Binge Eating and Weight Loss Outcomes in Individuals with Type 2 Diabetes: 4-Year Results from the Look AHEAD Study

Ariana M. Chao, Ph.D., CRNP[1,2], **Thomas A. Wadden, Ph.D.**[2], **Amy A. Gorin, Ph.D.**[3], **Jena Shaw Tronieri, Ph.D.**[2], **Rebecca L. Pearl, Ph.D.**[2], **Zayna M. Bakizada, B.A.**[2], **Susan Z. Yanovski, M.D.**[4], and **Robert I. Berkowitz, M.D.**[2,5]

[1]University of Pennsylvania School of Nursing, Department of Biobehavioral Health Sciences, Philadelphia, PA, USA

[2]Perelman School of Medicine at the University of Pennsylvania, Department of Psychiatry, Philadelphia, PA, USA

[3]University of Connecticut, Department of Psychology, Storrs, CT, USA

[4]National Institute of Diabetes and Digestive and Kidney Diseases, Division of Digestive Diseases and Nutrition, Bethesda, MD, USA

[5]The Children's Hospital of Philadelphia, Department of Child and Adolescent Psychiatry and Behavioral Science, Philadelphia, PA, USA

Abstract

Objective—To assess whether an intensive lifestyle intervention (ILI) for weight reduction precipitates binge eating (BE) and whether BE attenuates 4-year weight loss among participants with type 2 diabetes and overweight/obesity.

Methods—Participants (n=4,901) were from Look AHEAD, an RCT that compared ILI to diabetes support and education (DSE). We used annual assessments of measured weight and self-reported BE. Using yearly time points a person endorsed BE, participants were classified as: no BE; remitted BE; incident BE; inconsistent BE (2–3 years including baseline); and consistent BE (4 years including baseline). We used Cox regression and mixed-effects models for analyses.

Results—ILI participants were marginally more likely to report incident BE at year 4 than those in DSE (p=0.06). At year 4, ILI participants with remitted BE lost more weight (4.7±0.8%) than those with consistent BE (1.9 ±1.0%; p=0.03). ILI participants with no BE lost more weight (4.6 ±0.2%) than those with incident BE (3.1 ±0.6%; p=0.02) and consistent BE (p=0.01). DSE participants with remitted BE lost more weight than those with incident and consistent BE.

Correspondence to: Ariana M. Chao, Ph.D., CRNP, University of Pennsylvania School of Nursing, 418 Curie Blvd, Philadelphia, PA 19104; Tel.: 215-746-7183; Fax: 215-898-2878; arichao@nursing.upenn.edu.

Conclusions—Preexisting BE does not seem to be a contraindication for ILI, although persistent BE attenuates weight loss. Patients who report new or ongoing BE need additional treatment.

Keywords

Binge eating; weight; obesity; psychosocial behavior

Introduction

The health benefits of weight loss have been documented,[1,2] yet the behavioral effects of participating in a lifestyle program have not been fully determined. In some[3,4] but not all studies,[5,6] dieting precedes unhealthy weight-control behaviors, leading to concerns that lifestyle interventions for weight reduction may induce or exacerbate disordered eating behaviors such as binge eating (BE). BE is characterized by consumption of a large amount of food, with a sense of loss of control over eating.[7] A diagnosis of binge eating disorder (BED) is made if BE episodes occur at least once a week for 3 months or more, and are associated with marked distress without regular compensatory behaviors (e.g., purging).[7] Among overweight adults with and without preexisting BE, moderate caloric restriction does not seem to precipitate this behavior in the short term (1 year).[8–10] Further, in participants with BE at baseline, behavioral weight loss seems to decrease this behavior.[11,12] Whether these improvements return to baseline with long- term follow-up (>1 year) is unknown.

Individuals with BE may be less successful with weight management, regardless of whether diagnostic thresholds are met. BE has been identified as a risk factor for poor response to weight loss treatment in several,[9,13–15] but not all studies.[16–18] Thus, some clinicians have suggested that BE should be treated before weight loss.[19] Few studies have examined long-term effects (>1 year) of BE on weight loss, when behavioral adherence typically declines and weight regain is common.

In this study, we used data from the Action for Health in Diabetes (Look AHEAD) study to address these gaps. Look AHEAD is a 16-center randomized clinical trial that compared the effects of an intensive lifestyle intervention (ILI) to diabetes support and education (DSE) on incidence of major cardiovascular events.[20,21] Gorin and colleagues (2008) previously reported that participants randomly assigned to the ILI were marginally less likely to binge eat at year 1 than those in the DSE group (OR=0.77, p=0.06). Across groups, individuals who stopped BE at 1 year or who reported no BE at either baseline or 1 year lost 5.3 kg and 4.8 kg, respectively, which was significantly more than the 3.1 kg and 3.0 kg, respectively, lost among those who continued to binge eat or who had begun to binge eat at year 1.[9] The aims of this study were to: 1) assess the effects of the ILI on the precipitation (and possible remission) of BE over 4 years; and 2) examine whether 4-year weight loss outcomes were related to BE status over the 4-year period. We hypothesized that the ILI and DSE groups would not differ in incidence of BE and that the ILI group, as compared to the DSE group, would have a greater percent of participants who reported remission of BE. We also hypothesized that individuals who continued to report BE over 4 years would lose less weight than those who were continuously free of this behavior or reported remission of BE.

Methods

Participants

Details of the study's procedures have been reported previously.[22] In brief, 5,145 participants were recruited from 16 centers in the US. Participants were 45–76 years of age with overweight or obesity (body mass index (BMI) 25 kg/m^2; BMI 27 if on insulin) and type 2 diabetes. Participants were required to have a hemoglobin A1c<11%, systolic blood pressure<160 mm Hg, diastolic blood pressure<100 mm Hg and triglycerides<600 mg/dL. Local institutional reviews boards at each site approved the protocol and consent forms. The current analysis used the publically available data (n=4,901), which included consented and randomized participants and excluded people from Native American sites due to consent limitations. Participants with baseline compensatory behaviors (n=307) or with missing baseline BE data (n=12) were excluded from analyses.

Interventions

Participants were randomly assigned within each center to the ILI or DSE group.[23] The ILI included individual and group sessions focused on improving diet and physical activity. The goal of the program was to achieve and maintain a mean loss of 7% of initial body weight. Participants were prescribed a 1200–1800 kcal/day calorie goal and 175 minutes/week of moderate-intensity physical activity. Participants in ILI were seen weekly for the first 6 months, 3 times per month for the next 6 months, and at least once a month from years 2–4, with a combination of group and individual contacts following a standardized protocol.[23] BE was not explicitly addressed in sessions, though participants were encouraged to consume a regular pattern of meals. Intervention materials are available at https://www.lookaheadtrial.org/publicResources/interventionMaterial.cfm. Participants in DSE were invited to three group sessions each year that used a standardized protocol and focused on diet, physical activity, or social support.[24]

Assessments

Assessments were completed at baseline and annually thereafter by certified staff masked to intervention assignment. Participants were compensated $100 per visit.

Demographic and clinical characteristics—Height and weight were measured in duplicate using a stadiometer and digital scale (Tanita, model BWB-800, Willowbrook, IL) with participants wearing light clothing. Self-report forms were used to collect demographic data. Prescription medication use was assessed at baseline. Participants completed questions regarding diabetes duration and treatment regimen. Glycated hemoglobin level was measured with a dedicated ion-exchange high-performance liquid chromatography instrument [Bio-Rad Variant 11; Bio-Rad Laboratories, Hercules, California].

Binge eating—BE was assessed annually using a self-report questionnaire adapted from the Questionnaire on Eating and Weight Patterns (QEWP).[25] At each time point, participants were categorized as having BE if they endorsed consumption of a large amount of food in a discrete period of time while feeling a loss of control over eating at least once in the past 6 months. Participants reported the average weekly frequency of BE as less than 1 day a week;

1 day a week; 2–3 days a week; 4–5 days a week; or almost every day. A midpoint average was used for frequency intervals. Use of compensatory behaviors (e.g., vomiting, excessing exercise) in the past 3 months was assessed using questions from the QEWP.[25]

Dietary intake—Reported dietary intake was measured in a subgroup of participants (n=2,612) using a self-administered 130-item food frequency questionnaire. The measure assessed usual consumption during the past 6-months and was used to calculate daily energy intake, and percent of energy intake from fat, carbohydrates, and protein.

Weight loss history—At baseline, participants were asked the number of times (0, 1–2, 3–4, 5–6, or 7 times) that they had intentional weight losses of 5–9 lbs, 10–19 lbs, 20–49 lbs, 50–79 lbs, 80–99 lbs, and 100+ lbs. Number of previous weight loss attempts was computed using the lower end of the frequency intervals and summing across categories. Total amount of past weight loss was calculated by multiplying the frequency of attempts by the amount of weight loss, using the lower bound of the frequency and amount intervals and totaling across categories.

Depressive symptoms and quality of life—The Beck Depression Inventory (BDI) 1A was used to assess depressive symptoms.[26] The measure includes 21 symptoms with scores ranging from 0–63. A greater number of symptoms indicates higher depressive symptoms. Scores 10 suggest mild or greater depression. The 36-item Short-Form Health Survey was used to assess health-related quality of life.[27] Two summary scores, physical composite and mental composite, were used in this analysis. Summary scores are norm-based T-scores with a mean of 50 and standard deviation of 10. Lower scores indicate worse health-related quality of life.

Tobacco and alcohol use—Tobacco and alcohol use were assessed by self-report. Participants indicated whether they were a current, former, or never smoker. Participants reported the ounces of alcoholic drinks they typically consumed per week. Binge drinking was evaluated using an item asking how many days during the past month they consumed 5 drinks on the same occasion.

Attendance—Staff recorded participants' attendance to group and individual meetings. After the first year, attendance also incorporated scheduled bi-monthly phone or e-mail contacts and participants' attendance in Refresher Groups and National Campaigns.[28]

Definition of BE Groups

Five mutually exclusive groups were constructed based on the presence or absence of BE at each year. Trajectories were created using observed values. The five trajectory groups were: "no BE" (BE absent at baseline, Y1, Y2, Y3, and Y4); "incident BE" (BE absent at baseline but present at Y1, Y2, Y3, or Y4); "fully remitted BE" (BE present at baseline but absent at Y1, Y2, Y3, and Y4); "inconsistent BE" (BE present for 2–3 years including at baseline); and "consistent BE" (BE present at 4 years including at baseline).

Statistical Analyses

Analyses were performed using SPSS version 24 (Armonk, NY) with an alpha of 0.05. Baseline characteristics were compared between participants with and without BE using t-tests, Wilcoxon's rank-sum test, and chi-squared tests. We estimated the effect of the ILI (vs the DSE group) on BE incidence using multivariable Cox proportional hazards regression, with time to BE as the outcome. Cumulative incidence was estimated based on the number of first occurrences of BE divided by the number of people who were at risk (i.e., participants free of BE at baseline). Models were adjusted for factors that could affect weight loss and BE including baseline age, race/ethnicity, sex, education level, BMI, previous weight loss attempts, physical and mental health-related quality of life, depressive symptoms, number of prescription medications, and weekly alcohol consumption.[9] Comparable analytics were used to examine BE remission among participants who began the trial with this behavior.

The co-primary outcome analysis compared 4-year percentage change in baseline weight based on the trajectory of BE across 4 years. Models were fit and analyzed stratified by treatment. A piecewise, linear mixed-effects model with a breakpoint at year 1 was selected based on model fit.[29] Models adjusted for baseline differences between individuals with and without BE as used previously.[9] Chi-squared tests were used to compare categorical weight losses based on BE trajectory.

Results

Baseline Differences Based on BE

At baseline, 546 (11.2%) of the cohort reported having one or more episodes of BE in the past 6 months. Of those with baseline BE, the average number of days per week individuals reported BE was 1.6 ±1.6, and 41.4% of participants reported episodes on less than 1 day/week; 22.5% reported 1 day/week; 26.0% reported 2–3 days/week; 4.0% reported 4–5 days/week; and 5.1% reported BE almost every day. At baseline, 54 participants (1.1%) met DSM 5 criteria for BED.

Baseline characteristics and weight losses at 1 year by BE status have been described in detail previously.[9] Baseline differences between individuals with and without BE were recalculated based on the public access data set and yielded similar results (Table 1). Participants who reported BE, as compared with those who did not, were more likely to be younger, female, white, and to have >16 years of education (ps<0.05). Relative to participants without BE, those who reported BE had a higher BMI, more previous weight loss attempts, higher depressive symptoms, greater numbers of prescription medications, and lower physical and mental health-related quality of life (ps<0.05). Compared to participants without BE, those with BE reported consuming a higher number of calories per day, and a greater percentage of their intake came from fat (ps<0.05).

Binge Eating Behavior: Incidence and Remission by Treatment Group

At year 4, weight data were obtained on 90.1% of the sample, and both weight and questionnaire data were available for 88.6% of participants. Individuals with baseline BE

were no less likely to complete the 4-year assessment than were those without BE (88.1% vs 89.0%, p=0.54).

Incidence—Of participants without BE at baseline, 201 (10.2%) of ILI participants and 171 (8.3%) of those in DSE developed BE over the 4 years. The Cox proportional hazard model revealed that participants in the ILI were marginally more likely to have incident BE at year 4 than those in the DSE (HR=1.22, 95% CI=0.99, 1.51, p=0.06; Figure 1). BE incidence was significantly associated with a greater number of previous weight loss attempts (HR=1.03, 95% CI=1.01, 1.05, p=0.004). Older age (HR=0.97, 95% CI=0.95, 0.98, p<0.001), better baseline physical health-related quality of life (HR=0.98, 95% CI=0.97, 0.99, p=0.02) and better mental health-related quality of life (HR=0.98, 95% CI=0.96, 0.99, p=0.005) were significantly associated with lower incidence of BE.

Remission—Among the 546 participants who began the study with BE, at baseline, the ILI group reported a mean (±standard deviation) of 1.7 ±1.8 BE days per week and DSE participants reported 1.6 ±1.4 BE days per week. From year 1 to year 4, the average number of BE days per week significantly declined (p<0.001) in both groups. At year 4, the number of BE days per week in the ILI group was 0.5 ±1.3 and in the DSE was 0.4 ±0.9. Percentage reduction in the number of BE days per week did not differ between ILI (56.8%) and DSE groups (63.9%; p=0.50). Full BE remission was achieved by 46.0% of ILI and 46.7% of DSE participants. The ILI and DSE groups did not differ in the proportion of individuals who had full BE remission (adjusted HR=1.09, 95% CI=0.90, 1.32, p=0.37). None of the included covariates were significant predictors of full remission (ps>0.05).

BE trajectories—The ILI and DSE groups differed in BE trajectory (p=0.007) in unadjusted analyses. A greater percentage of DSE participants reported no BE at any time point (81.8%) compared to the ILI group (78.1%; adjusted residual = −3.2). A smaller proportion of DSE participants reported consistent BE (1.8%) compared to the ILI group (3.0%; adjusted residual=2.7). The number of participants in the DSE and ILI groups did not differ in the percentage of participants with fully remitted BE (5.0% vs. 6.0%), incident BE (7.4% vs 8.8%), or inconsistent BE (3.9% vs 4.1%).

4 Year Weight Loss Outcomes

ILI—At year 4, ILI participants who did not report BE at any time (over the 4 years) lost a mean (±standard error) of 4.6 ±0.2% of initial weight, compared to significantly smaller losses for participants with incident BE (3.1 ±0.6%; p=0.02) or those with consistent BE (1.9 ±1.0%; p=0.01). Percent weight loss did not differ among participants with no BE and those with inconsistent BE (3.5 ±0.9%). Individuals with fully remitted BE lost 4.7 ±0.8%, which was significantly greater than the loss for individuals with consistent BE (p=0.03), but did not differ from the other groups (Figure 2). At year 4, meeting a categorical weight loss of >7% differed by BE trajectory group (p=0.02; Figure 3a). Categorical weight losses also differed by BE trajectory for >0% (p=0.004) and 5% (p=0.02).

DSE—At year 4, participants in the DSE group who did not report BE at any time lost 0.9 ±0.2% of initial weight, which was significantly smaller than the 3.8 ±0.9% lost by

participants with fully remitted BE (p=0.001) and 3.3 ±1.0 lost by individuals with inconsistent BE (p=0.02; Figure 4). Participants who reported incident BE lost 0.8 ±0.7% and those with consistent BE gained 1.3 ±1.4%, which was significantly worse than participants with fully remitted BE (ps=0.007 and 0.002, respectively). Percent weight loss in participants with no BE was not significantly different from individuals with incident BE or those with consistent BE. Categorical percent weight losses differed by BE trajectory at >0% (p=0.003), 5% (p<0.001), 7%, 10% (p<0.001), and 15% of initial weight (p=0.01; Figure 3b).

Binge Eating Behavior and Treatment Adherence

During the first year, ILI participants with baseline BE attended a mean (±standard deviation) of 34.4 ±8.3 of a possible 42 sessions, which was not different from the 34.8 ±8.2 sessions attended by participants without baseline BE. Mean treatment contacts per year during years 2–4 did not differ significantly by BE trajectory group (p=0.06). Individuals without BE had 20.2 ±10.9 contacts, those with fully remitted BE had 17.8 ±10.2 contacts, and individuals with incident BE, inconsistent BE, and consistent BE had 21.1 ±10.1, 19.4 ±8.8, and 18.8 ±9.2, respectively.

Discussion

The current study assessed the effects of BE on 4-year weight losses in participants in the ILI and DSE groups. Across treatment arms, retention was high and similar among participants with and without baseline BE (88.1% vs 89.0%). Treatment attendance did not differ by BE trajectory. As hypothesized, participants in the ILI who consistently reported BE lost approximately half as much weight at year 4 as individuals who reported full remission of their BE after baseline, or those who did not report such eating at any time. Those who developed BE during the ILI also had attenuated weight loss compared to people without BE. Modest weight loses of 5% produce clinically significant improvements in metabolic risk factors.[30] While 47% of participants without BE achieved a 5% weight loss, only 38% of those with incident BE and 38% of individuals with consistent BE attained this goal. Participants who had full remission of BE lost similar amounts of weight as those who did not report BE at any time. More than half (54%) of individuals with fully remitted BE had a 5% weight loss at year 4.

The present findings support and extend previous results that participants who achieved remission from BE lost more weight that those who continued to binge eat.[9,14–16] Consistent with previous studies of shorter durations[9,14–16] and of patients who had bariatric surgery,[31,32] participants who continued or developed BE had smaller long-term weight losses than those without BE. These results suggest that individuals with preexisting BE should not be excluded or discouraged from engaging in behavioral weight loss. However, we believe that BE should be assessed regularly during weight loss. Participants who report BE after baseline assessments may benefit from additional treatment, such as cognitive behavioral therapy, to promote BE remission.[11] Cognitive behavioral therapy does not tend to produce weight loss, yet it does help to promote weight stabilization and prevent future weight gain.[33] For individuals who continue to binge eat after a lifestyle intervention, a

sequential or additive approach of behavioral weight loss followed by cognitive behavioral therapy may improve weight loss maintenance.

There was a trend at year 4 towards greater cumulative BE incidence in the ILI than in the DSE group, consistent with concerns that some investigators have raised.[3] It is possible that in a subset of individuals, ILI increases rigid and extreme dietary restraint, which may result in feelings of deprivation and subsequent BE. Among these individuals, enhancing flexible dietary restraint might prevent BE and improve weight loss.[34] Another explanation is that the ILI group, as a result of education regarding calories and portion sizes, may have become more aware of what constituted a large amount of food, as compared with DSE participants. This awareness may have led participants to use a more accurate standard in assessing when they had eaten a large amount of food.[35] Further study is needed to examine these hypotheses.

Similar to previous results, we found that higher BE incidence was significantly associated with a greater number of previous weight loss attempts,[36] younger age, and worse baseline physical and mental health-related quality of life.[37] These factors may be useful in identifying who is at greatest risk for developing BE during ILI. However, effect sizes were modest, potentially reflecting the overall low incidence of BE in this sample. Additionally, lifetime history of BE was not assessed. It is possible that individuals with incident BE during ILI may have had BE before they were assessed at baseline.

Contrary to our hypothesis, we found minimal long-term effects of the ILI on BE remission relative to DSE. At 1 year, the majority of individuals who reported BE at baseline no reported longer this behavior (67.6% ILI vs 65.9% DSE).[9] However, at year 4, the percentage of participants with full BE remission dropped to 46.0% of ILI participants and 46.7% of the DSE participants. This supports literature that the durability of BE remission after behavioral weight loss may not be sustained over time.[38] Specialty treatment for BE may be necessary to attain long-term remission.

There are several limitations to this study. A self-report measure of BE was used to facilitate efficient and cost-effective data collection. However, inconsistencies between self-reported versus interview-assessed BE behavior have been noted and interview-assessments are generally thought to be more accurate.[39] We created trajectories based on BE instead of full threshold BED due to the small percentage of participants who met full criteria. However, groupings based on BE behavior identified individuals at risk for suboptimal weight loss during ILI. Generalizability of these findings may be limited due to the study participant characteristics and procedures. Participants were 45–76 years of age, overweight with type 2 diabetes and recruited for a weight loss study. Since the peak age of onset of BE is late adolescence to early adulthood,[37] the participants' ages may have accounted for the low prevalence of BED and low incidence of BE. There may have been a "healthy volunteer effect".[40] Individuals interested in participating in an 11-year study may be more health conscious than people with diabetes in the general population. Since all participants had type 2 diabetes, results may not generalize to all individuals with overweight or obesity.

In conclusion, new or persistent BE was associated with attenuated 4-year weight loss outcomes in participants with overweight/obesity and type 2 diabetes. Individuals with new or persistent BE may need additional treatment during weight management to improve outcomes. Further research is needed to examine the efficacy of such interventions in improving BE abstinence rates and weight loss success.

Acknowledgments

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What is known about this subject?

- Studies have yielded mixed findings concerning whether intensive lifestyle interventions (ILI) for weight reduction precipitate binge eating (BE) and whether BE attenuates weight loss.

- Most studies have been of short duration (i.e., 1 year).

What does this study add?

- ILI participants were marginally more likely to report incident BE at year 4 than were those in diabetes support and education (DSE) control group.

- At year 4, ILI participants with no BE lost significantly more weight (4.6 ±0.2%) than those with incident BE (3.1 ±0.6%; p=0.02) and those with consistent BE (1.9 ±1.0%; p=0.01).

- These findings suggest that individuals with incident or persistent BE during ILI may have suboptimal long-term weight loss.
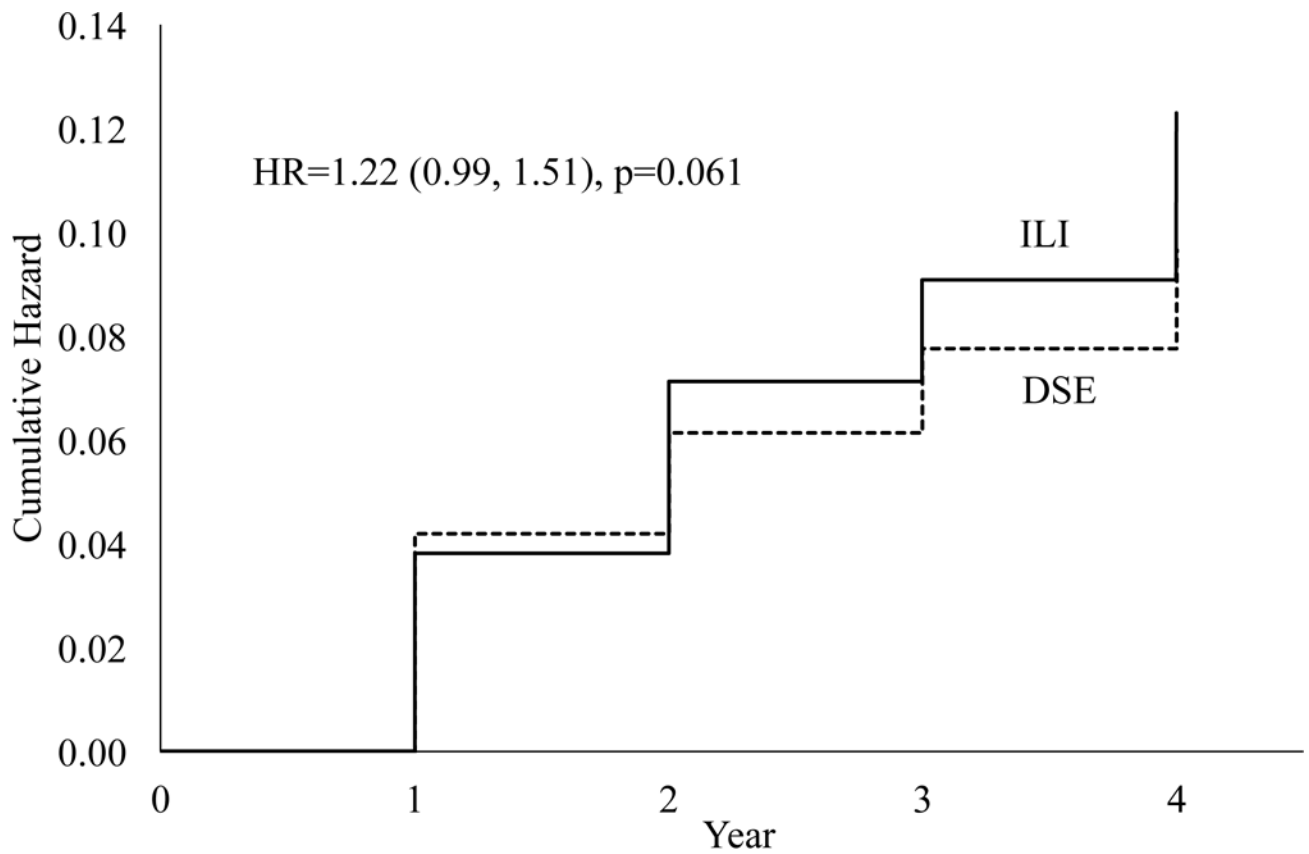
Figure 1.
Cumulative hazard ratio for intensive lifestyle intervention (ILI) versus diabetes support and education (DSE) for incidence of BE over 4 years in participants without baseline binge eating (BE).
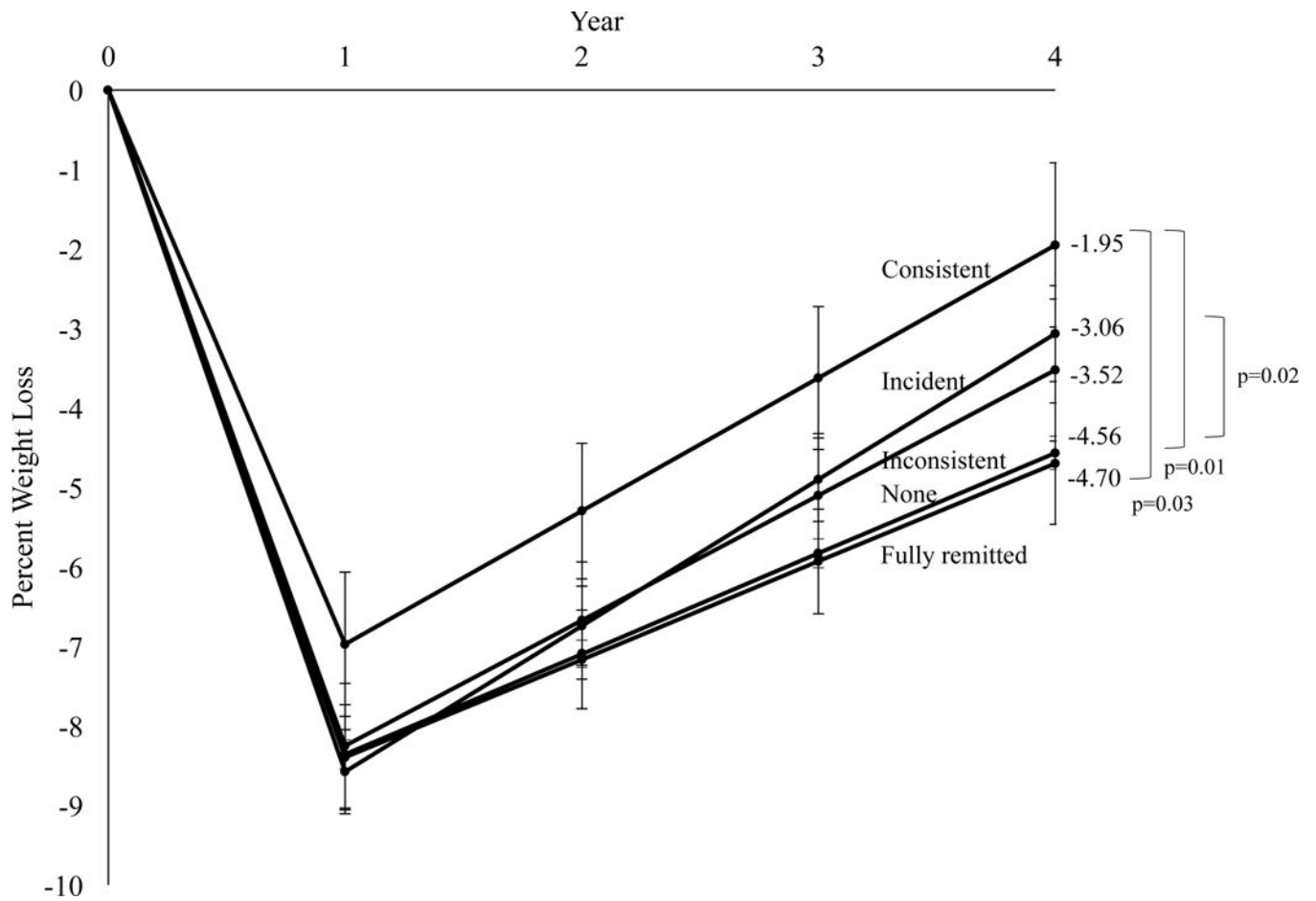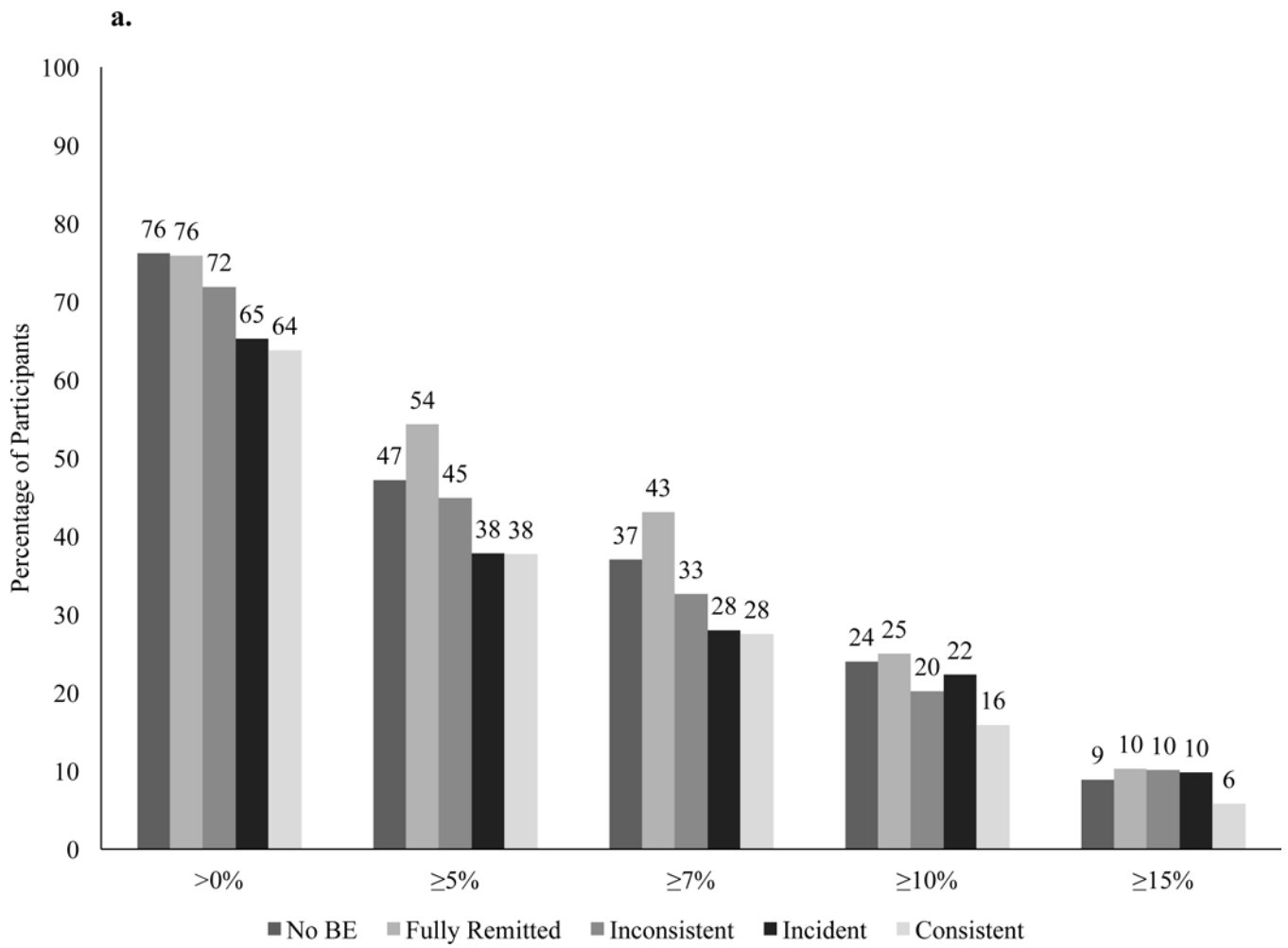
Figure 2.
Percent reduction in initial weight in the intensive lifestyle intervention (ILI) group by binge eating (BE) trajectory. Values shown are mean (±standard error) and weight losses were estimated using linear mixed-effects models controlling for baseline age, race/ethnicity, sex, education level, body mass index, number of previous weight loss attempts, quality of life (physical and mental composite scores), depressive symptoms, number of prescription medications, and weekly alcohol consumption.
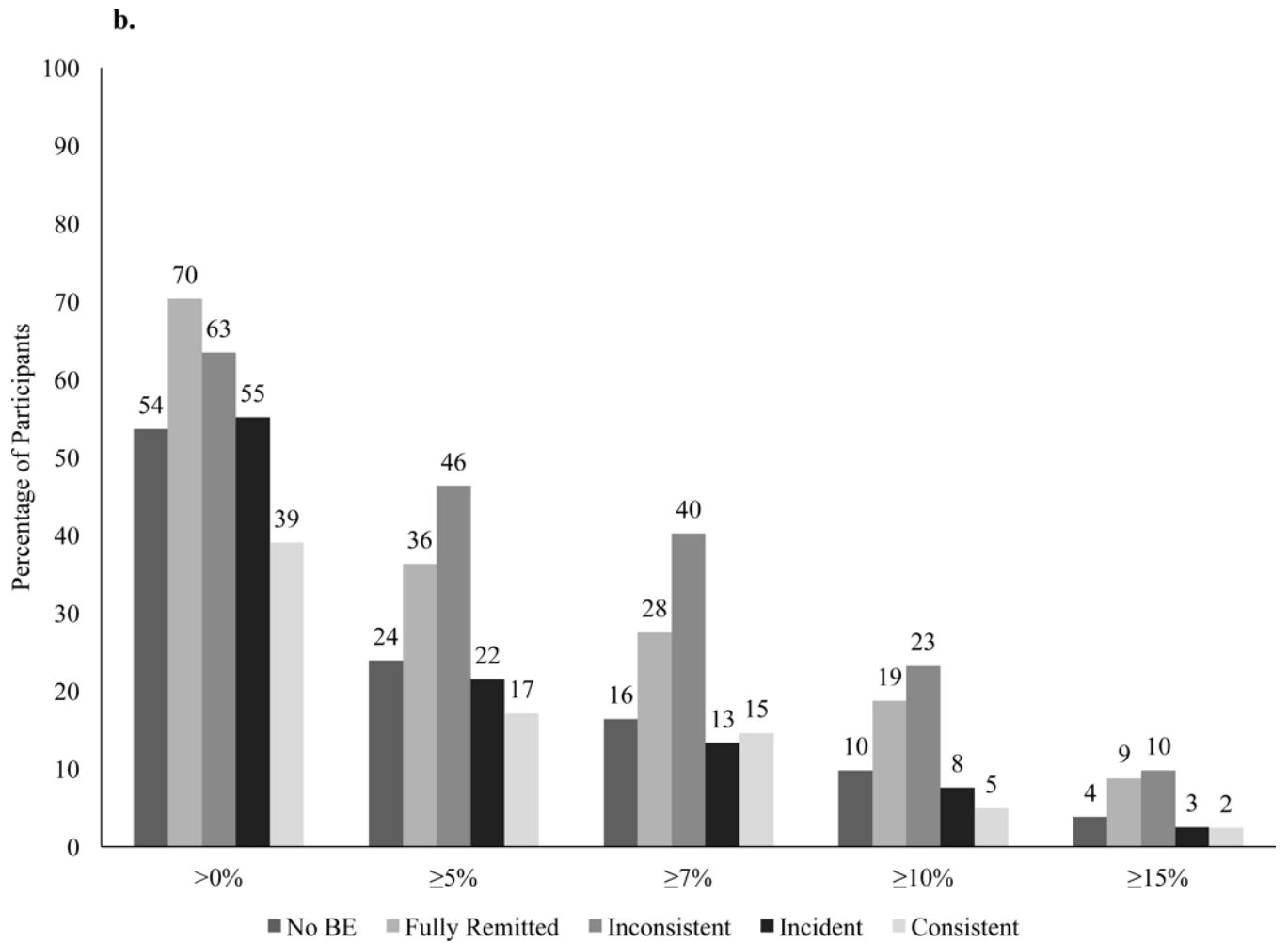
a.

Figure 3.
Percentage of participants in the intensive lifestyle intervention (a) and diabetes support and education (b) groups who at year 4 met different categorical weight losses.
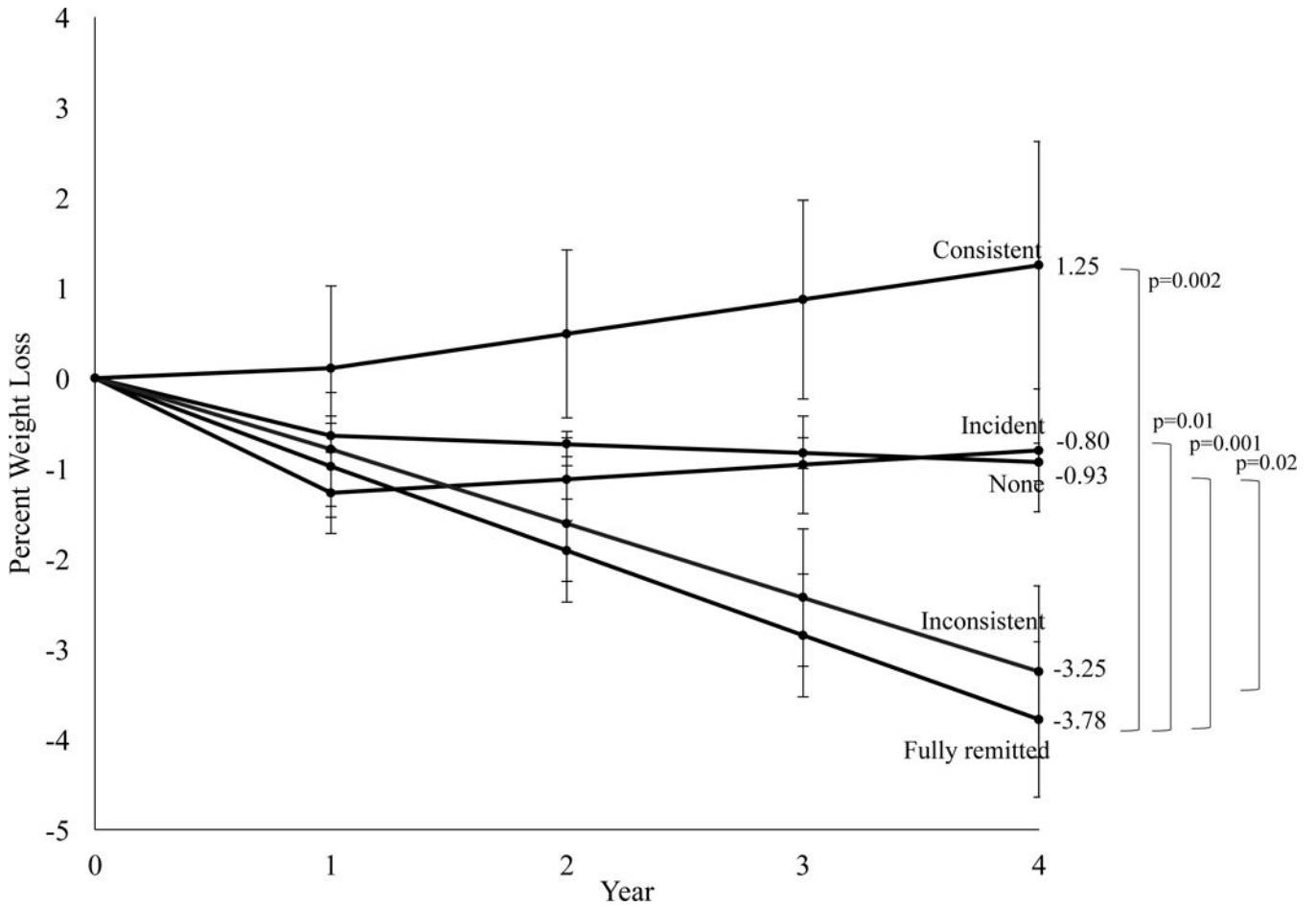
Figure 4.
Percent reduction in initial weight in the diabetes support and education (DSE) group by binge eating (BE) trajectory. Values shown are mean (±standard error) and weight losses were estimated using linear mixed-effects models controlling for baseline age, race/ethnicity, sex, education level, body mass index, number of previous weight loss attempts, quality of life (physical and mental composite scores), depressive symptoms, number of prescription medications, and weekly alcohol consumption.

Table 1

Participant characteristics of study sample by baseline binge eating (BE)

	No BE	BE	P-Value
Participants, No (%)	4026 (82.5)	546 (11.2)	
Age, mean (SD), y	59.22 (6.71)	57.40 (6.57)	<0.001
Sex			
Male, No. (%)	1705 (42.3)	198 (36.3)	0.007
Female, No. (%)	2321 (57.7)	348 (63.7)	
Race, No. (%)			
White	2652 (65.9)	418 (76.6)	<0.001
Hispanic	577 (14.3)	54 (9.9)	
African American	666 (16.5)	55 (10.1)	
Other/Mixed	131 (3.3)	19 (3.5)	
Education, No. (%)			
<13 yrs	783 (19.4)	76 (13.9)	0.01
13–16 yrs	1470 (36.5)	198 (36.3)	
>16 yrs	1688 (41.9)	259 (47.4)	
Married, No. (%)	2676 (66.5)	356 (65.2)	0.55
BMI	35.70 (5.77)	37.26 (6.06)	<0.001
Previous weight loss attempts, No.	5.70 (5.42)	8.32 (6.55)	<0.001
Previous weight loss, lbs	64.90 (84.64)	102.28 (106.49)	<0.001
Daily caloric intake, kcal[a]	1920.24 (836.83)	2350.26 (980.71)	<0.001
Daily fat intake, %[a]	39.78 (7.04)	40.86 (6.60)	0.01
Daily protein intake, %[a]	17.22 (2.92)	16.96 (2.69)	0.14
Daily intake carbohydrates, %[a]	43.85 (7.73)	43.12 (7.18)	0.12
BDI score, mean (SD)	4.92 (4.54)	7.60 (5.49)	<0.001
Alcoholic drinks (oz/week; sum beer, wine, liquor/wk), mean (SD), No./wk	9.00 (25.77)	6.94 (19.82)	0.03
Smoking, No. (%)			
Current	173 (4.3)	19 (3.5)	0.32
Former	1828 (45.4)	270 (49.5)	
Never	2018 (50.1)	256 (46.9)	
Binge drinking, No. (%)	206 (5.1)	16 (2.9)	0.03
Physical health, mean (SD)	48.32 (7.74)	46.20 (8.70)	<0.001
Mental health, mean (SD)	54.82 (7.47)	50.69 (9.64)	<0.001
Glycated hemoglobin level, mean (SD), %	7.26 (1.15)	7.26 (1.15)	0.88
Diabetes duration, mean (SD), y	6.62 (6.35)	7.18 (6.43)	0.06
Medications No., mean (SD)	5.58 (2.93)	5.87 (3.06)	0.03
Diabetes treatment, No. (%)			
Diet only	510 (13.1)	70 (13.3)	0.96
Oral medications without insulin	2667 (68.4)	358 (67.8)	
Insulin	720 (18.5)	100 (18.9)	

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