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Bidirectional Relationships Between Weight Change and Sleep Apnea in a Behavioral Weight Loss Intervention

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Abstract

Objective: To examine the bidirectional relationship between weight change and obstructive sleep apnea (OSA) in the context of a behavioral weight loss intervention.

Patients and Methods: Adults who were overweight or obese (N=114) participated in a 12-month behavioral weight loss intervention from April 17, 2012, through February 9, 2015. The apnea-hypopnea index (AHI), a marker of the presence and severity of OSA, was assessed at baseline, 6 months, and 12 months. Linear mixed models evaluated the effect of weight change on the AHI and the effect of OSA (AHI ≥5) on subsequent weight loss. Secondary analyses evaluated the effect of OSA on intervention attendance, meeting daily calorie goals, and accelerometer-measured physical activity.

Results: At baseline, 51.8% of the sample (n=59) had OSA. Adults who achieved at least 5% weight loss had an AHI reduction that was 2.1±0.9 (adjusted mean ± SE) events/h greater than those with less than 5% weight loss ($P<.05$). Adults with OSA lost a mean ± SE of 2.2%±0.9% less weight during the subsequent 6-month interval compared with those without OSA ($P=.02$). Those with OSA were less adherent to daily calorie goals (mean ± SE: 25.2%±3.3% vs 34.8%±3.4% of days; $P=.006$) and had a smaller increase in daily activity (mean ± SE: 378.3±353.7 vs 1060.1±377.8 steps/d; $P<.05$) over 12 months than those without OSA.

Conclusion: Behaviorally induced weight loss in overweight/obese adults was associated with significant AHI reduction. However, the presence of OSA was associated with blunted weight loss, potentially via reduced adherence to behaviors supporting weight loss. These results suggest that OSA screening before attempting weight loss may be helpful to identify who may benefit from additional behavioral counseling.

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Obstructive sleep apnea (OSA) is a prevalent sleep disorder whose underlying pathogenesis is often driven by excess weight.[1-3] Multiple studies have found that weight loss is effective at reducing OSA severity.[4,5] In particular, behavioral weight loss interventions, which typically incorporate dietary modification and physical activity to induce weight loss, reduce the apnea-hypopnea index (AHI) by 20% to 50%.[6] Accordingly, weight loss is a common first-line recommendation for overweight adults with OSA.[7]

In contrast, less attention has been placed on the potential impact of underlying OSA on attempted weight loss. Evidence suggests that OSA can impede weight loss,[8-10] but these studies are limited by small sample sizes,[8,10] and many did not consider adherence to behaviors supporting weight loss.[9,10] Moreover, these samples included few women, who are more likely to engage in weight loss efforts than men[11] yet among whom OSA is less likely to be recognized.[12]

The purpose of this study was to examine the bidirectional association between weight change and OSA in the context of a 12-month behavioral weight loss intervention. We examined the association between behaviorally induced weight loss and OSA severity

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and whether underlying OSA was associated with subsequent weight loss. Based on previous evidence, we hypothesized that OSA severity would be significantly reduced as a result of the lifestyle intervention. We also hypothesized that the presence of OSA would be associated with blunted weight loss and that adults with OSA would be less adherent with modifying caloric intake and physical activity compared with adults without OSA.

PATIENTS AND METHODS

Study Design and Sample

The present study was an ancillary component of the EMPOWER study. The primary aim of EMPOWER was to determine, using ecological momentary assessment methods, the triggers for lapses during intentional weight loss.[13] As a longitudinal descriptive study, all participants received a group-delivered behavioral weight loss intervention over 12 months. Additional details regarding participants and the intervention are described later herein and in the paper by Burke et al.[13] The University of Pittsburgh institutional review board approved the study protocol, and participants provided written informed consent before participating. The study was conducted from April 17, 2012, through February 9, 2015.

Adults 18 years and older with a body mass index (BMI; calculated as the weight in kilograms divided by the height in meters squared) of 27 to 44 who had not participated in a weight loss program in the previous 3 months were eligible. Exclusion criteria included the presence of medical conditions that could confound study findings (eg, diabetes), pregnancy, or other conditions that would prevent completion of the intervention.[13] All participants who were not being treated for OSA (eg, continuous positive airway pressure [CPAP]) were eligible to participate in the ancillary study; see the Supplemental Figure (available online at http://www.mayoclinicproceedings.org) for data loss through the study. Thirty-seven of the 151 participants enrolled in EMPOWER (25%) were excluded from the present analyses, leaving 114 participants (75%); primary reasons for exclusion included study participation before the addition of OSA assessments (n=18) and current OSA treatment (n=9). In addition, 12 of the 114 participants (11%) withdrew before study completion. Compared with those who completed the study, participants who withdrew were younger (mean ± SD age: 44.1±13.2 years vs 51.2±9.9 years; P=.03) and were less likely to be of white race (58.3% vs 85.3%; P=.02); however, they did not differ on other factors, including baseline BMI or AHI.

All the participants received a standard behavioral weight loss intervention delivered in groups.[14] Key intervention components included provision of behavior change strategies such as daily dietary and weekly exercise goals along with self-monitoring of dietary intake, physical activity, and weight.[13] Daily caloric intake goals were based on initial body weight and sex. For those weighing less than 90.9 kg (ie, <200 lb), 1200 and 1500 kcal/d were prescribed for women and men, respectively; for participants weighing 90.9 kg or more, 1500 and 1800 kcal/d were prescribed for women and men, respectively. Participants were instructed to gradually increase their physical activity over the initial 6 weeks until they reached a goal of 150 min/wk. Sleep was not addressed as part of the intervention. Daily self-monitoring of dietary intake, physical activity, and weight were performed using a smartphone application (Lose It!; FitNow Inc). Twenty-four group sessions were offered: meetings occurred weekly for the initial 3 months, biweekly during months 4 through 6, and then monthly during the final 6 months.

Measures

Sociodemographic Data. Sociodemographic data (age, sex, marital status, race/ethnicity, smoking status) were collected using a self-administered questionnaire.

Weight. Body weight was measured at baseline (BL), 6 months (6M), and 12 months (12M) by a digital scale (Tanita). Weight data at 6M and 12M are expressed as the percentage change from BL. Weight loss of at least 5% was considered clinically significant.[15]

Obstructive Sleep Apnea. Obstructive sleep apnea was assessed using a limited-channel home sleep testing device (ApneaLink