the participants provided informed consent as approved by each site's institutional review board.

Eligible participants ( $n = 5145$ ) were randomly assigned to an intensive lifestyle intervention (ILI) or to a diabetes support and education (DSE) control condition. The ILI was modeled after the Diabetes Prevention Program lifestyle intervention.<sup>21</sup> The goals of the intervention were to produce a mean weight loss of at least 7% of initial weight through caloric restriction (ie, diet of 1200-1800 kcal/d) and increased physical activity ( $\geq 175$  minutes per week of moderately intense activity).<sup>22</sup> To achieve these goals, ILI participants were offered 3 group meetings and 1 individual meeting each month during months 1 through 6 and 2 group meetings and 1 individual session per month during months 7 through 12. The DSE participants were offered 3 group meetings per year and were given basic information on diabetes, nutrition, and physical activity.

### DEFINITION OF BE GROUPS

Binge eating was assessed via a self-report questionnaire based on the Questionnaire on Eating and Weight Patterns.<sup>23</sup> We identified participants who indicated having any episode(s) of eating a large amount of food in a short amount of time, reported

feeling out of control, and denied any compensatory behaviors (559 participants [11.7%]) during the past 6 months. For the comparison group, we identified participants who reported no BE episodes or compensatory behaviors (4222 participants [88.3%]). Individuals who reported compensatory behaviors (ie, purging or excessive exercise; 332 participants) or were missing data on the items used to determine BE behavior (32 participants) were excluded. We chose to examine BE behavior as opposed to full-criteria BED as defined by the *DSM-IV* for several reasons. First, many more participants reported BE behavior (11.7%) than met *DSM-IV* criteria for BED ( $n = 123$ ; 2.6%), allowing for more power to complete analyses. In addition, very little research has examined the effects of these behaviors (in the absence of an eating disorder) in the context of a behavioral weight study among type 2 diabetic individuals. Also, examining BE behavior, which is easily assessed via self-report, rather than a diagnosis of BED, which is best done via structured interview, may have more clinical applications among health care professionals.

## MEASURES

### Demographics and Anthropometric Characteristics

Participants provided basic demographic information regarding sex, race/ethnicity, marital status, and educational background at baseline. Weight was measured at baseline and 1 year on a digital scale in lightweight clothing. Height was measured at baseline on a wall-mounted stadiometer.

### Diabetes Variables

At baseline, participants indicated the number of years since being diagnosed with diabetes and their current diabetes treatment regimen (ie, diet only, oral medications without insulin, or insulin). Plasma was collected at baseline and glycosylated hemoglobin level (measured by a dedicated ion-exchange high-performance liquid chromatography instrument [Bio-Rad Variant 11; Bio-Rad Laboratories, Hercules, California]) was used as a measure of glycemic control during the past 3-month period.

### Dietary Intake

Reported dietary intake was assessed on a subsample of the Look AHEAD participants ( $n = 2411$ ) using a self-administered 130-item food frequency questionnaire, modified from the Insulin Resistance Atherosclerosis Study,<sup>24</sup> that assessed usual consumption during the prior 6-month period. We examined reported daily intake of energy as well as percentage of energy intake from fat, protein, and carbohydrates for those participants included in the subsample at baseline and 1 year.

### Fitness Level

Participants completed a graded exercise test that was designed to elicit maximal effort at baseline and submaximal effort at 1 year.<sup>25</sup> Peak exercise capacity expressed as metabolic equivalents was estimated from treadmill speed and grade.

### Weight Loss History

At baseline, participants indicated the number of times (0, 1-2, 3-4, 5-6, or  $\geq 7$  times) they had intentional weight losses of 5 to 9 lbs, 10 to 19 lbs, 20 to 49 lbs, 50 to 79 lbs, 80 to 99 lbs, and 100 lbs or more (to convert pounds to kilograms, multiply by 0.45). We examined the number of previous weight loss

attempts (using the lower end of the frequency intervals and summing across categories) and the total amount of past intentional weight loss (defined as the frequency of weight loss attempts multiplied by the amount of weight loss achieved, using the lower end of the frequency and amount intervals and summing across categories).<sup>26</sup>

### Mood and General Health

The Beck Depression Inventory II was used to measure depressive symptoms.<sup>26</sup> The Beck Depression Inventory II has been shown to have high internal consistency, test-retest reliability, and construct validity.<sup>27</sup> The 36-Item Short Form Health Survey version 2, a widely used, validated measure, was used to assess general health.<sup>28</sup> Participants also reported the number of prescription medications they were currently receiving. These measures were assessed at baseline.

### Tobacco and Alcohol Use

Tobacco and alcohol use was assessed at baseline and 1 year by self-report. Participants indicated whether they were a current smoker, a former smoker, or had never smoked cigarettes. Participants also reported how many alcoholic drinks (including wine, beer, and hard liquor) they typically consume per week. Binge drinking was assessed with a single item that asked participants how many days during the past month they had consumed 5 or more drinks on the same occasion.

## STATISTICAL ANALYSES

Baseline characteristics were compared between binge eaters and non-binge eaters with the use of *t* tests for continuous variables and  $\chi^2$  tests for categorical variables. To examine change in self-reported BE status over time, participants were classified according to BE status at baseline and 1 year, yielding 4 categories: those who indicated no BE at both times (no/no), those who reported BE at baseline but not at 1 year (yes/no), those who indicated no BE at baseline and reported it at 1 year (no/yes), and those who reported BE at both times (yes/yes). Multiple logistic regression was used to examine the relationship between BE at 1 year and treatment group assignment. We determined the odds ratio and 95% confidence interval of BE at 1 year associated with treatment group assignment controlling for baseline BE separately and in combination with age, race/ethnicity, sex, education level, baseline weight, number of previous weight loss attempts, total amount of weight lost, depressive symptoms, self-reported general health, number of prescription medications, and binge drinking.

Multiple linear regression was used to model the effect of BE status on weight loss at 1 year controlling for age, race/ethnicity, sex, education level, baseline weight, number of previous weight loss attempts, total amount of weight lost, depressive symptoms, self-reported general health, number of prescription medications, maximum metabolic equivalents, and binge drinking. Models were fitted for the overall cohort (also controlling for intervention group) and separately by treatment group assignment. In addition, the same models were fitted controlling for dietary covariates (reported caloric intake, percentage of fat intake, and percentage of carbohydrate intake) for the subsample of participants furnishing baseline dietary data. To further explore the weight loss differences detected among the BE status groups, we modeled the effect of BE status on change in total reported caloric intake and change in fitness controlling for the same variables noted earlier.

We also ran the primary model examining the association between BE status and weight loss outcomes using DSM-IV BED

**Table 1. Demographic Characteristics of Study Sample**

Characteristic	Non-Binge Eaters <sup>a</sup>	Binge Eaters <sup>a</sup>	P Value
Participants, No. (%)	4222 (88.3)	559 (11.7)	
Age, mean (SD), y	59.1 (6.8)	57.3 (6.6)	<.001
Sex, No. (%)			.008
Male	1744 (41.3)	198 (35.4)	
Female	2478 (58.7)	361 (64.6)	
Race, No. (%)			<.001
White	2650 (62.8)	419 (75.0)	
Hispanic	576 (13.6)	54 (9.7)	
African American	663 (15.7)	55 (9.8)	
Native American	208 (4.9)	15 (2.7)	
Other	125 (3.0)	16 (2.9)	
Education, No. (%)			.003
<High school diploma	301 (7.3)	21 (3.9)	
High school graduate	746 (18.1)	87 (15.9)	
College graduate	3081 (74.6)	438 (80.2)	
Married, No. (%)	2861 (67.8)	378 (67.6)	.43

<sup>a</sup>Binge eating is defined as reporting any episodes of binge eating and no compensatory behaviors in the past 6 months.

criteria rather than BE behavior. The patterns of weight loss were identical between the 2 models; however, because of reduced sample size, the BED model was not significant ( $P = .09$ ) and the data are not presented. Additionally, among those reporting BE at baseline, we used the primary model to determine the relationship between baseline BE frequency and weight loss at 1 year as well as the relationship between baseline BE frequency and change in reported caloric intake.

Statistical analyses were performed with SAS statistical software version 9 (SAS Institute, Inc, Cary, North Carolina).

## RESULTS

At baseline, 11.7% of our cohort reported having 1 or more episodes in the past 6 months when they ate a large amount of food in a short period of time and felt they could not control what or how much they were eating. Of those who reported BE episodes, 41.3% did so less than 1 day per week, 49.6% reported BE episodes on 1 to 3 days per week, and 9.2% reported BE episodes on 4 or more days per week in the past 6 months. Only 123 participants (2.6%) met DSM-IV criteria for BED based on self-report.

### BASELINE DIFFERENCES

Individuals who reported any episodes of BE at baseline were younger ( $P < .001$ ) and more likely to be female ( $P = .008$ ), white ( $P < .001$ ), and college educated ( $P = .003$ ) than their non-BE counterparts (**Table 1**). Individuals who reported BE were also heavier ( $P < .001$ ) at entry into the Look AHEAD trial and had a more extensive weight loss history both in terms of number of weight loss attempts ( $P < .001$ ) and total amount lost ( $P < .001$ ) (**Table 2**). Baseline dietary intake differed between the 2 groups, with binge eaters reporting a higher daily caloric intake ( $P < .001$ ) and a greater percentage of calories from fat ( $P = .03$ ). Fitness levels did not differ between the groups (for maximum metabolic equivalents,  $P = .66$ ) (**Table 2**).

Individuals reporting BE drank fewer alcoholic beverages per week ( $P = .02$ ) and were less likely to report

**Table 2. Baseline Weight, Diet, and Fitness Levels**

Characteristic	Mean (SD)		P Value
	Non-Binge Eaters <sup>a</sup>	Binge Eaters <sup>a</sup>	
BMI	35.7 (5.8)	37.2 (6.1)	<.001
Previous weight loss attempts, No.	5.5 (5.4)	8.2 (6.5)	<.001
Previous weight loss, kg	42.1 (51.7)	65.2 (65.2)	<.001
Daily caloric intake, kcal	1922.4 (857.0)	2378.7 (1014.9)	<.001
Calories from fat, %	40.0 (7.0)	40.9 (6.5)	.03
Calories from protein, %	17.2 (2.9)	16.9 (2.7)	.18
Calories from carbohydrates, %	43.7 (7.7)	43.1 (7.1)	.21
Maximum METs	7.2 (2.0)	7.1 (2.0)	.66

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); METs, metabolic equivalents.

<sup>a</sup>Binge eating is defined as reporting any episodes of binge eating and no compensatory behaviors in the past 6 months.

**Table 3. Baseline Psychological and Physical Health Variables**

Variable	Non-Binge Eaters <sup>a</sup>	Binge Eaters <sup>a</sup>	P Value
BDI-II score, mean (SD)	5.2 (4.7)	7.8 (5.5)	<.001
Alcoholic drinks, mean (SD), No./wk	1.4 (3.3)	1.1 (2.7)	.02
Smoking, No. (%)			.12
Current	192 (4.6)	19 (3.4)	
Former	1885 (44.7)	273 (48.9)	
Never	2138 (50.7)	266 (47.7)	
Binge drinking, No. (%)	217 (5.1)	16 (2.9)	.02
General health score, mean (SD)	47.8 (8.7)	43.4 (9.4)	<.001
Diabetes duration, mean (SD), y	6.8 (6.5)	7.1 (6.3)	.22
Glycated hemoglobin level, mean (SD), %	7.3 (1.2)	7.3 (1.1)	.71
Medications, mean (SD), No.	5.5 (3.0)	5.8 (3.1)	.03
Diabetes treatment, No. (%)			.94
Diet only	525 (12.6)	71 (12.9)	
Oral medications without insulin	2847 (68.3)	371 (67.6)	
Insulin	795 (19.1)	107 (19.5)	

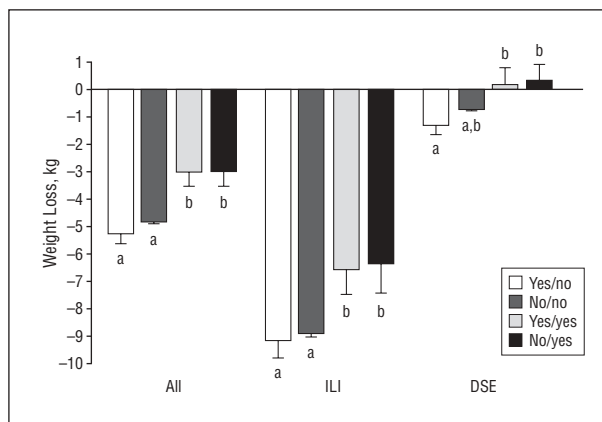
Abbreviation: BDI-II, Beck Depression Inventory II.

<sup>a</sup>Binge eating is defined as reporting any episodes of binge eating and no compensatory behaviors in the past 6 months.

binge drinking ( $P = .02$ ) than individuals who indicated no BE. Individuals reporting BE at baseline also had higher levels of depressive symptoms ( $P < .001$ ), reported worse general health ( $P < .001$ ), and were receiving more medications ( $P = .03$ ) than individuals who indicated no BE, but there were no group differences in glycated hemoglobin level, number of years since the diabetes diagnosis, or current diabetes treatment regimen (**Table 3**).

### 1-YEAR OUTCOMES

At 1 year, weight data were available for 96.4% of participants and weight and questionnaire data were available for 88.3% of participants. Individuals reporting BE at baseline were less likely to complete the full 1-year assessment (weight and questionnaire data) compared with non-binge eaters (85.2% vs 88.7%, respectively;  $P = .02$ ).



**Figure 1.** One-year weight loss by binge eating status. Yes/no indicates that the participant reported binge eating at baseline but not at 1 year; no/no, the participant did not report binge eating at either time; yes/yes, the participant reported binge eating at both times; and no/yes, the participant did not report binge eating at baseline but did at 1 year. ILI indicates intensive lifestyle intervention; DSE, diabetes support and education; and error bars, standard error. Groups with different lowercase letters are statistically different from each other.

Most individuals (85.4% overall; 84.9% with ILI and 85.9% with DSE) reported no BE at baseline or 1 year (no/no), 7.5% (8.3% with ILI and 6.8% with DSE) reported BE at baseline but not at 1 year (yes/no), 3.7% (4.0% with ILI and 3.5% with DSE) reported BE at both times (yes/yes), and 3.4% (2.9% with ILI and 3.8% with DSE) did not report BE at baseline but did at 1 year (no/yes). These patterns did not differ between the ILI and DSE conditions ( $P = .14$ ). Overall, of those individuals who reported BE at baseline, the majority (66.8% overall; 67.6% with ILI and 65.9% with DSE) did not report the behavior at 1 year. The frequency of BE behavior at baseline (<2 days per week vs  $\geq 2$  days per week) was not associated with whether BE continued at 1 year ( $P = .12$ ).

Participants randomly assigned to ILI were no more likely to binge eat at 1 year than those randomized to DSE (odds ratio for ILI vs DSE, 0.85; 95% confidence interval, 0.66-1.09;  $P = .20$ ) controlling for baseline BE. After adjusting for additional covariates, ILI participants were marginally less likely to binge eat at 1 year compared with DSE participants (odds ratio, 0.77; 95% confidence interval, 0.59-1.01;  $P = .06$ ). As expected, baseline BE was the most important predictor of behavior at 1 year ( $P < .001$ ).

As shown in **Figure 1**, after controlling for baseline differences between binge eaters and non-binge eaters, there were statistically significant differences in 1-year weight losses based on BE behavior over time ( $P < .001$ ) (**Table 4**). Specifically, individuals who reported BE at baseline but had stopped at 1 year (yes/no; mean [SE], 5.3 [0.4] kg) and individuals who reported no BE at either time (no/no; mean [SE], 4.8 [0.1] kg) had significantly better weight losses than those who continued BE (yes/yes; mean [SE], 3.1 [0.6] kg) and those who began BE by 1 year (no/yes; mean [SE], 3.0 [0.6] kg) ( $P < .001$ ). There were no weight loss differences between those who reported no BE at either time and those who reported BE at baseline but not at 1 year ( $P = .21$ ). Similar patterns were observed when looking separately at the ILI and DSE conditions.

Given the differences in weight loss across the BE status groups, post hoc analyses were conducted to exam-

**Table 4. Relationship of 1-Year Weight Loss, Caloric Intake Decline, and Fitness Change to Binge Eating Behavior at Baseline and 1 Year**

Variable and Model	Participants, No.	Binge Eating Behavior at Baseline/1 y, Adjusted Mean (SE)				P Value
		No/No	No/Yes	Yes/No	Yes/Yes	
1-y Weight loss, kg						
Unadjusted	4222	4.63 (0.13)	2.88 (0.66)	5.91 (0.44)	4.01 (0.62)	<.001
Model 1 <sup>a</sup>	3928	4.77 (0.11)	3.00 (0.58)	5.27 (0.39)	3.05 (0.56)	<.001
Model 2 <sup>b</sup>	1957	4.65 (0.16)	3.92 (0.71)	5.59 (0.51)	3.40 (0.70)	.04
1-y Calorie decline, kcal						
Unadjusted	1954	279.3 (18.2)	163.4 (82.7)	535.9 (56.9)	364.0 (76.2)	<.001
Model 2 <sup>b</sup>	1798	322.4 (14.8)	13.1 (65.9)	330.8 (46.3)	175.7 (64.6)	<.001
1-y Fitness change, METs <sup>c</sup>						
Unadjusted	3785	0.58 (0.02)	0.48 (0.12)	0.59 (0.08)	0.56 (0.11)	.85
Model 1 <sup>a</sup>	3533	0.59 (0.02)	0.48 (0.11)	0.52 (0.07)	0.46 (0.10)	.43
Model 2 <sup>b</sup>	1750	0.63 (0.03)	0.52 (0.15)	0.58 (0.10)	0.74 (0.14)	.68

Abbreviation: METs, metabolic equivalents.

<sup>a</sup>Model 1 is a linear model adjusting for sex, age, race/ethnicity, education, intervention group, baseline weight, weight loss history, Beck Depression Inventory II score, general health score, binge drinking, maximum METs (except for the METs models), number of prescribed drugs received at baseline, and baseline measure.

<sup>b</sup>Model 2 also adjusts for intake of kilocalories and percentage of calories from fat intake at baseline.

<sup>c</sup>The fitness change is calculated as METs at 1 year minus METs at baseline.

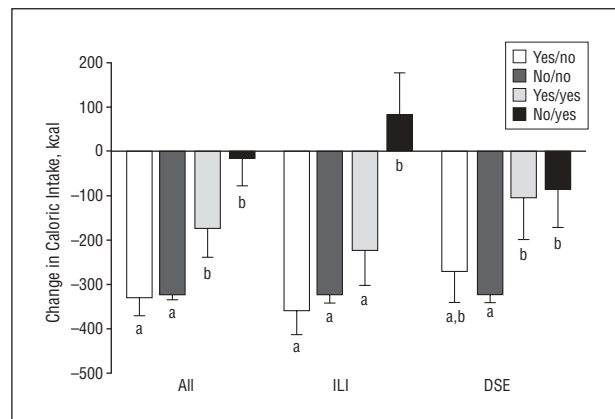
ine group differences in self-reported caloric change from baseline to 1 year in the subsample (n=1954) who completed the dietary measure. As shown in **Figure 2**, participants who reported no BE at either time (no/no) and those who reported BE at baseline but not at 1 year (yes/no) reported greater decreases in caloric intake from baseline to 1 year than those who reported BE at both times (yes/yes) or those who did not report BE at baseline but did at 1 year (no/yes) ( $P < .001$  for specific contrast and overall) (Table 4). The pattern was similar when looking separately at the ILI and DSE conditions, although some of the comparisons between BE categories were no longer significant. In addition to dietary data, we also conducted post hoc analyses to examine whether there were group differences in changes in fitness levels; however, no group differences were observed ( $P = .43$ ) (Table 4).

Among those who reported BE at baseline, there was a significant association showing that higher frequencies of self-reported BE episodes were associated with smaller 1-year weight losses ( $P = .03$ ); this pattern held true when examining the ILI condition separately ( $P = .048$ ) but was not found in the DSE condition ( $P = .62$ ). In the subsample providing dietary intake information, there was also a trend for higher baseline BE frequency to be associated with greater caloric declines during the 1-year period among those reporting baseline BE ( $P = .05$ ). This trend was more evident in the ILI condition ( $P = .04$ ) than in the DSE condition ( $P = .35$ ).

Finally, because of the influence substance use can have on weight, we examined whether the BE groups differed at 1 year in tobacco and alcohol use. There were no differences among the BE status groups at 1 year in the percentage of individuals who were currently smoking ( $P = .40$ ) or who reported binge drinking in the past month ( $P = .19$ ).

#### COMMENT

Approximately 1 in 10 overweight and obese individuals with type 2 diabetes participating in the Look AHEAD trial



**Figure 2.** One-year change in reported caloric intake by binge eating status. Yes/no indicates that the participant reported binge eating at baseline but not at 1 year; no/no, the participant did not report binge eating at either time; yes/yes, the participant reported binge eating at both times; and no/yes, the participant did not report binge eating at baseline but did at 1 year. ILI indicates intensive lifestyle intervention; DSE, diabetes support and education; and error bars, standard error. Groups with different lowercase letters are statistically different from each other.

reported having 1 or more episodes of BE in the 6 months prior to study entry. These individuals were younger and more likely to be female, white, and college educated than their non-BE counterparts, demographic differences that are consistent with prior reports of BE in individuals with type 2 diabetes.<sup>13,15,16</sup> As described by others,<sup>5,15</sup> individuals reporting BE at study entry had more difficulties with weight control, were heavier, and had more extensive weight loss histories. They also consumed a diet higher in total calories and fat, replicating prior work by Yanovski and Sebring<sup>29</sup> and by Yanovski et al.<sup>30</sup>

Individuals reporting BE in our sample reported higher levels of depressive symptoms, again consistent with the existing BE literature<sup>5,13,16</sup>; however, depression levels in this sample were quite low even among individuals reporting BE. Binge drinking was also infrequent in this sample. Of interest, however, is that at study entry we found sig-

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(continued)

nificantly lower rates of binge drinking in binge eaters compared with non-binge eaters, a finding that supports a recent report that obese individuals are less likely to have

substance use disorders than nonobese individuals.<sup>31</sup> While concerns have been raised about shifting addictions or symptom substitution such that the dietary restrictions accom-

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panying weight loss may lead to increases in substance use,<sup>32</sup> our study suggests that the modest weight losses produced by a behavioral intervention are not associated with increases in either alcohol or tobacco use.

Individuals reporting BE at study entry had worse physical health, both by self-report and by medication use, than non-binge eaters, but there were no differences in glycated hemoglobin level, years since the diabetes diagnosis, or diabetes treatment regimen. Studies to date examining the connection between BE and glycemic control have found mixed results.<sup>13,15,16</sup> This study, which examines this

relationship in a much larger and more demographically diverse sample, indicates that while overall physical health may be affected by BE, diabetes control per se is not.

Fewer than 4% of participants in either the ILI or DSE group who reported no BE at baseline reported the behavior at 1-year follow-up, suggesting as others have found<sup>9,14</sup> that behavioral weight loss treatment does not generally lead to initiation of BE behavior. In fact, those who participated in the ILI were marginally less likely to be engaging in BE behavior at 1 year than those in the DSE group. In addition, in both conditions, the majority of individu-

als (66.8%) who reported BE at baseline were no longer engaging in the behavior at 1 year. The reason for the instability of BE behavior is not clear. It could reflect a true improvement in BE as a result of participating in a structured program or it could mirror the natural course of BE, which has been shown to remit without treatment in many individuals in community samples.<sup>33,34</sup>

Perhaps most interesting is that 1-year weight losses were equivalent in individuals who indicated no BE at either baseline or 1 year and in individuals who reported BE at baseline but had ceased BE at 1 year. Weight losses in both of these groups were significantly better than in individuals who reported BE at both times or who started BE during the 1-year period, suggesting that BE is only problematic if it persists or starts during treatment. The differences in weight loss between those who stopped BE and those who continued or started BE, while relatively small (2 kg), may have important health implications, particularly if maintained in the long term. These improved weight losses appear to be explained by greater decreases in caloric intake in those with no BE and those who stopped BE during treatment. Many prior studies have assessed BE at the start of treatment only, perhaps accounting for some of the mixed weight loss results reported in the literature. Our findings confirm current recommendations<sup>14</sup> that individuals who binge eat should not be discouraged from entering behavioral weight loss programs. It also supports other studies suggesting that abstinence from BE is associated with better weight loss outcomes at 1 year compared with those who continue BE.<sup>35</sup> Given that individuals who continued BE and those who started BE during treatment did not fare as well, it would appear useful to assess BE throughout treatment rather than simply at entry into a program and to provide additional support as needed.

A limitation of this study is that we relied on a self-report measure of BE behavior. The gold standard for the assessment of BE is the Eating Disorder Examination interview.<sup>36</sup> Self-report measures of BE are most appropriately used as a screening measure for BE behavior as opposed to a diagnostic tool. However, the brevity and minimal cost of the self-report tool used in this study increase the likelihood that screening for BE could be conducted in primary care settings or repeatedly throughout a weight loss program. In addition, self-reported BE has been shown to be consistent with the Eating Disorder Examination interview in overweight individuals who binge eat.<sup>37,38</sup> It is also important to note that our sample was composed entirely of overweight individuals with type 2 diabetes who were seeking help to lose weight and were willing and able to participate in a long-term study. These individuals were likely very motivated to change their eating behaviors to improve their health and may not be representative of overweight individuals with type 2 diabetes as a whole. Moreover, because of the Look AHEAD trial's focus on cardiovascular outcomes, participants were required to be between the ages of 45 and 76 years, a group that may be less prone to BE than younger individuals.<sup>16,39</sup> These individuals had also been diagnosed with diabetes on average 7 years prior to study entry and may differ from newly diagnosed patients in eating habits and diabetes management. Our results should be interpreted with these limitations in mind.

This study adds to the literature by showing that BE still occurs with some frequency in overweight and obese older adults with type 2 diabetes. Although individuals reporting BE also reported a more depressed mood and worse physical health than their non-BE peers, their diabetes control and management did not differ. Most individuals who reported BE at baseline stopped BE by 1 year, and these individuals were just as successful at weight loss as those individuals who reported no BE on both occasions. Also, few individuals started BE during the 1-year period. This study lends further support to the recommendation that BE is not exacerbated by behavioral weight loss treatment and in fact may be improved by participating in a structured weight loss program targeting lifestyle changes.

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